

Education Applications & Developments VIII



Editor: Mafalda Carmo

Advances in Education and Educational Trends

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Edited by: Mafalda Carmo



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FOREWORD

inScience Press is delighted to publish this book entitled *Education Applications & Developments VIII* as part of the Advances in Education and Educational Trends books series. These series comprise the work of authors and editors to address global research in the Education area.

In this eighth volume, a dedicated set of authors explore the Education field, contributing to the frontlines of knowledge. Success depends on the participation of those who wish to find creative solutions and believe their potential to change the world, altogether to increase public engagement and cooperation from communities. Part of our mission is to serve society with these initiatives and promote knowledge, therefore it requires the reinforcement of research efforts, education and science and cooperation between the most diverse studies and backgrounds.

The contents of this 8th edition bring us to the most broadening issues in contemporary research on Education. This book explores four major areas within the broad spectrum of Education, corresponding to four sections: “Teachers and Students”, “Projects and Trends”, “Teachers and Learning”, and “Organizational Issues”. Each section comprises chapters that have emerged from extended and peer reviewed selected papers, originally published last year in the proceedings of the International Conference on Education and New Developments (END) conference series (<http://end-educationconference.org/>). This meeting occurs annually always with successful outcomes. Original papers have been selected and the authors were invited to extend and to submit them to a new evaluation’s process. Afterwards the authors of the accepted chapters were requested to make the necessary corrections and improve the final submitted chapters. This process has resulted in the final publication of 44 high quality chapters organized into 4 sections. The following sections and chapters’ abstracts provide some information on this book’s contents.

Section 1, entitled “Teachers and Students”, provides studies within educational programs and pedagogy for both teachers and students.

Chapter 1: *Reframing teacher education to the realities in some South African societies*; by Newlin Marongwe, & Grasia Chisango. This chapter argues for the need to reframe the nature of the Bachelor of Education (B.Ed.) degree to the realities of some South African societies. The curriculum must be relevant and factoring in the changed reality in some South African societies. The B.Ed. should keep pace with the societal changes. The chapter was guided by a situated learning theory. The chapter adopted a qualitative approach and a case study design. The study purposively selected 3 universities, 9 lecturers and 15 teacher trainees as participants. Data were collected through use of interviews and focus group discussions. Thematic frames were used to analyse data that were discussed concurrently with the findings. The study established a mismatch between how the teachers are trained and the

actual reality in schools. The implication drawn was that failure to move with speed to reconfigure the training of teacher education increases frustration and tension between teachers and learners. The chapter concludes that teacher education programme needs an urgent revamp to keep pace with techno learners and rapid social developments. John Dewey in Draves and Coates (2011, p. 11) agrees, “if we teach today’s students as we taught yesterday’s, we rob them of tomorrow”.

Chapter 2: The impact of teachers’ subject matter knowledge on students’ learning of rational numbers and proportion; by Natalia Karlsson, & Wiggo Kilborn. This study examines the impact of teachers’ subject matter knowledge on students’ learning. The mathematical content deals with rational number as fractions and proportion. The study includes pre- and post-tests from 99 students, classroom observations, students’ written solutions and interviews with 48 selected students after the post-tests. Findings from this study show that the impact of teachers’ subject matter knowledge and ability to identify the objects of learning, and apply this in teaching, strongly influenced the development of students’ conceptual learning about fractions and proportion.

Chapter 3: Reflecting on a PALAR co-teaching journey in teacher education; by Brigitte Lenong. Co-teaching at universities encourages student participation, opens chances for feedback, and promotes critical thinking. Co-teaching is a model that involves two or more professionals working together to plan, instruct, and monitor progress of a heterogeneous or blended group of students in and outside the classroom, to achieve learning objectives. The authors – lecturers in teacher education at a university of technology – embarked on PALAR (participatory action learning action research) in planning, instruction, and assessment, by working together as team partners in a process that stretched over more than two years. In this chapter we reflect on our collaboration. The process involved continuous action learning through experience, enhanced by co-reflection and critical questioning; furthermore, we undertook intentional action research with the primary goal of improving practice through successive cycles of plan–act–evaluate–reflect, and which lead to practice modification. We found that participating, collaborating, building relationships, communicating, and trusting, and the transformational nature of PALAR, are crucial to the process of enhancing learning. The findings imply that PALAR can provide lecturers with a rich learning experience. This chapter adds to the body of knowledge by demonstrating how the PALAR approach can be used in co-teaching for teacher education.

Chapter 4: Time allotted for nighttime sleep and the presence of fatigue in pupils from three high schools in Botoşani County; by Adriana Albu, Alexandra Ioana Crăcană, Elena-Cristina Gavriluță, & Florin Dima. Fatigue is a physiological phenomenon that occurs after sustained effort and disappears through active and passive rest. The studied group consists of 246 pupils from the 9th and 11th grades from three high schools in Botoşani county – a theoretical high school, a national college and sports high school. Most pupils say they sleep for 6-7 hours (37.80%)

or 7-8 hours (33.73%). Fatigue is often present in 46.34% of cases. When they wake up in the morning, 44.30% of pupils feel tired. The majority of pupils from the 11th grade feel tired at the end of the week, while those from the 9th grade feel tired at the beginning of the week. During the day, fatigue appears mostly in the middle of the school day (36.17%) with insignificant differences between grades or schools, but significant when correlating night sleep with the time of day when fatigue appears ($p < 0.01$). Napping is rarely present in the majority of pupils (46.74%). Most of the surveyed pupils have headaches or eye pain when fatigue occurs. Fatigue is present especially in pupils who recognize a short time spent sleeping at night. Recovery through sleep during the day is rarely present.

Chapter 5: *Towards a generalization: what students learn about multiplication*; by Natalia Karlsson, & Wiggo Kilborn. This chapter examines and analyzes students' learning about aspects of the concept of multiplication with a focus on perceptions and representations, and how they apply this to handling multiplicative situations and patterns in the multiplication tables. The analysis has been performed in the context of the generalization process related to teaching activities, with a focus on students' perception of multiplication. The theoretical approach is based on Davydov's (1990) view of theoretical generalization as a perception-conception-elementary concept (PCE model). The current mathematical content was classified according to: (1) multiplicative structures (Vergnaud, 1983); and (2) basic laws of algebra (van der Waerden, 1971). The relationship between students' learning and the teaching process was studied in order to identify students' learning in action. The study comprises two teachers and 40 students in two classes in grade 3 and was followed up two years later in grade 5 with one teacher and 25 students. The findings of this study can provide knowledge about students' learning about multiplication using structures and multiplication tables in a conceptual context.

Chapter 6: *Online technologies in teaching and learning. Lessons learnt while teaching during COVID-19 pandemic in Romania: Towards a "dual" education system*; by Alina Florentina Grigorescu (Pîrvu), & Cezar Scarlat. The education – as processes and systems, teachers and students – was affected by corona-virus pandemic, across the world. Since pandemic imposed rigorous social distancing, the education process has migrated to online environment, supported by appropriate technologies, with multi-sided effects on students, teachers, and technology producers. Thus, amid its profound negative impact, corona-virus pandemic functioned as an accelerator of using new online teaching technologies. The authors' scope of work encompassed a variety of education levels (from elementary to higher education) in Romanian educational environment. This chapter aims at summarizing major lessons learned by the authors' direct experiences of teaching under pandemic in two different education settings (international school, university) – with the general objective to formulate recommendations to: (i) teachers; (ii) students; (iii) education policymakers; as well as specific objectives: to identify similarities and significant differences among students by age and level of education; and eventually

formulate recommendations for technology producers. Essentially qualitative, the research methodology included secondary research (literature survey) and primary research methods (observation, interview and survey) – based on the authors' direct experience, yet teaching both local and international students. This study contributes at filling a literature gap, and opening further research paths in the field of online education.

Chapter 7: *Digital capital and safety in socialization process. An Italian case study*; by Ida Cortoni. The process of digital acceleration, which in the last few years of the pandemic crisis has affected formal socialization contexts such as schools and families, has led to a critical reflection on the new responsibilities and skills of the digital citizen, in order to preserve his autonomy in the management of virtual dynamics while respecting certain ethical principles at the basis of navigation. These principles underpin the implementation of a digital culture in which the use of devices is guided by a sense of responsibility and respect for otherness. The new digital skills of the citizen go beyond specific access techniques and focus mainly on conscious digital behaviour at the basis of safeguarding various forms of individual and social well-being. Through the illustration of the main results of a national survey promoted by Sapienza University of Rome in 2020, the paper intends to provide a reflection on the degree of diffusion of digital awareness among Italian adolescents and on the impact of school and family digital capital in the development and implementation of such skills.

Chapter 8: *Promoting epistemic virtues across the curriculum to educate 21st century citizens*; by Monica Tombolato. In our Knowledge Society, the ease of access to information due to advanced and user-friendly technologies often gives us the illusion to know more than we do. This "epistemic disease" is a danger to both democracy and public health. The educational system must therefore encourage good epistemic habits consistent with responsible citizenship. From a didactic perspective, this requires updating the curriculum in light of the educational challenge of the 21st century: training students to be virtuous epistemic agents by fostering their epistemic cognition. In this article, I intend to provide teachers with some useful operational guidance to achieve this goal. To this end, the epistemological concept of the virtuous epistemic agent is converted into a didactically fertile construct in two steps: first, observable knowledge-friendly behaviors are identified that can be regarded as clues to the habitus of the virtuous epistemic agent; then some procedural principles are formulated to help teachers design instructional activities that foster students' commitment to enacting those kinds of behaviors.

Chapter 9: *Written feedback messages: challenges and possibilities to support students' learning*; by Verónica Yáñez-Monje, Mariana Aillon-Neumann, & Cecilia Maldonado-Elevancini. This chapter presents two inquiries. The first corresponds to a part of a doctoral research regarding written forms of feedback. The study involves four teachers from three different primary schools in London. The main sources of data comprised teacher's interviews and the excerpts of written comments from their

students' books. Analysis suggested that feedback focused on correcting basics errors, seeking further actions on the task at hand and contrasting the work with learning objective and success criteria. These findings encouraged a collaborative research work to undertake a second study by using the same methodological approach in another context, namely, Chile. The participants were 60 primary school teachers enrolled in a professional development programme. They selected pupils' writing assignments to provide written feedback for them. Data show that the teachers faced difficulties at the initial stages as their comments were evaluative, centred on what was missing, with little room for students' self-assessment. The participants greatly improved their elaborated comments by being more descriptive and stressing the task's features. Both studies provide insightful data in terms of the problematic nature of teachers' written feedback that might hinder pupils' possibilities to achieve a broader understanding of quality.

Chapter 10: *Collaborative learning environments - Learning with Tiny Articles as a participatory learning network*; by André Seyfarth, Miriam Hilgner, & Bärbel Kühner-Stier. Over the past years, the nature of teaching has fundamentally changed. The learning process is challenged by a more uncertain and complex world. First grade students face a difficult starting point. Confidence in one's own learning process, between learners and teachers, and the strengthening of one's own peer group need to be intensively promoted. In order to develop critical thinking as individuals in a heterogeneous community and to make fears and uncertainties accessible to a scientific discourse, a new teaching concept for bachelor students in Human Sciences was designed. To encourage collaboration and interdisciplinary thinking, a novel format of simplified peer-reviewed publications was developed, called Tiny Articles. Inspired from the research cycle, we implemented different phases of critical thinking, reflections and writing episodes. This created eventually a virtual "common brain". This accumulation of knowledge, ideas, and reflections was shared with lecturers and opened up discussions about learning difficulties or problems. Learning with Tiny Articles is presented as a successful way of networked learning and working in mixed teams.

Chapter 11: *Developing Universal Design for Learning within higher and further education: the benefits of educator peer triads*; by Shaun Ferns, Irene McGinn, Nigel Vahey, Helen Williams, & Nicola Duffy. Universal Design for Learning (UDL) consists of a set of principles for curriculum development that aims to afford diverse learners equal opportunities to learn by providing more flexible and thus inclusive methods of teaching, learning and assessment. This chapter is focused on the present authors' collective learnings as a 'triad', a peer learning group of university educators participating in the Digital Badge for Universal Design in Teaching and Learning, accredited by Ireland's National Forum for the Enhancement of Teaching and Learning. We place particular emphasis upon our triad's (peer learning group) experiences implementing a UDL re-design of teaching and assessment as part of the Digital Badge. Our reflective analysis explores in detail how each lecturer's teaching, learning and assessment practices evolved as a function of systematically

incorporating various key practical elements of the UDL approach. Particular emphasis is placed upon describing how this UDL-based peer learning triad encouraged us as lecturers to adopt a more collaborative approach both with each other and with students.

Chapter 12: *The student's academic aspirations, predispositions and educational support*; by Josef Malach, Dana Vicherková, Martin Kolář, & Kateřina Malachová. This chapter presents the results of empirical research aiming to classify the students of the research group by their subjective view of their study ambitions and assumptions and analyse the relationship between them. Teachers' and schools' incentives to guide students towards technological thinking and deepen the school's interest in the field of study were examined as elements of academic support. The students' views on both of these variables were related to the perception of their educational aspirations. Academic aspiration expresses the anticipated level of performance or position the students wish to achieve. Study predispositions are a set of knowledge, competencies, cognitive abilities, talents, study ambitions and motivations. The research sample consists of 907 technical secondary school students in the Czech Republic. Descriptive data showed, that more than half of the respondents believe they have suitable prerequisites for studying and aspire to the status of a good student. Only 3% lack these prerequisites and have no ambition to be good students. Students with higher aspirations more frequently believe that they have sufficient prerequisites for studying and perceive school support to deepen their interest in the field. However, educational aspirations are separate from students' opinions about the teacher's efforts to develop technical thinking.

Chapter 13: *Opinion survey of teachers of dyslexic schoolchildren regarding learning skills*; by Bianca Rodrigues dos Santos, Giseli Donadon Germano & Simone Aparecida Capellini. The aim of this study was to characterize the opinion of teachers of students with dyslexia in a specific questionnaire on learning skills. 74 teachers of Brazilian schoolchildren with dyslexia participated, aged from 9 years to 10 years and 11 months from the 3rd to the 5th year of Elementary School I. The teachers answered the Learning Skills Questionnaire, composed of items: attention skills; visual processing skills; auditory processing skills; logical-mathematical reasoning skills; motor skills; behavioral skills. The questionnaire was filled out by teachers, with responses scored on a scale from 0 to 4 points (Likert Scale). Data for this study were collected from March 2019 to March 2020, before the start of the COVID-19 pandemic in Brazil. The results were analyzed statistically indicating that teachers answered “rarely” and “sometimes” for all categories, except for category behavioral, which most answers were “never”. There was also an indication of “I don't know” for all categories, suggesting that teachers' lack of knowledge regarding behaviors aspects of dyslexic's schoolchildren. The results allowed us to conclude that teachers still need of information about how schoolchildren with dyslexia learn to read, since the results “rarely” and “sometimes” were presented in all categories of academic learning.

Chapter 14: *The application of knowledge management in the teaching of translation in universities*; by Shiyang Liu, & Liu Liu. With the development of information technology, the universities are faced with an increasing need to integrate the knowledge management in their translation teaching, to form students' integral translation abilities and better the teaching efficiency. This research first makes a literature review on the knowledge management and the translation teaching. Then, we discuss the traditional translation teaching in universities and formulates the teaching model of knowledge management for translators', which includes the curriculum design, the search, identification and acquisition of information, the organization of information and the creation of personal knowledge bank, as well as the application of knowledge bank in the practical translation tasks.

Chapter 15: *Schoolchildren's performance on cognitive-linguistic skills during the context of a pandemic*; by Caroline Fernandes Brasil, Mariana Taborda Stolf, & Simone Aparecida Capellini. Aim: to characterize the performance of cognitive-linguistic skills of schoolchildren in early literacy during the pandemic. Twenty-two Brazilian schoolchildren participated in this preliminary study, distributed in GI, composed by ten schoolchildren for 1st grade and GII, composed by twelve schoolchildren for 2nd grade, submitted to the application of the Cognitive-Linguistic Skills Assessment Protocol. Results: schoolchildren from GI and GII showed average performance for writing the name, sequential alphabet recognition, and visual memory of shape. The GI presented a refusal response for the subtests of word, nonword and, picture dictation, word repetition and visual sequential memory of shapes and poor performance for alphabet recognition in random order and average performance for alphabet recognition in sequence. GII showed lower performance for the subtests of word, nonword and, picture dictation and superior performance for alphabet recognition in random order, alphabet in sequence and visual sequential memory of shapes. Discussion: the appropriation of the letter-sound relationship mechanism raises questions, since it evidenced the difficulty of all schoolchildren in cognitive-linguistic skills necessary for the full development of reading and writing. Conclusion: schoolchildren in the 1st and 2nd grade showed lower performance in cognitive-linguistic skills important for learning reading and writing.

Chapter 16: *Designing a curriculum for supporting the transition to adult life of young adults with intellectual disabilities*; by Ivan Traina. Individuals with intellectual disabilities (ID) are faced with significant barriers relating to the transition to adult life and employment. The proposed chapter's purpose consists of presenting the results emerged by the project of research E-IDEAS (Empowerment of youth with Intellectual Disabilities through Educational and training curricula for Acquiring employment Skills). In particular, the curriculum developed for supporting the acquisition of independent living and employment skills and the consequent transition to adult life of young persons with ID. Starting from a systematic analysis of literature on the topic, the chapter highlight the elements emerged that were used to develop the curriculum. Besides the search findings that

led to curriculum elaboration, it includes the description of the methodology adopted, learning contents, as well as teaching strategies and tools utilized. Lastly, the results achieved by participants who attended the curriculum are presented, its assessment discussed, and future research directions defined.

Chapter 17: *The relationship between parents' education and students' self-assessment of their own study prerequisites and aspirations*; by Josef Malach, Dana Vicherková, & Martin Kolář. In this chapter, we explore the importance of self-assessment for students in achieving success in their studies. Self-assessment involves evaluating one's own learning processes and outcomes. However, we focus on secondary school students' self-assessment of their study predispositions, aspirations, and motivation for success. This includes their knowledge, competencies, abilities, talents, and educational goals. Academic success encompasses various factors such as learning objectives, skills acquisition, satisfaction, persistence, and post-college performance. The study investigates the influence of parents' education on their children's careers. The authors examined the self-assessment of educational prerequisites and aspirations of 900 secondary school students aged 15-18 years. The results show that more than half of the respondents believe they have the necessary technical study prerequisites. However, self-assessment of study predispositions is not related to gender or field of study. The study also found that students' aspirations to succeed are related to their mother's education, not their fathers'. Overall, self-assessment is a crucial tool for students to achieve success in their studies. By evaluating their study predispositions and aspirations, students can set educational goals for themselves and work towards achieving them. The study also highlights the importance of parental education in influencing their children's educational aspirations.

Chapter 18: *Active foreign language learning practices in higher education: the perspective of actors*; by Véronique Delplancq, Ana Maria Costa Lopes, José Pereira, & Susana Fidalgo. The digital age and Generation Z are key features within the current panorama of teaching-learning practices in higher education and drive innovative student-centred strategies, oriented towards the reality of the labour market. The article describes an experience of pedagogical activation carried out through project-based learning using digital tools, with undergraduate Media Studies students of the School of Education in Viseu (Portugal), towards the acquisition of skills in French and English, during the academic year 2021-2022. The objective was to renew teaching practices, so as to foster greater student motivation on the part of forthcoming media professionals, by enhancing their competences and confidence with concern to spoken and written interaction within the context of foreign languages for specific purposes. The dynamics of learning combined with authentic contexts and digital tools, encourages teachers to rethink their methodology and objectives, in order to be more innovative. One accounts for the chosen strategy and the various steps followed, evaluates the path of both students and teachers, analyses the benefits, the drawbacks and the impact in terms of acquired skills and concludes with reflections for forthcoming work projects.

Chapter 19: *Exploring assessment types, instruments and methods of assessing knowledge, skills and values in higher education*; by Eric M. Chweu, Sibongile Simelane-Mnisi, & Andile Mji. This study aimed to explore the assessment types, instruments and methods of assessing knowledge, skills and values in higher education. The challenge was that lecturers could not comprehend, differentiate and apply assessment types, instruments and methods when assessing. The lecturers indicated that this could be attributed to the lack of assessment policy, strategy, awareness campaigns, workshops, orientation and framework that stipulates the use of assessment types, instruments and methods. The researchers have not come across literature that addressed the aforementioned. Participants were 10 lecturers who were purposively sampled and interviewed from seven Faculties at the University of Technology in South Africa. The question was: “To what extent are the assessment types, instruments and methods used by lectures to assess students’ knowledge, skills and values? A qualitative case study method was used to answer this question. Semi-structured interviews and document analysis were used for collection. Atlas. ti. was used for analysis. It was found that examinations, assignments, tests, presentations and discussions were interpreted by lecturers as assessment types and methods. Assessment types were not explicit in the module descriptors. Lecturers must develop assessments that are relevant, progressive and just in time.

Chapter 20: *Class singing by pre-service generalists: individual leading and co-teaching*; by Annamaria Savona. This study contributes to filling the gaps in how pre-service generalist teachers develop skills to lead class singing. In this chapter, I present the case study of two generalists who co-led class singing in their second-year internship while they taught individually in their first- and third-year internships. The comparison of the co-led lesson with the individual lessons shows significant differences in how the two generalists led the singing and managed the class. The focus of this study is on their use of audio devices and musical instruments. I filmed the internship lessons over the course of their three-year teacher training and analysed the moments when the trainees used audio devices and musical instruments. The analysis of the individual lessons shows changes in the in-situ practice of the two generalists using an audio device, guitar and body percussion. The analysis of the co-led lesson shows how the trainees collaborated on classroom management from a didactic and musical point of view.

Section 2, entitled “Projects and Trends”, presents chapters concerning, as the title indicates, education viewed as the center for innovation, technology and projects, concerning new learning and teaching models.

Chapter 21: *The perfect match for education for sustainable development: human needs versus sustainable altruism?*; by Erika Quendler, Matthew James Lamb, & Nouredin Driouech. Altruistically speaking, humanity has now reached a point where it has recognized that it has a responsibility to achieve a development that is sustainable, to wit the United Nations Sustainable Development Goals (SDGs).

This notwithstanding, as an intrinsically selfish creature, humanity also has a need to fulfil its own needs. This concept is set out by Maslow. Education is undeniably a linchpin in marrying these two concepts, aiming to meet the challenges and the needs of both today's and future generations. Whether and how these needs are met for any learner affects the learner's motivation to learn and the educator's motivation to teach. Therefore, it is paramount to reflect on the type of education that best "cultivates and guides the sustainable humanity" of the learners. This is the challenge facing today's Anthropocene society. Hence, this conceptual chapter attempts to distil a number of tangibles from the marriage of the SDGs with Maslow's hierarchy of human needs. One of the concrete outcomes is a series of features which aim to frame any realignment and transformation process for education for sustainable development (ESD). Finally, this chapter should fuel research and steer governance.

Chapter 22: *Reflections shaped by the COVID-19 pandemic for medical education in China, and globally*; by Liying Wei, & Pamela Brett-MacLean. The unprecedented global disruption introduced by the ongoing COVID-19 pandemic has highlighted the need to consider how to best prepare our learners to respond to the wide, interconnected array of global health challenges we face at this historical juncture. In 2019-20, when Professor Wei was a visiting professor at the University of Alberta, we began an East-West dialogue regarding the contributions of the medical/ health humanities to medical education. Following the emergence of the pandemic, we explored a broad literature base as they considered opportunities for reforming medical education to better prepare physicians to address complex global health circumstances and crises. Proposed directions for reorienting medical education include emphasizing systems science and public health competencies, promoting relationally-oriented identity formation and developing humanistic qualities and adaptive leadership ability through both systems-focused, humanities-informed curriculum and pedagogical processes. Ultimately, how successfully our learners respond to ongoing and emergent global health challenges will depend on how well we prepare them for the future. Recognizing increasing worldwide adoption of competency-based medical education, there is a pressing need to explore how to promote, and authentically assess, development of adaptive relational, collectivist competencies and capabilities.

Chapter 23: *Identifying the Ph.D. Students' needs for career enhancement skills*; by Alexandra Kosvyra, Dimitrios Filos, Tara Cusack, & Ioanna Chouvarda. To date, it is observed that an increasing number of Ph.D. graduates follow a career outside academia. The EU-funded CHAMELEONS project aimed to identify and fulfill the needs of Ph.D. students towards pursuing a career in digital and connected health industry. The CHAMELEONS overall goal was to develop innovative educational interventions offered by higher education to build more adaptable, entrepreneurial and employable graduates in both academic and non-academic environments. Thus, a range of courses or educational material provided by CHAMELEONS consortium members, or available in open platforms were identified, organized and offered to 15 students, of diverse background, enrolled in the program through a

State-of-the-Art (SotA) toolkit. Two questionnaires were provided to attain information on: (i) background and skills the students recognized as underdeveloped, (ii) students' preferences in terms of interest, reasons, and motivation of selection and skills they aim to acquire using SotA toolkit. Students selected courses not actually improving hard skills needed for their research, but soft skills in the business and career management direction, focusing mostly on creativity, innovation, and communication. Finally, the students mentioned that the drive for their selection was based on self-awareness tools which identified the underdeveloped skills required for a successful career.

Chapter 24: *School social work intervention with students at socio-educational risk: practices to promote equity in times of Covid 19*; by Sidalina Almeida. The Covid 19 pandemic, by electing distance learning, intensified the risks of dropout and failure of students with a more fragile relationship with the school, accentuating social inequalities and other inequalities and not allowing the multiplicity of their needs to be satisfied, in the sense of its integral development. The Portuguese government wanted to respond to the problems of absenteeism and school dropout, child poverty, intra-family violence, and mental illness, which were aggravated by the pandemic, giving guidance to managers, teachers, and technicians to reinvent the role of the school in times of physical distance, quarantine, and isolation. In this reinvention, the intervention strategies of the social workers were highlighted in the identification, and monitoring of risk/danger situations to which children and young people were subject and, in the articulation with the competent authorities and the community institutions, in promoting the right to education and social protection. Focusing on a qualitative approach, through interviews with social workers who are part of multidisciplinary teams in school clusters, in the metropolitan area of Porto in northern Portugal, we sought to know how they perceive their functions and professional practices, and their potential in making the right to education effective for combating inequalities.

Chapter 25: *Uses of artificial intelligence in intelligent tutoring system*; by Clément Aubeuf. This article aims to present the operation of an Intelligent Tutoring System exploiting artificial intelligence to personalize the learning of the learner and to automate certain tasks of the teacher. All the resources consulted and the educational objectives achieved by the learner will be processed using the TinCan API and the limitation of the amount of sensitive data sent to the cloud will be ensured by the use of peripheral artificial intelligence. We start by defining the concepts of artificial intelligence and Intelligent Tutoring System, then we focus on the implementation of machine learning in such a system and the advantages that this technique brings. Finally, we describe the limits of such a technology and the possible solutions to it.

Chapter 26: *What PhD students want from career-related modules: the CHAMELEONS project - An evaluation of three interdisciplinary, inter-sectoral and international modules*; by Tara Cusack, Jack Quinn, Ioanna Chouvarda, & Nicola Mountford. CHAMELEONS (Championing A Multi-Sectoral Education and Learning Experience to Open New Pathways for Doctoral Students, H2020-SwafS-2018-2020), is a programme of 3 EU-funded interdisciplinary, inter-sectoral and international modules that aimed to broaden the skills of PhD graduates improving their employability in academic and non-academic environments. Fifteen doctoral students from five European universities were recruited. This chapter represents evaluation conducted on all 3 modules. In terms of programme content, students perceived that real-time assessment, reflective learning, engagement with course coordinators and the opportunity to engage with practical research tools (Photovoice, Ecosystem Mapping and Walk My ID) all enhanced their learning. They suggested more group activities to enable them to better network with their doctoral colleagues as well as more practical activities. In terms of programme delivery students expressed a desire to have more physical face-to-face engagements while understanding the Covid-19 constraints. When given the opportunity to add freeform and unprompted comments, students almost without exception expressed their satisfaction with and appreciation for the modules. In terms of programme outcomes one student expressed an aspiration to be “more sure” of their skill set and marketability complimenting the focus on practical learning in the programme content review.

Chapter 27: *The e-readiness of student teachers for 21st century teaching: some reflections from a university of technology in South Africa*; by Paseka Patric Mollo. The COVID-19 pandemic and the hygienic measures of social distance brought impasses to education. Face-to-face activities are suspended, and this accelerated the use of Information Communications Technology (ICT) in most schools. Based on these changes, teacher education and training at universities should prepare prospective teachers that are able to function within digital and virtual classrooms. This study investigates the level to which student teachers were exposed to Technological Pedagogical Content Knowledge (TPACK) needed by them to function within such classrooms during and post-COVID-19 times. The study analyses, the Central University of Technology’s (CUT) final year Bachelor of Education student teachers’ e-readiness to integrate ICT and present lessons in these classrooms. A total of 60 student teachers were purposively selected for this study. Data was collected using online questionnaires. A 5-point Likert scale questionnaire was used to collect data from student teachers. Subsequently, results revealed that student teachers are aware of the importance of ICT and e-learning in schools. However, they acknowledge that they have limitations, and they are not fully ready in implementing ICT in digital & virtual classrooms. The study concludes by offering several theoretical and practical recommendations for the e-readiness of student teachers in such environments.

Chapter 28: *Employer, industry and policymaker views on doctorate education*; by Niamh Leniston, Joseph Coughlan, Tara Cusack & Nicola Mountford. As society undergoes green and digital transitions, various policymakers such as the European Commission expect universities to contribute to innovation and progress. As education's highest achieving graduates, the doctorate holder may be key in this era of innovation and problem-solving. As academic career prospects dwindle, and PhD graduates increasingly enter industry, academic research has highlighted that traditional PhD programmes may not provide the required skills and knowledge for the workforce today. To learn how best to address such issues, we consulted thirteen EU policy documents and industry-led reports; and interviewed thirteen employers to add their voice to the discussion. Findings align with previous reports of a lack of transferable skills, but also introduce new concerns such as the desire for adaptability, experience, and redefining skills with regards to self-presentation. We discuss interdisciplinarity and intersectorality as potential solutions to addressing these needs.

Chapter 29: *Relationship between oral reading fluency measures and visual attention span in Brazilian's schoolchildren in pandemic context. Reading fluency measures and Visual Attention Span*; by Giseli Donadon Germano, Lavínia Micaela Moreira, Ana Karolina Silva Deolindo, & Simone Aparecida Capellini. The aim of this study was to relate the measures of oral reading fluency and visual attention span in Brazilian students from the 4th grade of elementary school. Eleven students were submitted to three measures of oral reading fluency and the global visual attention span (VAS) for five characters. The reading correct word per minute measure was used with three texts that differed in complexity. The study was carried out after the adoption of remote teaching in the Pandemic. Spearman analysis was performed between fluency and VAS variables, with no significance. The results revealed a greater number of correct words per minute in the third reading time compared to the first two times, revealing that the real reading performance of 4th grade students is the average of 39 to 40 words per minute and average of fixation of 50% of the characters. These findings indicate academic losses due to low reading fluency rate, fewer characters per fixation and lack of relationship between the variables. These results pointed out to the decrease in reading practices during the Pandemic. As conclusion, there is a need for further studies about this theme.

Chapter 30: *Effects of a tutor based interactive-computerized intervention program for promoting comprehension skills in first grade at-risk Arabic students*; by Bahaa' Makhoul, Elite Olshtain, & Raphiq Ibrahim. The study investigated the effects of an interactive, individualized computer-based intervention program for advancing comprehension skills among children at risk of low literacy. Participants were forty Arabic-speaking first-grade students at literacy risk: 20 assigned to the intervention program, and 20 assigned as control group. In the intervention group, each student was paired with a tutor and was categorized in one of 4 sub-groups: high student and tutor motivation, low student and tutor motivation, high student motivation/low tutor motivation, and low student motivation/high tutor motivation. Students'

comprehension achievements and progress were measured before, during and after the program. Findings showed that the intervention program succeeded in advancing students' skills beyond motivation level, although the greatest improvement was found in the sub-group where both students and tutors had high motivation. Findings demonstrate the need for a specialized intervention to efficiently close the gap in comprehension skills among students at literacy risk and the importance of motivation of both students and tutors in the learning process.

Chapter 31: *Self-reported knowledge, experiences and predisposition towards interprofessional education and collaborative practice in faculty members from the centre-west region of Brazil: a qualitative study*; by Sebastião Benício da Costa Neto, & M. Graça Pereira. The mechanisms that facilitate interprofessional education and collaborative practice (IPECP) associated with the academic training project include the effective involvement of faculty members, a topic about which there is little available knowledge in Portuguese speaking countries. The goal of the present study was the understanding of self-reported knowledge, experiences, and willingness towards IPECP of health/related areas professors, from two universities in the centre-west region of Brazil. The intentional sample included 16 professors, members of the College and Teaching Structuring Cores (definition, management and update of undergraduate pedagogical projects), who answered a semi structured interview script and filled in a sociodemographic and professional profile questionnaire. The interviews were transcribed verbatim, validated by the participants and then submitted to a thematic content analysis, supported by NVivo, version 11. The results revealed six inductive thematic categories (Undergraduate Training Process, Professional Experience in IPECP, Mechanisms for IPECP, Openness to IPECP, Interprofessional Relations and Representation of IPECP), and 24 subcategories. In general, participants revealed to be open to IPECP, even though not all had knowledge of the mechanisms or technical, political, and ethical tools that favour the development of IPECP, in undergraduate degrees.

Chapter 32: *Science teachers' perceptions and practices on using mobile-based informal formative assessment for inquiry-based teaching in South African science classrooms*; by Noluthando Mdlalose, Umesh Ramnarain, & Mafor Penn. The proliferation of mobile technologies in different contexts contributes to the rapid and extensive implementation of mobile-based teaching and learning practices across the globe. Effective implementation of mobile-based informal formative assessment practices in science classrooms could yield to scientifically literate learners who are able to communicate, work collaboratively to construct knowledge and think critically. Data was collected from four purposively selected science teachers around Gauteng province, through questionnaire, classroom observations and stimulated-recall discussions. The findings from the questionnaire indicated that all four participating science teachers still enact formative assessment following the traditional and teacher-dominated approach. Numerous challenges such as insufficient classroom time, inadequate resources and unstable Wi-Fi connection hinders teachers from frequently practicing inquiry-based instructional strategies and

technology-enhanced formative assessment. Although these four science teachers have experienced numerous challenges, they have pointed out numerous benefits of implementing mobile-based formative assessment for inquiry-based learning. Benefits such as enhanced learner engagement, knowledge construction, participation, motivation, and comprehension of scientific concepts during the learning process were reported. However, certain changes such as flexible curriculum, adequate teaching and learning time and adequate and relevant teacher professional development must be implemented to ensure successful mobile technology-enhanced formative assessment for inquiry-based learning practices.

Chapter 33: *Impact of teacher creativity styles on science teacher training in inquiry-based science education*; by Eva Trnová. The efficiency of teacher education is an essential issue in continuous professional development. The main areas affecting this efficiency are innovative educational methods, teacher training methods and personality characteristics, including creativity styles. The study is devoted to researching the roles of teacher creativity styles in science teacher training in implementing inquiry-based science education. The research was conducted in the frame of the European project PROFILES. Design-based research has been used as a research frame. Fifty Czech science teachers - participants in the PROFILES project were identified as innovators using Kirton Adaption-Innovation Inventory. A comparison of teachers' activities during training with characteristics of teachers-innovators was conducted. The research results confirmed teachers' innovative behaviour during the training of IBSE implementation. The main research finding is that the style of creativity (innovators) influenced the interest and process of teacher training. The research implies that it is necessary to accept the creative style of teacher-participants in training courses to be efficient.

Section 3, entitled “Teaching and Learning”, offers research about foundations in the education process itself, in various contexts, both for tutors and students.

Chapter 34: *Media, language and their impact on the development of young children's political awareness - Thoughts and preliminary research results of an interdisciplinary research project*; by Gudrun Marci-Boehncke, Matthias O. Rath, & Raphaela Tkotzyk. The interdisciplinary project PoJoMeC, funded by The Federal Agency for Civic Education (Bundeszentrale für politische Bildung) in Germany, examines the political awareness and understanding of preschool and elementary school children. Thereby the interdisciplinary approach takes place from the perspective of political didactics, literature and media didactics, and journalism. The main research goal is to survey how political awareness of young children is expressed. Therefore, we draw on qualitative approaches, in which we focus (a) on the children's explicit knowledge, and (b) concepts of rule-based behavior. The different levels of abstraction of these concepts are based on a modification of the ecological model of human development according to Uri Bronfenbrenner (1979). This article outlines, on one hand, an interdisciplinary investigation for a

viable concept of politics for research with children between the ages of 4 to 8 years. Therefore, we consider areas such as political didactics, literature and media studies, and philosophy, and introduce a research framework that does not start with terms and concepts but considers more fundamental forms of social perception. On the other hand, this chapter explains methodological approaches and evaluation methods and presents the preliminary results of a pretest with a sample of German preschool children.

Chapter 35: *Teaching towards joy and involvement with Western and Arab classical music*; by Shoshan Shmuelof, Eyad Hamza, & Michal Hefer. Listeners at concerts of classical music, both Western and Arab, are dwindling. Educational policy does not invest enough to preserve the gifts of previous generations. We will argue that what prevents teachers from introducing their pupils to this music is the absence of teaching methods that make listening to unfamiliar music challenging, engaging, and fun. This chapter introduces new pedagogy and a program of prepared concerts for teaching classical music in primary schools and preschools. One of the innovative methods of teaching is the "Musical Mirror" approach, based on the principle that movement gestures are the source of musical gestures and their use aids in the individual's cognitive and affective identification with the music. Conclusions drawn from the study are based on responses to questionnaires and interviews of practicing teachers, both those who are teaching Western and those who are teaching Arab music. The use of Musical Mirrors and Graphs raised teachers' confidence for teaching complex music because it deepens their understanding and generates excitement and identification with the music which they then transfer to their students. Furthermore, the concert program provides a professional framework with opportunities for collaborative learning both for themselves and their pupils.

Chapter 36: *Deeper conceptualization and anchoring of knowledge in second language learning*; by Marie J. Myers. There are increasing concerns around the teaching and learning of French, Canada's second official language, due to a lack of proficiency in the language by future teachers in the English-speaking provinces. The main question is around how to improve this situation and find specific answers for some of the major problems, especially to increase deep learning. To investigate this, instructor teaching notes were analyzed to uncover what was deemed most efficient, as for example noting how the instructor drew attention to knowledge to be mastered and how metacognitive strategies were implemented. Various categories were looked at including ways involving the affective domain, through emotions and using innovative ways to see if they provided a further impact for the crystallization of thoughts and anchoring of knowledge. Overall results show that students reported that they appreciated the corrective feedback the way it was dispensed. A variety of issues were also uncovered. Due to page limitations, in this chapter we present overarching aspects.

Chapter 37: *"My dance area - your dance area" - Metaphors of nursing trainee identity in the context of virtual communities of practice*; by Linda Hommel. Virtual Communities of Practice (vCOP) in the context of nursing education evolve their significance in the case of professional identity development. "What does it mean to be a nursing student?" is a central question in the nursing education context, in which the foundation for a professional identity is laid. Since communication in virtual communities of practice is predominantly text-based, there are often rich descriptions of one's own view as well as reflections on what has been experienced. Studies indicate, that linguistic peculiarities are evident in the expression of nurses in the form of frequent metaphorizations. Against this background, this research addresses the question of what metaphors nursing trainees use in the context of virtual communities of practice to describe their perceptions of being a nursing trainee. The goal of the study is to describe the core characteristics of nursing scholar identity and derive curricular consequences. Within the framework of a netnographic research design, data collection is done through field observations. In the context of data evaluation, Schmitt's metaphor analysis is used. Preliminary results show, that nursing trainees describe their identity in terms of metaphorical expressions, which manifest themselves in Being a Nursing Trainee and Being a Prospective Nurse.

Chapter 38: *Sharpen critical thinking skills to boost future works. The case of engineers from freehand drawing to digital processes*; by Francesca M. Ugliotti, Davide L. D. Aschieri, & Anna Osello. Learning never stops, and neither does teaching. Re-engaging critical thinking learned at an early age and boosting skills within the university setting play a critical role in shaping a generation of professionals capable of meeting the ever-changing challenges of the modern world. The experience is related to the Building Engineering degree program at the Politecnico di Torino, specifically in the first-year Building Drawing course, pointing out the relevance of the approach from the beginning of the curricular path. The discipline of Drawing, understood as a language of communication for the construction industry, is the element around which an active learning path with students is developed. The scheme adopted provided theoretical notions as the knowledge foundation, then methods and tools between tradition and innovation for representing and analyzing the projects with a critical attitude. Real-world (freehand sketching), digital (Computer-Aided Design vs Building Information Modelling), Augmented and Virtual (avatar in the metaverse) practices are presented to provide a synoptic picture of possibilities that the student may choose to self-consciously employ in further academic courses and their working life.

Chapter 39: *Teachers perspectives of virtual programs to promote student engagement in secondary education*; by Samantha F. Junkin. Households can be very distracting for students, simultaneously teachers are unable to walk around to see if students are engaged or distracted (Farah & Barnett, 2019). In addition, teachers can feel intimidated and overwhelmed by technology (Hertenstein, 2020; Schaffhauser, 2020). Teachers are struggling with virtual learning and have gotten little to no professional development on how to engage students in an online platform

(Schwartz, 2020; Williams, 2021). This study will dive into various virtual programs for promoting student engagement. This perspective will help provide professional development direction on which programs could be used to engage students in a virtual setting.

The participants included current teachers enrolled in a master's of education program in southeast Alabama. The participants learned about various free online programs and were able to implement those programs in their classrooms simultaneously. At the end of the semester, students took an online survey asking which programs were least to most helpful for engagement, easiest to implement, and programs they would like to know more about.

Chapter 40: *Examining the factors influencing English teaching and learning in rural settings throughout Europe and the United States*; by Diane Boothe. This chapter examines English learning environments and methods in rural settings in Europe and the United States, assessing their contributions to language learning, both written and spoken. Educational systems are compared and contrasted, including two different styles of English education structured in a comparative analysis using five focal areas. These focal areas are expanded to include the definition and structure of rural education, English language learning modalities, linguistic environment, educational outcomes, and indicators of success. The opportunity to investigate the experiences of teachers who are active in rural communities and focus on the multidimensional aspects of the education of multilingual learners provides valuable information that contributes to expert teaching and learning and bridges the gap between educating rural and urban populations of students. Embracing English language learning, new technologies, and initiating change through proactive educational strategies including a paradigm shift to incorporate a translanguaging pedagogy for emergent English speakers will lead to relevant and purposeful accomplishments in rural school settings.

Chapter 41: *Applying inquiry-based learning into practice: a case study of one rural South African physical sciences teacher*; by Nomzamo Xaba, & Aviwe Sondlo. The South African secondary school curriculum expects teachers to adjust their ways of teaching to include activities that involve learner participation. However, there is little to no support that is aimed at developing in-service teachers' effective inquiry-based practises from the Department of Basic Education (DBE). Therefore, this mixed-method research aimed to investigate whether Physical Sciences teachers' beliefs about inquiry-based learning transpired in their teaching. A quantitative method was used to determine the teachers' beliefs about inquiry and a qualitative method was used to analyse the selected teacher's classroom pedagogical practices and provide insights into whether their beliefs about inquiry translated into their teaching practices. An adopted version of the Science Curriculum Implementation Questionnaire (SCIQ) was used to determine the teachers' beliefs while an Electronic Quality of Inquiry Protocol (EQUIP) was used to evaluate the selected teacher's pedagogical practices. The findings of this study indicate that the Physical Sciences teachers in the Zululand District generally had a positive belief about

inquiry-based learning. However, the selected teacher's pedagogical practices did partially reflect their beliefs about inquiry. The qualitative method it was found that the selected teacher was centred within developing inquiry (Level 2).

Chapter 42: *Reflections on didactical challenges in teaching computer programming*; by Marcin Fojcik, Martyna K. Fojcik, Sven-Olai Høyland, & Jon Øivind Hoem. One of the key challenges of modern society is the vast number of technological devices surrounding us. As a result, general ICT skills are essential for both work and personal time. In addition, ICT skills are widely used in the education of different subjects. The challenge is that while computer science (programming) is relatively well covered in the literature, computer science in other professions, including education for non-IT professionals, is not.

Teaching computer programming is particularly difficult in courses for students from outside computer science fields. The fundamental problem is: what computer skills should be taught and to what extent? It is usually impossible to teach all possible concepts in a course. In this case, the focus should be on programming terminology, key definitions, or perhaps - computational thinking and problem-solving skills? Another challenge may be using English or the national language and selecting examples based mainly on mathematics or practical experiences.

This chapter presents the experiences and reflections of authors from different universities, departments, and courses on teaching, using other pedagogical approaches, and programming theories comparing programming for computer science students and non-computer science students.

Section 4, entitled “Organizational Issues”, gives a glance on tools for implementing organizational learning and change in the education context.

Chapter 43: *Relationship between school climate and grade 9 learner achievement in science: comparing South Africa and Singapore*; by Marien Alet Graham. South Africa scored worst in scientific achievement at the ninth-grade level in the Trends in International Mathematics and Science Studies (TIMSS) 2019. Singapore, the TIMSS 2019 leader, and South Africa are compared. Quantitative positivist design was applied. Multi-level models showed that, for both countries, learners with a higher sense of belonging performed better. In Singapore, school buildings, grounds, and audio-visual tools for instruction were significant predictors; however, in South Africa, appropriate instructional materials and technologically skilled staff were. Singaporean learners at schools where principals claimed their audio-visual resources for instruction were not affected by shortage or inadequacy performed significantly worse than those in schools where principals said it is affected. Several explanations were offered for this surprising discovery, but Singapore education officials and stakeholders may need to investigate more. Thus, for Singapore, we urge additional investigation of the surprising outcome while, for South Africa, prioritising schools with insufficient instructional materials and training all teachers in technology. Stakeholders should also invest in school climate

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surveys and other interventions supporting a healthy school environment. Additional research is encouraged to establish the nature of the impact that a healthy school climate has on learner achievement through longitudinal studies where causation can be proven.

Chapter 44: *Perceived realities of rural primary school teachers in Malawi: applying Bronfenbrenner's ecological systems theory*; by Guðlaug Erlendsdóttir, & Peter Mtika. The ability of teachers to enhance the quality of education depends on the teachers' knowledge, skills, motivation and conducive working environment. This study examines teachers' experiences in four rural primary schools in Malawi, focusing on the impact of their working and living conditions on the quality of education. The study followed a qualitative research approach, collecting data through semi-structured interviews. Data were obtained from 24 teachers, four headteachers and four primary education advisors (PEA). Bronfenbrenner's ecological systems theory was applied to interpret data. The teachers, headteachers and PEAs are represented in the microsystem, their interactions comprise the mesosystem, their working and living conditions are represented in the exosystem, and the macrosystem consists of the customs and laws of society. The findings show that the microsystem, which involves teachers, headteachers and PEAs, appears somewhat active; teachers teach despite numerous challenges. However, interactions between units within that system are weak, resulting in limited mesosystemic interaction. Implications of the findings are discussed later in this chapter.

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Section 1
Teachers and Students

Chapter # 1

REFRAMING TEACHER EDUCATION TO THE REALITIES IN SOME SOUTH AFRICAN SOCIETIES

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ABSTRACT

This chapter argues for the need to reframe the nature of the Bachelor of Education (B.Ed.) degree to the realities of some South African societies. The curriculum must be relevant and factoring in the changed reality in some South African societies. The B.Ed. should keep pace with the societal changes. The chapter was guided by a situated learning theory. The chapter adopted a qualitative approach and a case study design. The study purposively selected 3 universities, 9 lecturers and 15 teacher trainees as participants. Data were collected through use of interviews and focus group discussions. Thematic frames were used to analyse data that were discussed concurrently with the findings. The study established a mismatch between how the teachers are trained and the actual reality in schools. The implication drawn was that failure to move with speed to reconfigure the training of teacher education increases frustration and tension between teachers and learners. The chapter concludes that teacher education programme needs an urgent revamp to keep pace with techno learners and rapid social developments. John Dewey in Draves and Coates (2011, p. 11) argues, “if we teach today’s students as we taught yesterday’s, we rob them of tomorrow”.

Keywords: initial teacher, teacher education programme, learner behavioural conduct, school-based experience, curriculum redevelopment.

1. INTRODUCTION

The globe is ever more becoming dangerous and uncertain. Sibanda and Marongwe (2022, p. 1) state, “Since the uncertainty and precariousness of society cannot be arrested, the onus is on the education system, at whatever level of education, to equip learners for effective adjustment and flexibility to the volatility of society”. The above authors argue further that education being offered had stubbornly remained conservative while the world had continued to evolve (Sibanda & Marongwe, 2022). Given the arguments above, an analysis or reflection on the state of the training programme offered to Bachelor of Education Degree (B.Ed.) student teachers in South Africa is necessary. Such an analysis should focus on the review of dealing with learners showing symptoms of indiscipline, counselling, infusion of technology into learning and teaching among other things. This would be important to transform the programme and speak to the millennium generation found in present schools and the society that is fast changing. Darling-Hammond, Flook, Cook-Harvey, Barron, and Osher (2020) argue that for 21st-century learners to be created, focus must be on teachers’ 21st century skills and re-conceptualize how teachers could be evaluated and trained. Siarova, Sternadel, and Mašidlauskaitė (2017, p. 7) state, “a broader range of skills and abilities is needed to navigate a changing landscape characterised by the increasing importance of information and communication technologies (ICTs). From the interaction we did with some university teacher trainees, we discovered

that most teacher trainees were not enthusiastic to go for School Based Experience (also known as Teaching Practice in some corners of the globe) citing their inability and how they struggled to deal with the generation of learners currently found in schools.

Paterson and Luescher (2022) argue that for the production of skills and knowledge, higher education systems needed to be rebalanced for African countries to develop. Teaching and learning/education plays a critical role towards the economic development of any country. This justifies the need to ensure that the B.Ed. programme is revamped and equip student teachers with the necessary skills and knowledge to address some of the societal challenges that manifest in learners at school. We would like to believe that this would make the student teachers to be relevant given that the world is fast changing.

Reconfiguring the initial teacher education in universities can be a necessary move to take in response to learner behavioural challenges faced by teachers in some secondary schools. Violence is prevalent at some South African schools. Cases such as learners' shootings at school premises, physical violence, beating up of teachers, and in some instances, killings of teachers at schools, drug, and alcohol abuse, (Nhambura, 2020) are common on news headlines in South Africa. In line with the above, Steyn and Mentz (2008) observe that there was a dramatic increase in lack of discipline in schools and classrooms, increase of violence on school grounds, learners and parents with HIV/AIDS, unemployment, poverty, and other societal issues that exert pressure on teachers. Based on the above scenario, we argue for the restructuring of the initial university teacher training programme. It is of great importance to ensure that the way teachers are trained suits and meets the demands and the dynamics of the present society. We can term this 'fit for purpose'. The question to ask is 'are teacher trainees equipped by universities to deal with the social ills that are now common in secondary schools?'

2. OBJECTIVES

The study objectives were:

To establish lecturers' and student teachers' perceptions regarding the current B.Ed. programme offered in South African universities to trainee teachers in relation to the actual practice in secondary schools.

To identify measures that can be used to ensure that Bachelor of Education Degree teacher trainees are prepared to deal with the psychological and social disorder conducts of secondary school learners in Eastern Cape Province of South Africa.

3. THEORETICAL FRAMEWORK

The study was informed by the Situated Learning Theory (SLT). Jean Lave and Etienne Wenger founded the SLT in the 1980s (David, 2007). The Situated Learning Theory's key feature is its belief that learning should take place within authentic context, culture, and activity (David, 2007). SLT argues that learning happens when students work as a team and are given real life activities to work on. Lave and Wenger (1991) argue that SLT students' ideas and actions are shaped by the environment. The theory was suitable for this study since it provides usable knowledge to real world contexts which also the current study is arguing for. Theory will be used to draw recommendations for the chapter.

4. LITERATURE REVIEW

We are aware of the debate on the model that universities can adopt to train student teachers in institutions of higher learning. Van der Walt and Fowler (2006) state that there

was an ongoing debate amongst educationists, worldwide, regarding a particular model for teacher education within the context of the attainability, sustainability, and effectiveness of the particular model. We are of the view that the suitability of a model is determined by its capacity to address the needs and challenges faced by the audience it is going to service. Currently, the South African universities are using the integrated model to train the prospective teachers (Robinson, 2015). It is the responsibility of the South African Qualification Authority (SAQA) to set the requirements or criteria and register them on National Qualification Framework (NQF) that guide universities offering the teacher training programme. According to the Ministry of Education (2001), the custodian for all teacher education programmes are institutions of higher learning under the Department of Higher Education and Training (DHET).

The focus of this chapter is on the reconfiguring of the Bachelor of Education Degree's nature, content and expected outcomes for the different qualifications for teacher education. The Department of Education (DoE) (2007) indicates that the nature, content, and attributes for the qualifications for teacher education are articulated in the Norms and Standards of the Department of Education (DoE) (2000). The SAQA indicates that the B.Ed. programme bears 480 credits. The nature of the programme is that it covers the area of specialisation and the professional component. The Departments of Basic Education and Higher Education and Training (2011) specify the roles or responsibilities that should form part of the programme in terms of content to be covered. The roles are: (1) a learning mediator (2) an interpreter and designer of learning programmes and materials (3) a leader, administrator, and manager (4) a scholar, researcher, and lifelong learner (5) responsible for a community, citizenship and pastoral role (6) an assessor and (7) a learning subject specialist. From the above integrated model mostly followed by South African universities offering teaching degree programmes shows that the emphasis is on subject-content knowledge and pedagogy (Steyn & Mentz, 2008). However, Labate (2020) is of the view that reality needs to be acknowledged that "... purely academic knowledge seems not enough to keep with the 21st century challenges" (Labate, 2020, p. 2).

The chapter is arguing for a change in the approach and nature of the curriculum for Bachelor of Education degree to speak to the changed reality in societies. Zeleza (2022) states that universities should never be like ivory towers that are separated from their societies and the entire world. Zeleza argues that university values, missions and institutional cultures should reflect their times and locations. Hence authors of this chapter arguing for revamping of the B.Ed. programme to speak to the times and societies in South Africa. From literature discussed above, there is little emphasis if any for the curriculum to focus on understanding of the sophisticated changing social character of schools. The student teacher might have the knowledge, yes, but is s/he equipped to manage learners' diverse classrooms who are influenced by the societies they are coming from (Mugenyi, 2021)? Such learners might have a tendency of displaying behaviours that are difficult (Nhambura, 2020; South African Human Rights Commission, 2008) for teacher trainee or newly qualified teachers. This might result in cultural shock and likely to find the teacher or learners missing in action, hence the need for this current study. It is also crucial to train and equip student teachers with the skills necessary to deal with the current generation of secondary school learners. Darling-Hammond (2006) states that it required teachers to have a deeper knowledge of how to address a diverse array of learners and more refined diagnostic abilities to inform their decisions. In a similar view, Levy and Murnane (2004) posit that the ability to communicate in complex environment requires constant information flow and adjustment.

5. METHODOLOGY

The chapter adopted a qualitative approach and a case study design given that the aim of the study was to argue for the need to reconfigure the curriculum of Bachelor of Education Degree offered to student teachers. Three universities, 9 lecturers and 15 teacher trainees were purposively chosen to participate in the study. Purposive sampling technique was used since it allows researchers to select participants deliberately and purposefully with rich information (Creswell & Creswell, 2018) suitable for the study. Data were collected through use of interviews and focus group discussions that permitted room for probing to get clarity (Mncube, 2012). Interviews were used to collect data from the lecturers while focus group discussions were used to gather data from the students. The interviews and focus group discussions were audio-taped and transcribed verbatim. Thematic frames and verbatim quotations were used to analyse data that were discussed concurrently with the findings. Permission to conduct research was sought and granted by the three universities that participated in the study. Permission to use names of the universities and participants was not granted hence use of codes. Participants were assured of anonymity, confidentiality, privacy, and their rights to be observed. Consent forms to participate in the study and to be audio recorded were signed by the participants. We explained the purpose of the research to the participants and assured them that they could withdraw from participating in the study without being victimised.

6. FINDINGS AND DISCUSSION

In relation to the B.Ed. programme offered in some South African universities, the following challenges were identified from the responses given by both students and lecturers. We noticed that the participants' perceptions of the programme were characterised more with challenges associated with the programme as explained below. All interviews and focus group discussions focused on a question that solicited the participants' views related to the B.Ed. programme: 'What are your perceptions regarding the nature of the B.Ed. programme being offered to undergraduate secondary school teacher trainees?' Follow-up questions included 'What experiences have you had of the programme?' and 'What changes would you like to see in the programme?' We asked empirical questions and probed for clarity.

The common critical issues that emerged from the study and recorded were.

a) Lecturers' and students' perceptions

- *The courses offered by universities do not match the lived reality in secondary schools.*
- *Too much focus on theory and content*
- *Heavy workload for lecturers and has a bearing on supervision of students on SBE/TP*
- *Need for more learning time, semester is too short due to late starting of lectures or tutorials*
- *Student teachers not well trained to face the pressures faced in societies that are reflected in secondary schools.*
- *Programme taught by some staff who do not have a teaching or professional qualification*

Both academics and students felt that the B.Ed. programme offered had some gaps that needed an urgent attention. There was a consensus that the programme was focusing too much on the specialized knowledge at the expense of other factors such as preparing and equipping the student teachers with information on how to deal with divergent learners.

The participants shared similar sentiments that the programme was divorced or detached from reality of what was happening in schools. These sentiments are in line with the views raised by Zeleza (2022) that universities should not be like ivory towers where they are detached from reality. Zeleza argues further that universities should come up with programmes or fields of study that reflect the cultures and times of a society. This will give student teachers confidence and the passion to work when they know that the B.Ed. is relevant and addressing the societal needs and are prepared to face the harsh realities out there.

Student teachers or newly trained teachers often found themselves struggling to deliver the content they would have learnt at university because of the challenges they encounter in class. Academic A from university B indicates, *'Universities need to rethink about the B.Ed. programme. The way we are teaching and preparing student teachers is not enough. They struggle when they go to schools that are currently marked by violence, theft, abuse, learners with conduct disorders, harsh societies, poverty, diseases and so forth. How will the student teacher deal with such behaviours?'* Academic AA from university C shared a similar view, *'there should be a curriculum change and development that is constructed by university curriculum developers, student teachers and school management for the universities' teaching to mirror reality of what is happening in societies. Our students are not adequately trained to deal with reality hence advocating for a curriculum reform'*. This is in line with views raised by Sibanda and Marongwe (2022) that education was supposed to gravitate more towards developing lifelong adaptable students, than simply equipping them with academic content. They further argue that content should be aligned to skills, attitudes and dispositions that students require to be successful in the future.

In addition to the above views, Academic AAA from university A expressed concern on the issue of staff who were teaching student teachers without them having a teaching professional qualification. AAA thus said, *'I feel that the whole system needs a revamp and reconsider the criteria that can be used to recruit lecturers in the faculty of education. How is it possible that someone without a teaching qualification trains a teacher?'* The depiction is that teaching as a profession is no longer taken seriously if a student could be prepared by someone who has not walked the way. It is argued that not everyone can be a teacher since teaching is an art or science that needs one to be prepared also by a professional somebody. In fields such as health-medicine, accounting, architecture, etc. there is no Tom and Dick who could just be handpicked to do the job. It would be seen as an insult. Bowman (2018) posits that teaching as a noble profession should be upheld with the integrity it deserves since teaching 'is not for everyone'.

The responses that were collected through students' focus group discussions corroborated the data collected from academics through interviews. What this implies is that the B.Ed. programme being currently offered in these 3 universities is at stake and an urgent attention to address the issue is needed. A student from university A's focus group voiced the issue of time which they felt was not enough. The student thus said, *'We need more time, the time we spend on school-based experience is too short for us to be grounded in the actual practice. Moreso, our lecturers always complain about huge workloads and this result in them not assisting us adequately during our teaching practice. They only visit us once while on teaching practice, so, we lack proper guidance. Sometimes we are even attached to inexperienced mentors in schools after being taught again by some inexperienced lecturers'*. From university B's focus group, students were concerned about the shocks they get when they go to schools for observation and school-based experience. The group through one student thus said, *'Our experience at university and experience in schools is like we are in two separate worlds or planets. How we are prepared at university*

and what is expected of us when we go to schools is totally different. Schools expect us to mark and balance registers but at university we don't do that. Sometimes we feel discouraged and embarrassed to go on teaching practice because you feel that I am not ready to stand and face the pressure in schools. Some learners' conduct behaviours are difficult to handle'.

The other focus group from university C also raised more or less similar views to the ones raised by the other two groups. The general consensus was that the participants were not happy about how the current programme is being offered in terms of its nature, content and timeframes. Noteworthy is that student participants expressed concern on the behaviour of some learners in secondary schools when they go for SBE. Psychologically, troublesome behaviour, intimidates some teachers and kills the morale. The savvy cohort of learners in some secondary schools in South Africa are apparently very violent (Nhambura, 2020) and schools are no longer safe. The implication is that when tables are turned upside down like that, then the curriculum should also be turned upside down to match reality.

Another implication is that the actual root cause of such a behaviour must be established since this could be enabled by other factors from home or primary school. Now, how prepared are the student teachers to tackle this when they go to schools? da Silva Alves and do Prado (2021) state that the family was the child's first social nucleus, responsible for the formation of behavioural, moral, intellectual, emotional, and developmental aspects. Rohenkohl and Castro (2012) in da Silva Alves and do Prado (2021) established that children of couples with high levels of conflict and low affectivity tend to present more behavioural and emotional problems compared to children of families whose parents have few conflicts and are more affectionate.

b) Actual Experiences

- *Shortage of skilled and experienced lecturers*
- *Struggling to infuse community engagement activities*
- *Lack of proper ICT infrastructure for teaching and learning*
- *Lecturers and students lack basic computer skills for teaching*

Both academics and students who participated in the study expressed concern that the B.Ed. programme had to ensure that student teachers were exposed to use of technologies to keep pace with the wonders of the twenty-first century. Some student teachers expressed that they did not have confidence to use information and communication technologies since they were not prepared for that by their lecturers. Some of the lecturers were also struggling to use those technologies. A student from university C's focus group said, *'How is it possible that in this age of technology, universities are still producing teachers who cannot go into schools and use technologies when the learners they will be teaching are a techno savvy generation?'* The implication for this question is that student teachers are not adequately capacitated to use ICTs and when they go to schools, they feel lost. It also shows that their lecturers lack or have limited skills to use ICTs. This finding is in line with the finding that was established by Marongwe, Munienge, and Chisango (2019) that some university lecturers were not infusing technologies in their teaching and learning. It also emerged from the study that some universities that participated in the study had no adequate ICT infrastructure, hence, a lack of enthusiasm to use ICTs. The ICT infrastructure only improved amid the COVID19 pandemic that pushed universities to switch to online. The above issues affect directly how the universities prepare the student teachers. Abunowara (2016) observed that the use of ICT was usually disregarded in teacher training programmes. It can be drawn that universities will produce teachers who are not technologically orientated. When such teachers go to schools that use ICTs, they found themselves being incompetent to meaningfully use the ICTs in their teaching.

This can cause learners who are being taught to misbehave in class because the teacher will not be using the means that appeal to them as techno-savvy learners.

Students from University B shared a sad anecdote concerning the treatment of their teacher from the school principal. Two of the students in the group witnessed that incident when they were with their lecturer during SBE. The lecturer had gone to a certain school where these two student teachers were doing their SBE. Then the principal of that school asked the lecturer in the presence of his student teachers that (quoting one of the students who was quoting the principal), ‘are your students able to use ICTs effectively to enhance learning and teaching? I doubt that. I rather prefer student teachers from University X to students from your university’. The student who was narrating the story highlighted that the lecturer wished the earth could swallow him whole and disappear. What a shame and embarrassment to be told straight into your eyes like that? Based on the above, this is a sign that the B.Ed. curriculum needs to be redeveloped. These students’ knowledge and use of ICTs were perceived as limited by some important stakeholders such as their future employer. Such views that are out there calls for curriculum reconfiguring for it to remain relevant.

Fagrell, Fahlgren, and Gunnarsson (2020) argue that normally for a curriculum to be changed there should be an external force pushing for change, such as in the context of these students. For this to be achieved it means that resources such as provision of information and communication technology (ICT) infrastructure should be available for students to be exposed to them and get acquainted. This will give them experience of real issues they will encounter when they go to the schools. This serves as a wake-up call that things should be done differently from how things used to be done before. This can be summarised by the views expressed by John Dewey in Draves and Coates (2011, p. 11) that, “*if we teach today’s students as we taught yesterday’s, we rob them of tomorrow*”. The B.Ed. programme needs to be aligned to the development of 21st century skills, knowledge and dispositions (Sibanda & Marongwe, 2022).

c) Mitigation Strategies

- *Reforming the programme by making it more practical than theoretical (hands-on)*
- *Content structure to be balanced and focus also on techniques and skills to deal with the changing societies*
- *A must teach with technology for all student teachers*

The study participants envisaged a B.Ed. programme that matches and speaks to what is happening in schools. Interesting proposals were submitted by both student teachers and their lecturers. There was a consensus that a curriculum reform in terms of the programme structure, content, approach, and use of technology need not to be re-emphasised. The programme should be more practical and authentic to avoid a mismatch between how student teachers are trained and how things are done in schools. For example, the use of a collaborative digital tool such as Jamboard, is likely going to excite students and grab their attention during lessons. This enriches students’ learning since it is a modern participatory method that appeals more to techno savvy learners. There is need to expose student teachers to Jamboard which is a digital interactive whiteboard some had never used before. In line with the above views, Redecker et al. (2011, p. 34) posit, “Comparing experts’ findings with those of the teachers, who had been asked to concentrate on school education rather than the whole picture of societal change, what is striking is the degree of coincidence and overlap. Experts and teachers both underline that technological change will be one of the main drivers for change in education and training”. Hence, we are arguing for reforms in the manner student teachers are presently trained as also advanced by Sibanda and Marongwe (2022). Institutions of higher learning need to urgently redesign the B.Ed. programme to avoid a situation whereby change will be forcefully dictated by trends in the

society. Redecker et al. (2011, p. 16) opine that educational institutions should re-create themselves as resilient systems with flexible, open, and adaptive infrastructures, ... and re-connect with society; schools will become dynamic, community-wide systems and networks that have the capacity to renew themselves in the context of change.

7. FUTURE RESEARCH DIRECTIONS

This research has opened great opportunities for potential further studies. It was done on a small scale using qualitative approach of which quantitative approach could have reached a larger population that allows for results to be generalised. It would be interesting to see how universities in urban areas are faring versus universities in rural areas. Comparisons can be made to universities in developed countries whose student teachers practice teaching in suburbs that are marred with gang violence and drugs.

8. CONCLUSION

The chapter concludes that the B.Ed. programme currently offered at universities that participated in the study has some gaps that impact negatively on the performance of student teachers when they are placed for school-based experience. Some classroom realities are not addressed, and students are shocked when in class struggling to deal with reality. Use of ICTs should be infused into the training of student teachers. To summarise, the current B.Ed. programme being offered should be reconfigured to match the changed reality in schools and speak to the current societal pressures. The student teachers are not adequately prepared to deal with changed reality in schools.

9. RECOMMENDATIONS

Based on the findings of the study, it is recommended that the universities under study should relook at the programme they are offering. This will help to produce graduate teachers who are relevant and who can stand the societal pressures. The B.Ed. programme needs to be reconceptualised and include issues such as technology, community engagement, current social ills being experienced in schools such as increased violence, pandemics, etc. The Situated Learning Theory adopted by the study argues that students' ideas and actions are shaped by the environment. This would go a long way in preparing the student teacher to be future ready and save him/her from a culture shock. Curriculum should be responsive and depict reality to avoid a misalignment between what is taught and the real world. We recommend a mechanism to be put in place for timely changes of the curriculum as too slow changes are equally bad as too rapid ones. So, proper speed of the curriculum changes is commendable. Education offered should fit for purpose, it should match the student/learner than learner to fit into education. The universities are also urged to work and learn from each other for them to produce graduate teachers who will be efficient and relevant.

REFERENCES

- Abunowara, A. M. (2016). Using technology in EFL/ESL classroom. *International Journal of Humanities and Cultural Studies*, 1(2), 7–23.
- Bowman, J. C. (2018). *Teaching is not for everyone*. Retrieved from https://cdn.ymaws.com/www.proedtn.org/resource/resmgr/docs/press_release_pdfs/2018-01-26_TeachingisNOTforE.pdf
- Creswell, J. W., & Creswell, J. D. (2018). *Research Design Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.) SAGE Publications Ltd, United Kingdom.
- Darling-Hammond, L. (2006). Securing the right to learn: Policy and practice for powerful teaching and learning. *Educational Researcher*, 35(7), 13-24.
- Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B. & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science*, 24(2), 97–140. <https://doi.org/10.1080/10888691.2018.1537791>
- da Silva Alves, E., & do Prado, P. S. T. (2021). Domestic violence and school performance. In C. Pracana & M. Wang (Eds.), *Psychology Applications & Developments VII* (pp. 154-165). Lisbon, Portugal: inScience Press. <https://doi.org/10.36315/2021padVII14>
- David, L. (2007). Situated learning theory. *Learning Theories*. Retrieved from <https://www.learning-theories.com/situated-learning-theory-lave.html>
- Department of Education (2007). *The National Policy Framework for teacher education and development in South Africa. 'More teachers, better teachers'*. Government Gazette No 29832. 26 April. Pretoria.
- Department of Education. (2000). *Norms and standards for educators*. Government Gazette No 82. Pretoria.
- Draves, W. A., & Coates, J. (2011). *The Pedagogy of the 21st*. LERN Books
- Fagrell, P., Fahlgren, A., & Gunnarsson, S. (2020). Curriculum development and quality work in higher education in Sweden: The external stakeholder perspective. *Journal of Praxis in Higher Education*, 2(1), 1-18.
- Labate, H. (2020). *Knowledge access and distribution: the future(s) of what we used to call 'curriculum'*. Paper commissioned for the UNESCO Futures of Education report. UNESCO.
- Lave, J. & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press, London.
- Levy, F., & Murnane, R. J. (2004). Education and the changing job market. *Educational Leadership*, 62(2), 80-83.
- Marongwe, N., Munienge, M., & Chisango, G. (2019). Can a Solution be Found Using Information and Communication Technology Gadgets in Higher Education? A Case of a Rural University. In L. Gómez Chova, A. López Martínez, I. Candel Torres (Eds.), *11th International Conference on Education and New Learning Technologies* (pp. 1079-1088). Spain: IATED Academy
- Ministry of Education (2001). *National Plan for Higher Education in South Africa*. Retrieved from <https://www.justice.gov.za/commissions/feeshet/docs/2001-NationalPlanForHigherEducation.pdf>
- Mncube, V.S. (2012). Perceptions of parents of their role in the democratic governance of schools in South Africa: are they on board? *South African Journal of Education*, 29(1), 83–10.
- Mugenyi, E. (2021). *Family Factors, School Environment and Conduct Disorders Among Primary School Pupils in Kampala District* (Master's thesis, Makerere University, Kampala, Uganda). Retrieved from <http://makir.mak.ac.ug/handle/10570/9357>
- Nhambura, M. (2020). *Handling of violent behaviour of learners in secondary schools: A case study of Vryburg Cluster in North -West province*. North-West University, South Africa.
- Paterson, M., & Luescher, T. M. (2022, July 28). Reconfigure HE for employable graduates, relevant research. *Africa, University World News*. Retrieved from <https://www.universityworldnews.com/post.php?story=20220612115615969>
- Redecker, C., Leis, M., Leendertse, M., Punie, Y., Gijsbers, G., Kirschner, P., Stoyanov, S., & Hoogveld, B. (2011). *The future of learning: preparing for change*. EUR 24960 EN. Luxembourg (Luxembourg): Publications Office of the European Union.

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- Robinson, M. (2015). *Teaching and Learning Together: The Establishment of Professional Practice Schools in South Africa. A Research Report for the Department of Higher Education and Training*. Stellenbosch University and the Cape Peninsula University of Technology, South Africa.
- Siarova, H., Sternadel, D., & Mašidlauskaitė, R. (2017). *Assessment practices for 21st century learning: Review of evidence* (NESET II Report). Publications Office of the European Union. Retrieved from https://nesetweb.eu/wp-content/uploads/2019/06/AR1_20172.pdf
- Sibanda, J., & Marongwe, N. (2022). Projecting the Nature of Education for the Future: Implications for Current Practice. *Journal of Culture and Values in Education*, 5(2), 47-64.
- Steyn, H. J., & Mentz, E. (2008). Teacher training in South Africa: The integrated model as viable option. *SAJHE*, 22(3), 679–691.
- The Departments of Basic Education and Higher Education and Training (2011). *Integrated Strategic Planning Framework for Teacher Education and Development in South Africa*. Departments of Basic Education and Higher Education and Training, Pretoria.
- Van der Walt, J. L. & Fowler, S. (2006). Constructivist teaching-learning theory: A stewardship approach. In A. De Muynck, & J. L. van der Walt (Eds.), *The call to know the world* (pp. 13–50). Amsterdam: Buijten & Schipperheijn.
- Zeleza, P. T. (2022, July 28). A ‘poverty of low expectations’ bound to bedevil excellence. *University World News*, Retrieved from <https://www.universityworldnews.com/post.php?story=20220727144552906>

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Chapter # 2

THE IMPACT OF TEACHERS' SUBJECT MATTER KNOWLEDGE ON STUDENTS' LEARNING OF RATIONAL NUMBERS AND PROPORTION

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ABSTRACT

This study examines the impact of teachers' subject matter knowledge on students' learning. The mathematical content deals with rational number as fractions and proportion. The study includes pre- and post-tests from 99 students, classroom observations, students' written solutions and interviews with 48 selected students after the post-tests. Findings from this study show that the impact of teachers' subject matter knowledge and ability to identify the objects of learning, and apply this in teaching, strongly influenced the development of students' conceptual learning about fractions and proportion.

Keywords: teachers' subject matter knowledge, fraction and proportion, students' learning.

1. INTRODUCTION

Empirical studies show the complicity, as well as the importance, of interpreting and transforming subject matter knowledge into teaching. The concept of common content knowledge in instruction, concerning mathematical contextualizing of teaching, and transferring it into more complete specialized content knowledge, has received attention in recent years (Adler & Sfard, 2017; Subramaniam, 2019; Karlsson & Kilborn, 2021). What is emphasized is the importance of teachers' subject matter knowledge and teachers' ability to identify and understand the crucial content in teaching as well as widening and deepening this by appropriate variation. These issues have been discussed earlier in an educational and didactical context by Even (1993) and Lamon (2007) who agreed upon the complicity of teaching a mathematical content with rigor, especially within the area of fraction numbers and proportion. This means that teachers' knowledge of mathematical content with a focus on subject matter is linked to students' learning and gives students opportunities to learn mathematics (Livy & Vale, 2011).

According to Ohlsson (1988), fractions, ratio and proportion are connected areas. However, learning fractions is complicated. To sum up, fractions are difficult to learn and include a long-term process that presupposes learning continuity from grade 1 to grade 9 (Hackenberg & Lee, 2015). As different aspects of fraction and proportion are introduced during different school years, usually by different teachers, there is an urgent need for long-term planning to secure this continuity in teaching and learning. "In general, the researchers found that teachers with a relatively weak conceptual knowledge of mathematics tended to demonstrate a procedure and then give students opportunities to practice it. Not surprisingly, these teachers gave the students little assistance in developing and understanding what they were doing" (Kilpatrick, Swafford, & Findell, 2001, p.377).

Moreover, to understand and operate with rate and proportion, students need a thorough understanding of fractions and how to operate with fractions (Behr, Harel, Post, & Lesh, 1992). This is not an easy task. For students, this demands a long-term process of developing adequate knowledge. For teachers, it requires a thorough knowledge of the mathematics they teach (Ma, 1999), what Shulman (1986) calls subject matter knowledge. Also, other researchers, like Ball, Bass, and Hill, (2004) emphasize the importance of teachers' subject matter knowledge.

Hill, Ball, and Schilling (2008) pointed out that teachers' knowledge of subject matter, related to two components, common content knowledge and specialized content knowledge, is an important prerequisite for students' possibilities to learn. They also emphasized the strong connection between the quality of teaching and teachers' subject matter knowledge, and also that there are different factors in the instructions that entail possibilities as well as challenges for teachers' subject matter knowledge to be used in practice.

2. BACKGROUND LITERATURE VIEW

2.1. Rational Numbers and Proportion

Rational numbers consist of equivalence classes like $\frac{3}{4} = \frac{6}{8} = \frac{9}{12} = \frac{12}{16} = \frac{15}{20} = \frac{18}{24} = \dots$. An equivalence class can be identified by expanding and/or reducing a given fraction (Ohlsson, 1988). This is an important piece of knowledge to understand proportion.

Direct proportion can be expressed as a relationship between four numbers or quantities in which the ratio of the first pair equals to the ratio of the second pair, written $a:b = c:d$ or $\frac{a}{b} = \frac{c}{d}$. If $\frac{a}{b}$ equals a constant k , one gets the linear proportion $a = kb$.

Moreover, to solve problems from this field, two conditions are required, a capacity to reason about proportion and find suitable mathematical models, and a capacity to carry out the calculations. Both conditions are related to students' perception of fractions as numbers and as equivalent classes.

In teaching proportion, there is often a focus on part-part, part-whole, whole-whole and the like, during earlier school years, not on important qualities related to the definition of proportion or proportion as a mathematical model. According to Suggate, Davis, and Goulding (2009) this may cause confusion in handling ratio.

The mathematical discourse about fractions and proportions, organized by the teacher, is central for students' learning. This discourse is built on the teacher's common knowledge about fractions, and how to implement it in teaching as specialized knowledge. Specialized knowledge is a bridge between content and students' learning (Depaepe, Verschaffel, & Kelchtermans, 2013; Radovic, Black, Williams, & Salas, 2018).

2.2. Conceptual Change and Conceptual Learning

Learning mathematics is a long-term process, where understanding of fractions is successively experienced by students. Therefore, teaching in grade 8 must rely upon students' pre-knowledge from earlier school years. Referring to Lesh, Post, and Behr (1988), fractions and proportional reasoning are cornerstones of algebra and other areas of mathematics. At the same time fractions are a foundation for proportion. However, as Ohlsson (1988) points out, one difficulty in mastering fractions is "the bewildering array of *many related but only partially overlapping ideas* that surround fractions" (p. 53). This calls for clear and long-term learning of fractions and proportion (Alajmi, 2012; Lee, Choy, & Mizzi, 2021; Berggren, 2022).

When students are taught a new phenomenon, they are often more inclined to assimilate it to their current understanding than to accommodate it with a new and deeper understanding. Posner, Strike, Hewson, and Gertzog (1982) call attention to the process of *Conceptual Change*, "where accommodation may be a process of taking an initial step towards a new conception by accepting, and then gradually modifying, other ideas as they more fully realize the meaning and implication of these new commitments" (p. 223).

A conceptual change is not easy to accomplish, and unsuccessful assimilation could lead to anomalies in students' thoughts. The students conceptual change from fractions to proportion needs conceptual support in teaching (Hiebert & Carpenter, 1992), where teachers' content knowledge in mathematics is a main domain (Grootenboer, 2013).

This study examines the impact of teachers' knowledge of subject matter on students' learning of fractions and proportion from grade 2, 4, 5 to grade 8.

The research questions are:

RQ1. In what ways do teachers transform subject matter knowledge into teaching?

RQ1. What do students experience from teaching about fractions and proportion?

RQ3. What is the relationship between teachers' subject matter knowledge and students' learning from grade 2 to grade 8?

3. THEORETICAL APPROACH AND DESIGN

3.1. Subject Matter Knowledge

Subject matter knowledge includes three different components: *common content knowledge*, *specialized content knowledge* and *knowledge at the mathematical horizon*. To choose an object of teaching and find its crucial aspects, teachers need subject matter knowledge (Ball, Thames, & Phelps, 2008). To unpack a content, like fractions as equivalence classes and proportion, and adapt it to students' pre-knowledge, experiences and abilities, teachers need to understand the mathematical concepts and how to express it in teaching. This is also a condition for keeping a focus on "the object of learning" and to offer a suitable variation of the content.

The teaching of fractions and proportion during earlier school years is often based on preliminary, more perceptible, concepts, and such preliminary concepts must gradually be developed into correct mathematical concepts. Hence, it is not enough for teachers to understand the mathematics they are currently teaching, but also to understand it in such a way that the content can be unpacked and developed during later school years (Hill et al., 2008). This makes demands on teachers' ability to overview the development and progression in students' learning from grade 1 and on, to ensure a progression in teaching. It is important to notice, that lack of mathematical content knowledge, like subject matter knowledge, can never be compensated by experiences from practice (Ball, Hill, & Bass, 2005). *Common content knowledge* is a didactical tool for teachers in dealing with a mathematical content and identifying its "objects of learning" and "crucial aspects." *Specialized content knowledge* is a tool for teachers to understand how students learn and how to transform and apply knowledge in teaching praxis.

In this study, particular attention has been paid to teachers' *subject matter knowledge* of fractions and proportion.

3.2. Variation Theory and the Object of Learning

For learning to take place, some crucial aspects of the object of learning need to vary, while others need to remain constant (Marton, 2015). From a teacher's point of view, this requires a good survey of and insight into the actual content as well as opportunities to identify students' multiple conceptions of an actual phenomenon. If not, it is impossible to present a content that enables students to find crucial aspects of the objects of learning or to offer them relevant variation. This means that teachers' subject matter knowledge is crucial for their ability to teach and thus for their students' ability to learn. This is the core of variation theory and its application of teaching and learning in praxis (Marton & Pang, 2006).

Marton (2015) emphasizes that "the object of learning is constituted in the course of learning" (p. 161). To study how an object of learning is understood it is important to relate it to a certain aspect. Inspired by Pong and Morris (2002), the following aspects are chosen: *The expected object* (EO): What are students expected to learn about fractions and proportion? *The intended object* (IO): What do teachers intend to teach according to the chosen object of learning (fraction and proportion)? *The manifest object* (MO): How is the object of learning related to what was really mediated in the classroom? *The experienced object* (XO): What have the students experienced about fractions and proportion from teaching?

3.3. Design of the Educational Materials

To achieve the purpose of this study, an intervention approach was used. The intervention assumed construction of educational materials, EM1 for grade 2, EM2 for grades 4 and 5 and EM3 for grade 8 (all constructed by the researchers). The materials and the purpose of the materials were presented to the teachers during a seminar. Finally, the teachers involved were observed during three lessons each when implementing the EMs.

EM1 deals with an informal introduction of rational numbers and ratios as part-part, part-whole, whole-whole and part of a number (Ohlsson, 1988).

EM2 deals with rational number (fractions) as equivalent classes, extension of fractions, and how to apply ratio and proportion in problem solving (Suggate et al., 2009).

EM3 deals with rational numbers and proportion related to algebraic concepts of ratio and proportionality, and how to use algebraic concepts in problem solving (Ohlsson, 1988).

The aims and goals of EM1, EM2 and EM3 are described in detail in teachers' guides with a focus on crucial aspects of the object of learning, variation of concepts, and how to use this in problem solving. The *expected objects* were given in EM1, EM2 and EM3. The *intended objects* were explained in the teachers' guides and discussed during the seminars.

4. METHODS

4.1. Participants and Data Collection

The study included five classes and five teachers who were rated as highly successful by their principals: T1 (13 students) in grade 2, T2 (21 students) and T3 (20 students) in grade 4, T3 (19 students) in grade 5 and T5 (26 students) in grade 8. The classes were chosen from five schools situated in different suburbs of Stockholm. The reason for this choice of grades was that part-part-whole and part of a number are introduced in grades 1 to 3 before rational numbers and proportion are formally introduced in grades 4 or 5. Lastly, operations with rational numbers and algebraic concepts of ratio and proportionality are more formally taught in grade 8. The study was implemented during five or six successive lessons. Two weeks before that, the teachers were invited to a seminar, where the aims and goals of the study

were introduced, and they got access to their EMs. One week before the study was carried out, the students got a pre-test. During the study, all communication between teachers and students was recorded by video, with an extra microphone on the teacher. One week after the study, the students got a post-test and a sample of them was also interviewed. The number of students chosen for the individual interviews varied based on two criteria: (1) their achievement on their post-test, (2) the quality of their answers were especially interesting. The interviews were audio-recorded and transcribed. All collected data were transcribed, categorized, thematized and analyzed according to the methodological design and the theoretical approach.

4.2. Observation schedule

The observation schedule has links to *mathematical content knowledge* (Ball et al., 2008), the theoretical approach with a focus on *subject matter knowledge*, and the methodological design (Marton, 2015). The content of the observations was categorized according to Pong and Morris (2002). The teachers' subject matter knowledge was systematized according to qualitative dimensions showed during the teaching process.

The *common content knowledge* category was interpreted according to: (1) logical structure in the teaching, (2) correct terminology and correct notations, (3) use of correct formulas, and (4) the ability to identify students' conceptions and misconceptions. The *specialized content knowledge* category was interpreted as follows: (1) *identifying* and determining whether *students' non-standard solution* could be generalized; (2) whether students' solution was correct and, if not, in which step the calculation went wrong; (3) identifying patterns in students', wrong solutions and *misunderstandings* and (4) taking measures to give the students *conceptual support* in their teaching.

5. ANALYSIS

The analysis was based on theoretical tools on three levels: (1) To understand the outcome of the teaching process related to teachers' *subject matter knowledge*. (2) To understand students' learning during the lessons and the outcome of pre- and posttest and interviews. (3) To understand relationships between levels (1) and (2). The analysis also includes the relations between teaching as intended and manifest objects and learning as expected and experienced objects. The analysis resulted in answers to research questions RQ1, RQ2 and RQ3.

6. RESULTS

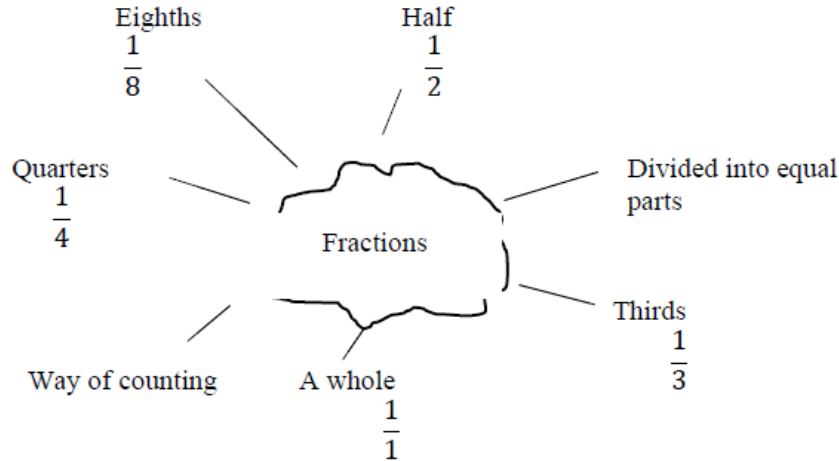
6.1. Teaching and Learning in Grade 2

The mathematical content in EM1 was an informal concept of fraction: part, whole, and part-whole with a focus on part of a number. Before the study, the students worked during one week with fraction as a number and fraction as part-part-whole.

Example 1

At the beginning of the first lesson of the study, teacher and students made a "mind map" as a repetition of what they already knew about fractions. The outcome is presented in figure 1.

Figure 1.
Students' experiences about fractions.



The organization of this discussion had a focus on student's experiences about fractions and how to express one or two parts of a whole and how to write this as a fraction. This example showed the students' earlier experiences of fractions (XO).

Example 2

During the first lesson, students had to divide objects in parts. For example, a picture of 12 cinnamon buns in a 3 X 4 pattern was divided into 2, 3 or 4 parts. The students cut the picture into parts which they pasted onto a piece of paper. Later, the students got formal task like *how many are: (a) 2 thirds of 12 buns? (b) 3 quarters of 12 buns?* (IO).

The teaching referred to concrete materials and students' early experiences about dividing the cinnamon buns into parts (EO). Characteristics of T1:s teaching is found in table 1.

Table 1.
Characteristics of T1:s teaching.

Teaching and focus on	Mathematical content and concept of fraction	Crucial aspects of fractions and proportion	Common content knowledge	Specialized content knowledge	Indicative communication with students
T1	not enough	enough	not enough	enough	good

The post-tests in grade 2 showed that 9 of 13 students were able to solve tasks like *How many buns are two thirds of 16 buns* and 15 of the students were also able to solve the task, *which is the most, 1 third of 6 apples or 2 sixths of 6 apples?* (XO).

The individual interviews in grade 2 with focus on students' experiences of fractions showed that students felt challenged by tasks without an everyday context because they had no experience of working with two-step tasks, that is, the connection between part-whole and part of number and related how to formally express fractions (XO).

6.2. Teaching and Learning in Grades 4 and 5

EM2 for grades 4 and 5 contains tasks about extending fractions and fractions as equivalence classes. Concerning extending of fractions, the crucial aspect was, that when the denominator is doubled (tripled), the numerator will also be doubled (tripled) like in $\frac{2}{3} = \frac{2 \cdot 2}{2 \cdot 3} = \frac{3 \cdot 2}{3 \cdot 3}$. The aim was that students were expected to continuously explain and discuss this process (IO).

Teacher T2 carried out teaching with a focus on the object of learning and spent almost an hour to ensure that students understood the basics of fractions and how to express fractions before she proceeded. After that, teaching continued fluently without problems. This is confirmed by students' active participation and performance during the lessons.

Here are some examples from teaching in classes T3 and T4.

Example 3

Class T3, grade 4. Discussions of how to express $\frac{1}{3}$.

T3: Which figure shall we write in the numerator?

Students: Six, one, two, three, three, four, six.

Many students were often talking at the same time and were often just guessing (MO).

Example 4

Class T4, grade 5.

T4: How many parts are coloured?

Student: Two.

T4: Out of?

Student: Three.

T4: Two of three (writes $\frac{2}{3}$).

The communication in class T4 was of the type triads, where the students were piloted to fill in a separate number. Consequently, few of them understood connections like $\frac{2}{3} = \frac{2 \cdot 2}{2 \cdot 3} = \frac{3 \cdot 2}{3 \cdot 3}$ (MO).

The teaching in class T2 showed a strong significance regarding the connection between common content knowledge and specialized content knowledge. There were well structured lessons with a stringent focus on the students learning and development. Teaching in class T3 and T4 lacked a clear logical structure and moreover, teachers had difficulty in identifying the students' misconceptions and correct them (MO), see table 2.

Table 2.
Characteristics of T2:s, T3:s and T4:s teaching.

Teaching and focus on	Mathematical content and concept of fraction	Crucial aspects of fractions and proportion	Common content knowledge	Specialized content knowledge	Indicative communication with students
T2	good	good	good	good	good
T3	not enough	not enough	not enough	not enough	not enough
T4	not enough	not enough	not enough	not enough	not enough

The pre-test in classes T2, T3 and T4, showed that some of the students already had some experience of fractions and proportion, while most of them did not. The post-tests showed that T2's students solved and explained most of the tasks correctly (XO), while most of T3's and T4's students had difficulty in finding and explaining their solutions (XO). A noteworthy observation, which was confirmed during the interviews, is that most students in class T3 and T4 really tried to solve the tasks, but most of them had misconceptions of the content (XO), see table 3.

Table 3.
Students' misconceptions in tasks, T2, T3 and T4 classes

Type of misconceptions	$\frac{1}{4} = \frac{2}{8} = \frac{4}{12}$	$\frac{3}{4} = \frac{5}{8} = \frac{7}{12}$	$\frac{3}{4} = \frac{6}{8} = \frac{9}{16}$	$\frac{3}{4} = \frac{4}{8} = \frac{5}{16}$
T2	0	0	0	0
T3	4	2	0	1
T4	6	0	5	2

The individual interviews in grades 4 and 5 showed that most of the students in class T3 and T4 were able to understand and discuss fraction and proportion *when the interviewer supported and guided the students*, for example that (1) a fraction can be written in an infinite number of ways $\frac{1}{4} = \frac{2}{8} = \frac{3}{12} = \dots$; (2) such an equivalence class will also show the concept of ratio; (3) in this equivalence class a denominator is always four times larger than the numerator (XO).

6.3. Teaching and Learning in Grade 8

The EM3 contained tasks about proportion and proportionality related to problem solving and rational equation. The aim with the tasks was to explain the connection between fractions, proportion and proportionality and apply this in different types of tasks (IO).

Example: "During a sale the prices were reduced by 10%. Bob paid 63 euro for a pair of shoes. What was the price before the sale?"

The aim with the task was to introduce and discuss the concept of ratio and proportionality in problem solving and to use different possibilities to carry out the calculation. Instead, the teacher used only the formula $x = \frac{630}{0,90}$. It was difficult to identify any focus on proportion or concept of ration and proportionality in the teaching (MO). Moreover, there was limited space for students to communicate or learn different methods during the lessons (XO). The main teaching focus was on formulas and cross-multiplication. However, the meaning of the formulas was not presented to the students, and many of them did not understand when to use them (MO).

It was also clear that students had limited experiences about ratio and proportion. In their textbooks, proportion is defined as $y = kx$. This concept does not work in solving tasks like the one about *Bob's shoes*, above. If proportion had been defined as $\frac{y}{x} = k$, there would have been a simple connection between proportion and ratio, especially if the students had experience of how fractions are classified in equivalence classes. The character of T1's teaching is shown in Table 4.

Table 4.
Characteristics of T5:s teaching

Teaching and focus on	Mathematical content and concepts	Crucial aspects of fractions and proportion	Common content knowledge	Specialized content knowledge	Indicative communication with students
T5	good	not enough	not enough	not enough	not enough

The pre- and post-test in grade 8 showed that most of the students were able to solve simple tasks on ratio and proportion but had difficulty with problem solving that presumed conceptual knowledge about fractions, ratio, proportion and rational equations (XO). The post-tests showed that students just focused on calculation, not on significance or concepts. For example, 11 of 26 students were not able to solve tasks like $\frac{2}{5} = \frac{6}{x}$ or solve a task like "A flagpole gives a shadow that is 6 meters long. Moa who is 1.50 meter tall gives a shadow that is 1 meter long. How tall is the flagpole?" However, the most remarkable observation was that none of the students made an outline of the situation with the flagpole. This result confirmed that a basic understanding of concept proportionality is important for students' procedural fluency (XO).

Another observation was that many students in grade 8 had the same experiences and the same types of misconceptions about fractions and proportion that were found among the students in classes T3 and T4 in grades 4 and 5. An interpretation of this is that teachers T3 and T4 were unable to perceive the students' misconceptions (specialized content knowledge). Teacher T5 tried to solve the consequences of such a situation among her students by teaching procedural formulas just fitting to solve predictable problems.

7. CONCLUSION AND DISCUSSION

This study includes intervention with the intention to study content and crucial aspects in teaching and learning fraction and proportion, in the context of conceptual progression and development. Current conceptual contents are: (1) fractions as part, whole, part-whole and part of a number in grade 2; (2) rational numbers as equivalence classes and expanding of rational numbers into proportion in grades 4 and 5; (3) proportionality related to rational equations and problem solving in grade 8. The mathematical context has a focus on teachers' *common content* and *specialized content knowledge* in the teaching. Students' learning in different classroom contexts, related to teachers' subject matter knowledge and teaching style, was central in the observations of the teaching-learning process.

RQ1: In what ways do teachers transform subject matter knowledge into teaching?

One outcome of the study shows that teachers' *common content knowledge* and *specialized content knowledge* were of varying quality. Another outcome is that teacher's *subject matter knowledge* has a decisive influence on how to teach a content and to find the crucial aspects of the object of learning. Teachers T1 and T2 with satisfactory subject matter knowledge were able to organize a classrooms discourse and identify the object of learning and its crucial aspects (Marton, 2015; Ball et al., 2005). On the other hand, teaching in classes T3, T4 and T5 lacked sufficient subject matter knowledge to understand the actual aims and goals. Instead of using the educational materials (EM 2 and EM3) to explain the ideas of equivalence classes (formally or informally) or how to handle ratio in problem solving, they just focused on counting or formulas. Another problem with teaching in classes T3, T4

and T5 was a one-way communication in triads, which made it impossible to reason and to find misconceptions in students' thoughts (Ball et al., 2008; Hill et al., 2008). Even if these teachers tried to follow up the ideas found in the educational materials, they were not able to change their teaching style (Depaepe et al., 2013; Radovic et al., 2018).

RQ2: What do students experience from teaching about fraction and proportion?

The post-test for grade 4 contained tasks of a similar nature as those in the post-test for grade 8. The results of student's achievement in classes T3 and T4, and the results in grade 8 were similar. The errors made by students in grade 8 were often the same as in grades 4 and 5. During the interviews with students in classes T3, T4 and T5 it became evident that many of these errors depended on the same kinds of misconceptions. The most obvious one was students' perception of extending fractions like $\frac{3}{4}$ as $\frac{3+2}{4+2}$. However, the teachers' one-way communication made it difficult to observe these misconceptions and do something about them. At the same time most of students in class T1 and T2 solved most of all tasks. Let us compare this result with the overall result of the post-test in grade 8, where every other student solved almost all problems correctly while most of other students did not solve any. What we learn from this is the importance for students to have suitable pre-requisites (Lesh et al., 1988; Ohlsson, 1988; Grotenboer, 2013) and conceptual continuity in learning about fractions (Alajmi, 2012; Lee et al., 2021; Berggren, 2022). Moreover, when students are introduced to a new concept, they are often more inclined to assimilate it according to their current understanding than develop a new and deeper understanding (Posner et al., 1982; Hiebert & Carpenter, 1992).

RQ3: Which is the relationship between teachers' subject matter knowledge and students' learning from grade 2 to grade 8?

The study showed that subject matter knowledge as phenomena and how it is expressed in teaching had a strong impact on students' learning about fractions and proportion. The relationship between the manifest object (MO) and the experienced object (XO) showed that subject matter knowledge had a positive impact on the intended object and consequently on students' learning (T1 and T2). On the other hand, without sufficient subject matter knowledge or attention to the intended object (T3, T4 and T5), the teaching had a negative impact on students' learning. In order to do something about students' misconceptions, there is a need for a conceptual change, otherwise they may grow and cause anomalies in students' thoughts (Hiebert & Carpenter, 1992; Ball et al., 2005; Hill et al., 2008).

Findings from this study are not general. Researchers consider investigating more about students learning about fractions, especially conceptual shift from fractions to algebra in the teaching context.

REFERENCES

- Adler, J., & Sfard, A. (2017). *Research for Educational change*. London: Routledge.
- Alajmi, A. H. (2012). How do elementary textbooks address fractions? A review of mathematics textbooks in the USA, Japan, and Kuwait. *Educational Studies in Mathematics*, 79(2), 239–261.
- Ball, D.L., Bass, H., & Hill, H.C. (2004). Knowing and using mathematical knowledge in teaching: Learning what matters. In A. Buffgler, & R. Lausch (Eds.), *Proceedings for the 12th Annual Conference of the South African Association for Research in Mathematics, Science and Technology Education* (pp. 51– 65). Durban: SAARMSTE.

- Ball, D. L., Hill, H.C., & Bass, H. (2005). Knowing mathematics for teaching: Who knows mathematics well enough to teach third grade, and how can we decide? *American Educator*, 29(1), 14–17.
- Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching. What makes it special? *Journal of Teacher Education*, 59(5), 389–407.
- Behr, M., Harel, G., Post, T., & Lesh, R. (1992). Rational number, ratio and proportion. In D. A. Grouws (Eds.), *Handbook of research on mathematical teaching and learning* (pp. 296-333). New York: Macmillan.
- Berggren, J. (2022). *An important part of the whole. The role of metaphors in the teaching and learning mathematics* (Doctoral dissertation, Stockholm University, Sweden). Retrieved from <https://www.diva-portal.org/smash/get/diva2:1698594/FULLTEXT01.pdf>
- Depaepe, F., Verschaffel, L., & Kelchtermans, G. (2013). Pedagogical content knowledge: A systematic review of the way in which the concept has pervaded mathematics educational research. *Teaching and Teacher Education*, 34, 12–25.
- Even, R. (1993). Subject-matter knowledge and pedagogical content knowledge: prospective secondary teachers and the function concept. *Journal for Research in Mathematics Education*, 24(2), 94–116.
- Grootenboer, P. (2013). The praxis of mathematics teaching: developing mathematical identities. *Pedagogy, Culture and Society*, 21(2), 321–345.
- Hackenberg, A. J. & Lee, M. E. (2015). Relationships between students' fractional knowledge and equation writing. *Journal for Research in Mathematics Education*, 46(2), 196–43.
- Hiebert, J., & Carpenter, T. (1992). Learning and teaching with understanding. In D. Grouws (Ed.), *Handbook of research on 81 mathematics teaching and learning* (pp. 65–97). New York: Macmillan.
- Hill, H., Ball, D., & Schilling, S. (2008). Unpacking Pedagogical Content Knowledge: Conceptualizing and Measuring Teachers' Topic-Specific Knowledge of Students. *Journal for Research in Mathematics Education*, 39(4), 372–400.
- Karlsson, N. & Kilborn, W. (2021). Teachers' and students' perception of rational numbers. In Inprasitha, M., Changsri, N. & Boonsena, N. (Eds), *Proceedings 44th Annual meeting on the International Group for the Psychology of Mathematics Education Vol 3. Mathematics Education in the 4th Industrial Revolution: Thinking Skills for the Future* (pp. 96–103). Khon Kaen, Thailand: PME. Retrieved from https://pme44.kku.ac.th/home/uploads/volumn/pme44_vol3.pdf
- Kilpatrick, J., Swafford, J., & Findell, B. (Eds.). (2001). *Adding it up: Helping children learn mathematics*. Washington: DC: National Academy Press.
- Lamon, S. J., (2007). Rational numbers and proportional reasoning. Towards a theoretical framework. In F. Lester (Eds.), *Second handbook of research on mathematics teaching and learning* (pp. 629–668). Charlotte, NC: Information Age Publishing.
- Lee, M. Y., Choy, B. H., & Mizzi, A. (2021). Exploring the introduction of fractions in Germany, Singapore, and South Korea mathematics textbooks. *Journal of the Korean Society of Mathematics Education*, 24(2), 111–130.
- Lesh, R., Post, T., & Behr, M. (1988). Proportional Reasoning. In M. Behr, and J. Hiebert (Eds.), *In Number Concepts and Operations in the Middle Grades. Research Agenda for mathematics Education* (pp.93–118). Virginia: National Council of Teachers of Mathematics, Lawrence Erlbaum Associates.
- Livy, S. & Vale, C. (2011). First year teachers 'mathematical content knowledge: methods of solution for ratio question. *Mathematics Teacher Education and Development Journal*, 13(2), 22–43.
- Ma, L., (1999). *Knowing and Teaching Elementary Mathematics*. Mahwah New Jersey: Lawrence Erlbaum Associates.
- Marton, F., (2015). *Necessary conditions of learning*. London: Routledge.
- Marton, F., & Pang, M. F. (2006). On Some Necessary Conditions of Learning. *The Journal of the Learning Sciences*, 15(2), 193–220.

- Ohlsson, S., (1988). Mathematical Meaning and Applicational Meaning in the Semantics of Fractions and Related Concepts. In J. Hiebert and M. Behr (Eds.), *Research agenda for mathematics education: number Concepts and Operations in the Middle Grades* (pp. 55– 92). Virginia: National Council of Teachers of Mathematics. Lawrence Erlbaum Associates.
- Pong, W. Y., & Morris, P. (2002). Accounting for Differences in Achievement. In F. Marton & P. Morris (Eds.), *What matters? Discovering critical conditions of classroom learning* (pp. 9– 17). Gothenburg: Gothenburg Studies in Education Sciences.
- Posner, G., Strike, K., Hewson, P., & Gertzog, W. (1982). Accommodation of a Scientific Conception: Toward a Theory of Conceptual Change. *Science Education*, 66(2), 211– 227.
- Radovic, D., Black, L., Williams, J., & Salas, C. E. (2018). Towards conceptual coherence in the research on mathematics learner identity: a systematic review of the literature. *Educational Studies in Mathematics*, 99(1), 21– 42.
- Shulman, L., (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4–14.
- Subramaniam, K. (2019). Representational coherence in instruction as a means of enhancing students' access to mathematics. Graven, M., Venkat, H., Essien, A. & Vale, P. (Eds.), *Proceedings 43rd Annual meeting on the International Group for the Psychology of Mathematics Education* (Vol. 1, pp. 33–52). South Africa: PME. Retrieved from <https://www.igpme.org/publications/current-proceedings/>
- Suggate, J., Davis, A., & Goulding, M. (2009). *Primary Mathematical Knowledge for Primary Teachers* (Third Ed.). London: David Fulton Publishers Ltd.

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Chapter # 3

REFLECTING ON A PALAR CO-TEACHING JOURNEY IN TEACHER EDUCATION

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ABSTRACT

Co-teaching at universities encourages student participation, opens chances for feedback, and promotes critical thinking. Co-teaching is a model that involves two or more professionals working together to plan, instruct, and monitor progress of a heterogenous or blended group of students in and outside the classroom, to achieve learning objectives. The authors – lecturers in teacher education at a university of technology – embarked on PALAR (participatory action learning research) in planning, instruction, and assessment, by working together as team partners in a process that stretched over more than two years. In this chapter we reflect on our collaboration. The process involved continuous action learning through experience, enhanced by co-reflection and critical questioning; furthermore, we undertook intentional action research with the primary goal of improving practice through successive cycles of plan–act–evaluate–reflect, and which lead to practice modification. We found that participating, collaborating, building relationships, communicating, and trusting, and the transformational nature of PALAR, are crucial to the process of enhancing learning. The findings imply that PALAR can provide lecturers with a rich learning experience. This chapter adds to the body of knowledge by demonstrating how the PALAR approach can be used in co-teaching for teacher education.

Keywords: co-teaching, PALAR, collaboration, teacher education.

1. INTRODUCTION

Universities still socialise lecturers with extensive teaching knowledge, skills, experience, and practices that are relevant to the traditional one-teacher-per-classroom mode of teaching. Despite research and teaching practice finding that collaboration in higher education institutions is effective, lecturers often work in isolation, in self-contained or departmentalised lecture halls, with one lecturer per classroom working independently. Because lecturers are still prone to solo teaching, co-teaching as an instructional method is an important concern for university lecturers. Co-teaching may be difficult for lecturers who are accustomed to working in isolation, because they must now share the teaching space and transition from an individual to a collaborative model of accountability and practice (Scantlebury, Gallo-Fox, & Wassell, 2008). Moreover, co-teaching at universities has not always been met with enthusiasm, and there has been uncertainty about the most effective approach, resulting in lecturers facing obstacles to successful collaboration (Pratt, 2014; Lenong, 2022). Professionals or lecturers may occasionally take on co-teaching responsibilities but encounter difficulties putting co-teaching ideas or models into practice or applying them in their teaching and learning environment (Härkki, Vartiainen, Seitamaa-Hakkarainen, & Hakkarainen, 2021).

Co-teaching was introduced in schools as an inclusive educational method that allowed general and special education teachers to collaborate to improve learning and meet

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the needs of all students (Cook & Friend, 1995). It was also introduced in higher education institutions in various domains (Bacharach, Heck, & Dahlberg, 2010; Jeannin & Sing, 2018; Rabin, 2020; Lenong, 2022). Friend (2008) proposes that the word co-teaching should not be defined by the discipline, the type of training of the participants, or the composition of the team. Scholars from a variety of disciplines have looked into co-teaching in higher education (Bacharach et al., 2010; Jeannin & Sing, 2018; Rabin, 2020); however, the reality is that studies have not succeeded in breaking down the resistance to or uncertainties about co-teaching, or addressed the fear of being observed by other lecturers and issues related to the unequal relationships of participants, in order to achieve a common co-teaching goal in the teacher education perspective.

Nunes (2018) confirms that lecturers or other professionals may experience difficulties implementing co-teaching. As a result, for co-teaching to be effective, it must be understood, lecturers must be sure about its implementation, and they should have a positive attitude. Hence, the purpose of this chapter is to report on how PALAR (participatory action learning action research) can be used to build trust and equal relationships while overcoming barriers to co-teaching.

The chapter reports on the action learning and critical reflection that were the main factors in the co-teaching approach of this study. The chapter begins with a summary of the theory that drove the research and practical application of PALAR in teacher education at the university of technology involved. It will conclude by emphasising the importance of PALAR in building trust and equal relationships in co-teaching classrooms, to improve student learning. Conclusions will be drawn from the study and recommendations will be made for future research.

2. NATURE OF CO-TEACHING

Co-teaching differs from traditional instructional models in which the lecturer is the sole distributor of knowledge and skills. Cooperative teaching, as defined by Friend (2015), is a merger between general and special educators teaching in a classroom to provide educational curriculum to all students. The term cooperative teaching was later shortened to co-teaching by Cook and Friend (1995). Co-teaching was developed to allow general and special education teachers to interact to improve learning and meet the needs of all students (Cook & Friend, 1995). Initially, co-teaching was offered as a method of supporting children with disabilities in schools (King-Sears, Jenkins, & Brawand, 2020). Co-teaching was first used in schools as an inclusive education method, though it is now being used in higher education too, in heterogenous or blended groups (Bacharach et al., 2010; Jeannin & Sing, 2018; Rabin, 2020).

Teacher education has been implementing the technique of co-teaching since the early 1980s (Badiali & Titus, 2010). Hence, for this chapter, co-teaching, also called collaborative teaching or team-teaching, is a method of instruction that brings together two or more teachers of equal status to create a learning community with shared planning, instruction, and student assessment. Co-teaching can involve a team of department or faculty members, specialists from outside the university, guest speakers, and students – or other arrangements according to how collaboration is determined (Richards, Lawless Frank, Sableski, & Arnold, 2016).

Co-teaching can take different approaches, depending on the instructional needs of students and the task to be presented (Jeannin & Sing, 2018). These approaches include parallel teaching, alternative teaching, team teaching, one teaches one assists, and

alternative teaching. Most definitions of the concept include ideas of collective participation, shared vision, and team reflection (Fluijt, Bakker, & Struyf, 2016).

Ferguson and Wilson (2011) argue that co-teaching enhances lecturer expertise by encouraging lecturers to learn, reflect, change, and give students the chance to learn with effective instructional approaches and alignment of views, values, and teaching. Co-teaching allows for radical care, which has facilitated the development of opportunities for reciprocity in the study of power, identity politics, oppression, privilege, and action (Roland & Jones, 2020). According to Krammer, Gastager, Lisa, Gasteiger-Klicpera, and Rossmann (2018), co-teaching has gained in popularity in recent years, because collaborative teaching can provide differentiated, high-quality instruction that considers all students' needs. This is necessary because students differ significantly in terms of knowledge, abilities, and learning performance. Additionally, Minett-Smith and Davis (2019) report that it leads to improved staff and student satisfaction, which results in staff retention.

Most of the research on co-teaching at the university level has found it to be beneficial to both students and faculty (Hanusch, Obijiofor, & Volcic, 2009; Carpenter, Kerkhoff, & Wang, 2022). Carpenter et al. (2022) state that collaboration creates a richer learning environment and aids teachers to develop practices that support student learning. Co-teaching provides a solid basis for developing quality teaching abilities, cultivating connections, and collaborating for successful inclusive practice during first-year teaching experiences and beyond (Bacharach, Heck, & Dahlberg, 2007; Pettit, 2017). To effectively collaborate or co-teach subjects and work together to satisfy the needs of a variety of students, teaching has become reliant on collective knowledge and the sharing of a wealth of diverse perspectives by lecturers (Majola, 2019; Nunes, 2018). An additional benefit, according to Minett-Smith and Davis (2019), is that it increases staff and student happiness, leading to staff retention. Co-teaching offers an ideal context for learning by providing a zone of proximal development for students and providing ground to lecturers to develop teaching (Roth, Robin, & Zimmermann, 2002).

Bacharach, Heck, and Dahlberg (2008) report that including co-teaching in teacher preparation programmes is a viable strategy for building collaborative abilities, improving classroom instruction, promoting professional growth, and developing student communication skills. During teaching practicum, mentor teachers usually work with one student teacher for several weeks. During student teaching, first-year teaching experiences, and beyond, co-teaching provides a strong foundation for developing quality teaching abilities, and cogenerating connections and collaboration (Bacharach et al., 2008; Pettit, 2017; Lenong, 2022). Co-teaching is an instructional method that needs to be understood to be implemented effectively.

2.1. Principles of Co-teaching

The following principles, as explained by Friend (2016), contribute to co-teaching: mutual respect, mutual goals, shared accountability, and shared resources. The other elements partners must agree on are that they must have common goals and share a belief system, they bring different knowledge, skills, and resources and, thus, learn from each other (Lock, Clancy, Lisella, Rosenau, Ferreira, & Rainsbury, 2016). They must respect opposing viewpoints and thereby demonstrate parity.

2.2. Pitfalls of Co-teaching

The difficulties of incorporating co-teaching as an instructional method need to be addressed. Factors that may bring about difficulties in co-teaching may be external or

internal. Internal factors can be attributed to lecturers' attitudes, their feelings of confidence, fear of failure, and their coping mechanisms (Härkki et al., 2021). Though it has grown in popularity, there is still a lack of knowledge, and a lack of skill in relation to organising co-teaching (Sundqvist, Björk-Åman, & Ström, 2021). Lecturers might also find it difficult to switch from solo teaching to co-teaching (Krammer et al., 2018). Moreover, lecturers may have a fear of being observed by colleagues in the classroom (Scantlebury et al., 2008; Zang & Feng, 2020).

External factors that affect co-teaching are a shortage of adequate training, insufficient administrative support, a mismatch between co-teachers, and difficulties in establishing parity (Krammer et al., 2018). In addition, Sundqvist et al. (2021) report the following challenges: differences in knowledge base, expectations, and goals, conflicting goals, lack of time, and difficulties relating to power. These pitfalls might impede the smooth implementation of co-teaching at universities. Additionally, problems may arise when behind-the-scenes co-planning is done without participants having the necessary knowledge of best practices (Cooley, 2021). According to Drescher and Chang (2022), universities might not be equipped to handle the regulatory adjustments necessary to accommodate new teaching models, such as assessment systems, the effect on promotion or tenure, and the ability to schedule classes to accommodate the needs of two professors rather than one. Hussin and Hamdan (2016) suggest that a poor collaborative culture and a lack of administrative support are significant barriers that professionals face. Steele, Cook and, Ok (2021) identified the following drawbacks of co-teaching: co-teaching is time consuming, increases costs, causes conflicts between faculties, and involves financial, logistical, ideological, and social issues.

3. PARTICIPATORY ACTION LEARNING ACTION RESEARCH

Zuber-Skerritt (2011, p. 2) defines PALAR as a "synthesis of conceptions of action learning (AL) + action research (AR) + participatory action research (PAR) that develop in the PALAR paradigm in theory and practice (praxis)". PALAR is used for collaborative, critical inquiry, performed by academics themselves in their own teaching practice, to investigate student learning challenges and curriculum problems in higher education (Zuber-Skerritt, 2011). PALAR ensures that critical reflection on learning is strengthened by participatory, democratic, mutual relationships, which have the aim of achieving a common goal (Zuber-Skerritt, Wood, & Louw, 2015.).

The four recurring stages of PALAR (plan–act–observe/evaluate–reflect) lead to a better knowledge of participants' changing practice and encourage critical reflection. These four cyclical stages help researchers to identify the requirements of all participants in a collaborative manner. The optimal plan of action is determined and implemented based on the needs that were identified.

The three Rs of PALAR as described by Kearney, Wood and Zuber-Skerritt (2013) – relationship, reflection, and recognition – can be used as a guide when employing this approach. These three aspects allow a truly participatory approach to knowledge generation and tangible social and educational improvements (Kearney et al., 2013).

The first part of PALAR, which is action learning (AL) is a cyclical learning process that takes place in small groups of people who share a common interest in solving real-world problems (Hurst & Marquardt, 2019; Zuber-Skerritt, 2002). The second part of PALAR is action research (AR), which aims to modify practices, people's understandings of their practices, and the contexts in which they practice (Kemmis, 2009). Conducting action research with a PALAR approach has the benefit of encouraging participants to

reflect critically on current knowledge and existing practice, before they adjust and improve their practices, as needed (Zuber-Skerritt, 2018). PALAR leads to communication, lifelong learning and transformational change on both personal and professional levels (Zuber-Skerritt et al., 2015).

PALAR, as explained above, was an excellent starting point for this study, and enabled us to reflect on our journey of co-teaching at a university. Various creative activities were launched along the PALAR journey, which are elaborated on in the next sections.

4. RESEARCH METHODOLOGY

The study was carried out in a four-year university-based teacher education programme in South Africa, with the aim of reflecting on a PALAR co-teaching journey. The chapter is driven by PALAR as an approach, philosophy, paradigm, methodology and a theory of learning (Zuber-Skerritt, 2015). PALAR is democratic, and it permitted co-researchers learn from one another as they shared their views on solving the challenge that had been identified. PALAR encouraged collaboration, teamwork, and participation (Zuber-Skerritt, 2015). The four recurring stages of PALAR, as explained above (plan–act–observe/evaluate–reflect) were followed. The study followed a qualitative approach, based on careful consideration of the principles of PALAR. Data was collected through meetings and workshops, by means of participants' written reflections and information gathered with a free interview schedule.

The meetings were held quarterly to reflect on how to improve knowledge and skills. Two workshops were presented. In this study, the co-researchers (we) were active interveners who helped one another. The four lecturers who worked collaboratively, participated in the study, and were involved in co-teaching lessons, which served as the research context. Permission to record discussions was granted. The institution granted ethical clearance, and confidentiality and anonymity were guaranteed. We critically reflected and reported on our journey of co-teaching. Data were collected using virtual and audio recording devices and were transcribed into text for analysis. The data were analysed thematically throughout all the cycles (Cohen, Manion, & Morrison, 2011). The team teaching coded and recorded the data as individual members and came to a mutual agreement for the final themes. The researchers (we) collectively described themes and coding relationship via group discussions. We validated the findings to ensure that the researchers' (our) conclusions were correct.

Through PALAR, we were given the opportunity to think and act critically, so that we could become lifelong action learners and cooperate effectively with others to achieve personal and communal learning goals. In the planning stage, we started by identifying problems relating to implementing co-teaching effectively in the Education III module. We completed a needs analysis and agreed on the following: we had vast knowledge and experience of teaching the content, and we were interested in co-teaching. Furthermore, we all attended regular meetings and we were familiar with delivery of content and assessment methods. It was important to motivate each other, and regular meetings helped us to be task oriented and increased our enthusiasm.

Lecturers were interested in participating (P), working together on solving the problem affecting teaching and learning, learning from experience (AL) and engaging in a systematic inquiry (AR). The skills, knowledge, and experience of the students in the classroom were valued as assets in the course of a practical professional development programme, because they share knowledge and link learning to the settings of teaching

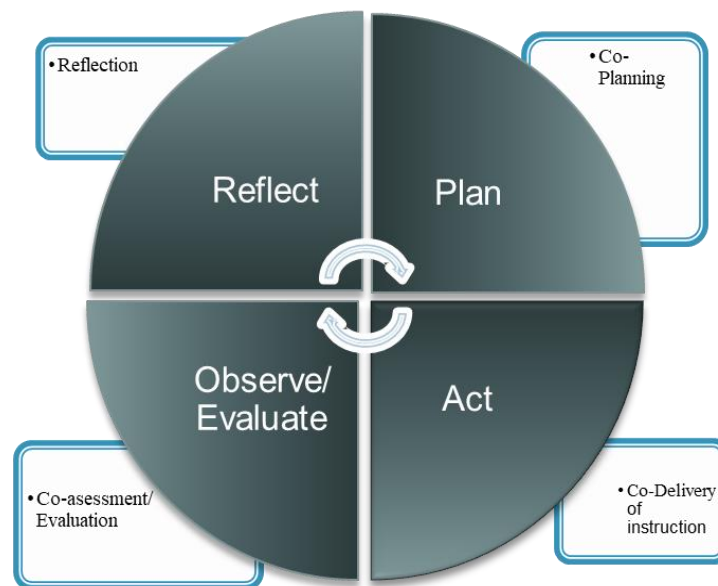
(Darling-Hammond & McLaughlin, 2011). However, we also realised our own lack of knowledge during co-teaching, which resulted in a workshop that touched on defining how co-teaching should be implemented, and the different approaches and principles of co-teaching. We produced and shared knowledge, problems, ideals, and fears, and sought out opposing viewpoints.

We agreed to complete the allocated task, which involved designing slides and compiling test and examination question papers; we were also involved in collaborative marking. We started with parallel teaching, which meant that each lecturer taught their own class, though planning and assessment was done collaboratively. We were all expected to reflect on our planning, delivery of content and assessment procedures.

After learning about it, we experienced co-teaching a lesson in one sitting. The agreement was that all of us would be present in the class, and the lecturers who had been allocated to co-teach the topic, would do so. This meant that our co-teaching involved more than two professionals being in the classroom. At the end of the lesson, all the lecturers contributed to the lesson; we reflected on how co-teaching had been implemented and how it could be improved. To complete these learning pathways, we were assigned specific tasks and had to provide evidence during meetings. We discovered that we had to learn more about co-teaching and identify requirements for further action, especially in planning and delivery of a lesson. The focus was on what can we do to improve co-teaching.

A new cycle of (re-)plan-act-evaluate-reflect took place. The learning pathways were designed to be implemented over a three-year period, to allow for personal growth and skill gain. The meetings took place quarterly to reflect on improving our knowledge and skills.

Figure 1.
PALAR and co-teaching stages.



In conceptualising the figure, the PALAR inner cyclical learning process is the driving force of co-teaching. Action learning and critical reflection were the main factors in the co-teaching approach. Co-planning, co-delivery of instruction and co-assessment are the

important stages of co-teaching that are intertwined in PALAR. The model suggests that, in the three stages of co-teaching, co-reflection needs to be incorporated. The approach shows intentional action research with the primary objective of improving practice through successive cycles that each consisted of plan–act–evaluate–reflect, and involve continuous action learning through experience, which need to be enhanced by co-reflection and critical questioning.

5. FINDINGS AND DISCUSSIONS

This chapter reports on how PALAR can be used to build trust and equal relationships while overcoming co-teaching barriers. The mutual learning process created new ways of knowing and understanding co-teaching. During each cycle, the three critical components – relationship, reflection, and recognition of the PALAR process – were demonstrated. The findings of the experiences and critical reflections of the lecturers are reported below according to themes.

5.1. Interpersonal relationship development and trust

The findings show that, to build a positive collaborative working environment, good interpersonal relationships must be built. We focused on relationship building to kick off the planning phase. Our collaboration was guided by trust, love, and mutual respect. For co-teaching relationships to develop, according to Roland and Jones (2020), co-teaching needs to occur naturally or evolve in a healthy manner – they should not be superficial. A good working relationship is important in co-teaching. Respect and trust are essential elements of collaboration. This view was demonstrated by the participants in the following comments:

Lecturer 1: Working as an educator tends to expose one to a lot of different people, whom through their own separated experiences possess in them different values, standards, and norms.

Lecturer 2: The relationships I've gradually developed... my interpersonal relationship with them became stronger seeing we had to assist each other as well as learn from one another.

Lecturer 3: It did build a good trust amongst lecturers.

Lecturer 4: Trust has also been influenced by the interpersonal relations that developed over the duration of the content delivery. I have had colleagues who seemed to not favour me much because of the age gap between myself and them, yet towards the end of the semester my relationship with them got better because of the work-related ideas that got to be shared during the semester and during the process of PALAR.

Lecturer 2: Collaboration ensured that I respected everyone during co-teaching.

Lecturer 3: A perfect relationship is developed because of the we are free and comfortable with each other. We regard ourselves not only as colleagues but as friends as well.

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The comments show that co-teaching can improve teamwork, communication skills, and the ability to be thoughtful and open to new ideas from others, which leads to a good work ethic and trust. Co-teaching is viewed as a professional, marriage-like relationship or strong partnership, in which lecturers share instruction equally (Friend, 2015). The interpersonal relationship dimensions discovered in both the meetings and workshops included trust, inclusion, acceptance, love, hope and commitment.

5.2. Team facilitation and assessment boost confidence

The delivery of content and assessment were done in the form of station and parallel approaches to co-teaching, according to which each lecturer had to consider the strengths and weaknesses of the other during presentation. This boosted teamworking abilities and confidence to present before other colleagues. The lecturers had to work together and practice teamwork in order to achieve common goals or objectives of the module content. This is confirmed by the comments below.

Lecturer 2: My experience with facilitation improved through learning from my colleagues in the workplace, because of their years of experience working students of different cultures and generations, the colleagues had all the necessary skills I needed to assist me accordingly.

Lecturer 3: We planned lessons together, we shared resources, did preparation together and this made co-teaching effective and an enjoyable experience. I gained confidence.

Lecturer 1: I was not prepared to co-teach, particularly with experienced professionals, but the meetings and workshops allayed my concerns.

Lecturer 4: Working together makes difficult teaching process very simple and enjoyable.

These comments show that moral support fosters confidence in teaching, promotes a healthy work environment, and fosters a co-teaching environment in which perspectives can be shared (Kruger & Yorke, 2010). This finding is confirmed by Sharma and Cobb (2018), who argue that co-teaching allows for understanding of course content from various lived experiences, which inspires critical dialogue. Assessment and facilitation were a collaborative process that helped lecturers to gain knowledge and skills from one another while also promoting a healthy working environment that was free of fear of criticism by colleagues.

5.3. Pragmatic issues in co-teaching

The reflection sought information on the challenges experienced by lecturers in the co-teaching environment. The lecturers alluded to the following pitfalls of co-teaching: fear of collaborating, fear of teaching in front of others, and resistance to co-teaching. This reflection by a colleague summarises the views of many of the co-researchers:

Lecturer 2: I was scared to embark on co-teaching, I didn't want to teach in front or alongside my colleagues.

The finding was that lecturers found it difficult to move from solo teaching to sharing a classroom with a colleague; doing so could result in fear. Härkki et al. (2021) maintain that internal factors influence lecturers' attitudes, feelings of confidence, fear of failure, and coping mechanisms. These factors might impede the implementation or smooth running of co-teaching.

5.4. Lessons learnt from the co-teaching journey

We reflected on the lessons learnt from the PALAR co-teaching journey, to determine whether there are benefits to implementing co-teaching in teacher education. Lecturers reported that they appreciated the opportunity to collaborate and co-teach, as indicated in their reflections.

Lecturer 3: Co-teaching was not new to me... However, I did not know that this process and approaches or how to implement it.

Lecturer 1: I learnt through co-teaching that learners are all different and teachers must be mindful of their structures as they implement them in their respective classrooms. Teachers are also human beings with different attributes and values, co-teaching does not do away with such, but embraces it as it exposes to teachers, moments of preparation where they tend to learn more about how to treat each other not to embarrass themselves in front of their students.

Lecturer 4: I have learned that I had to be more open minded, accommodative, and willing to be a team player. I also learned that it needed a lot of emotional intelligence and patience, most importantly communication and respect.

Lecturer 2: I have learned that working together is good but if there is a mutual understanding and communication must be used to accommodate all parties involved.

These reflections clearly show that the team that was involved in the PALAR co-teaching journey benefited from the experience, and their participation resulted in a positive learning pathway.

6. CONCLUSIONS AND RECOMMENDATIONS

The findings from the data provided by the lecturers who participated in the PALAR co-teaching journey refer to internal factors, such as being afraid to collaborate, and fear of and resistance to co-teaching, which need to be managed. However, the lecturers generally agreed that they benefited from the experience, and it led to a positive learning environment. Subsequently, the PALAR path for co-teaching demonstrates the importance of participation, collaboration, relationship building, respect, communication and trust, and the transformational nature of the process for enhancing learning. There is, therefore, a need for co-teaching to be supported by all stakeholders, and the necessary training should be provided to lecturers. The findings imply that PALAR can be used to provide rich learning experiences for lecturers who are involved in co-teaching. PALAR provided lecturers with the opportunity to think and act critically, to become lifelong action learners

and to effectively collaborate with others to achieve personal and communal learning goals. As a result, by demonstrating how the PALAR approach can be used in co-teaching in teacher education may help lecturers to keep their students engaged and enhance effective content delivery with no recommended division of authority. Lecturers who are exposed to co-teaching are likely share a common goal; they will bring different knowledge and skills and will sharing a wealth of diverse perspectives on transmitting knowledge.

The chapter contributes to the literature by providing a view on co-teaching in teacher education through PALAR. Future research should incorporate perspectives from university-based management and other stakeholders, in order to probe co-teaching as an instructional method.

REFERENCES

- Bacharach, N., Heck, T. W., & Dahlberg, K. (2007). Co-teaching in higher education. *Journal of College Teaching & Learning (TLC)*, 4(10). <https://doi.org/10.19030/tlc.v4i10.1532>
- Bacharach, N.L., Heck, T.W., & Dahlberg, K.R. (2008). What makes co-teaching work? Identifying the essential elements. *College Teaching Methods & Styles Journal (CTMS)*, 4(3), 43–48. <https://doi.org/10.19030/ctms.v4i3.5534>
- Bacharach, N., Heck, T.W., & Dahlberg, K. (2010). Researching the use of coteaching in the student teaching experience. In C. Murphy & K. Scantlebury (Eds.), *Coteaching in international contexts. Research and practice* (pp. 35–52). Dordrecht, The Netherlands: Springer.
- Badiali, B., & Titus, N. E. (2010). Co-teaching: Enhancing student learning through mentor-intern partnerships. *School-University Partnerships*, 4(2), 74–80.
- Carpenter, J. P., Kerkhoff, S. N., & Wang, X. (2022). Teachers using technology for co-teaching and crowdsourcing: The case of Global Read Aloud collaboration. *Teaching and Teacher Education*, 114, 103719. <https://doi.org/10.1016/j.tate.2022.103719>
- Cohen, S., Manion, L., & Morrison, K. (2011). *Research methods in education* (7th ed.). Routledge. <https://doi.org/10.4324/9780203720967>
- Cook, L., & Friend, M. (1995). Co-teaching: Guidelines for creating effective practices. *Focus on Exceptional Children*, 28(3). <https://doi.org/10.17161/foec.v28i3.6852>
- Cooley, M. (2021). *Co-teaching to benefit special education and general education students of all ages*. (Master's thesis, University of Wisconsin-Platteville). Retrieved from <https://minds.wisconsin.edu/bitstream/handle/1793/81340/Cooley%2C%20Megan.pdf?sequence=1&isAllowed=y>
- Darling-Hammond, L., & McLaughlin, M. W. (2011). Policies that support professional development in an era of reform. *Phi Delta Kappan*, 92(6), 81–92.
- Drescher, T., & Chang, Y. C. (2022). Benefits of collaborative teaching models in teacher education programs: Sharing disability knowledge and promoting inclusion. *Teacher Development*, 26(2), 151–165. <https://doi.org/10.1080/13664530.2022.2032299>
- Ferguson, J., & Wilson, J. C. (2011). The co-teaching professorship: Power and expertise in the co-taught higher education classroom. *Scholar-Practitioner Quarterly*, 5(1), 52–68.
- Fluijt, D., Bakker, C., & Struyf, E. (2016). Team-reflection: the missing link in co-teaching teams. *European Journal of Special Needs Education*, 31(2), 187–201. <https://doi.org/10.1080/08856257.2015.1125690>
- Friend, M. (2008). Co-teaching: A simple solution that isn't simple after all. *Journal of Curriculum and Instruction*, 2(2), 9–19.
- Friend, M. (2015). Welcome to co-teaching 2.0. *Educational Leadership*, 73(4), 16–22.
- Friend, M. (2016). Co-teaching as a special education service: Is classroom collaboration a sustainable practice? *Educational Practice and Reform*, 2.
- Hanusch, F., Obijiofor, L., & Volcic, Z. (2009). Theoretical and practical issues in team teaching a large undergraduate class. *International Journal of Teaching and Learning in Higher Education*, 21(1), 66–74.

- Härkki, T., Vartiainen, H., Seitamaa-Hakkarainen, P., & Hakkarainen, K. (2021). Co-teaching in non-linear projects: A contextualised model of co-teaching to support educational change. *Teaching and Teacher Education, 97*, 103188. <https://doi.org/10.1016/j.tate.2020.103188>
- Hurst, R. R., & Marquardt, M. (2019). Action learning: Past, present and future. In O. Zuber-Skerrit, & L. Wood (Eds.), *Action learning and action research: Genres and approaches* (pp. 19-33). Emerald Publishing Limited. <https://doi.org/10.1108/978-1-78769-537-520191005>
- Hussin, M. K. A. B., & Hamdan, A. R. B. (2016). Challenges of co-teaching in Malaysian inclusive classroom: administrators', teachers' and parents' overview. *Procedia-Social and Behavioral Sciences, 217*, 477-486.
- Jeannin, L., & Sing, N. (2018). Co-teaching within diversity: A disruptive productive source of professional development. *South African Journal of Higher Education, 32*(2), 103–121. <https://doi.org/10.20853/32-2-2337>
- Kearney, J., Wood, L., & Zuber-Skerritt, O. (2013). Community–university partnerships: Using participatory action learning and action research (PALAR). *Gateways: International Journal of Community Research and Engagement, 6*, 113–130.
- Kemmis, S. (2009). Action research as a practice-based practice. *Educational Action Research, 17*(3), 463–474. <https://doi.org/10.1080/09650790903093284>
- King-Sears, M. E., Jenkins, M. C., & Brawand, A. (2020). Co-teaching perspectives from middle school algebra co-teachers and their students with and without disabilities. *International Journal of Inclusive Education, 24*(4), 427–442. <https://doi.org/10.1080/13603116.2018.1465134>
- Krammer, M., Gastager, A., Lisa, P., Gasteiger-Klicpera, B., & Rossmann, P. (2018). Collective self-efficacy expectations in co-teaching teams – what are the influencing factors? *Educational Studies, 44*(1), 99–114. <https://doi.org/10.1080/03055698.2017.1347489>
- Kruger, D., & Yorke, C. (2010). Collaborative co-teaching of numeracy and literacy as a key to inclusion in an independent school. *South African Journal of Education, 30*(2), 293–306.
- Lenong, B. (2022). Pre-service teachers engaging in co-teaching: a transformative learning perspective. *ICERI2022 Proceedings, 1771–1777*.
- Lock, J., Clancy, T., Lisella, R., Rosenau, P., Ferreira, C., & Rainsbury, J. (2016). The lived experiences of instructors co-teaching in higher education. *Brock Education Journal, 26*(1). <https://doi.org/10.26522/brocked.v26i1.482>
- Majola, L. (2019). Teacher learning through collaborative teaching: a case study in a secondary school in Pietermaritzburg (Doctoral dissertation, University of Kwazulu-Natal). Retrieved from: https://ukzn-dspace.ukzn.ac.za/bitstream/handle/10413/18235/Lungile_Majola_2019.pdf?sequence=1&isAllowed=y
- Minett-Smith, C., & Davis, C. L. (2019). Widening the discourse on team-teaching in higher education. *Teaching in Higher Education, 25*(5), 579–594. <https://doi.org/10.1080/13562517.2019.1577814>
- Nunes, A. (2018). *Inclusion teachers' perspectives on coteaching* (Doctoral dissertation, Walden University). Retrieved from <https://scholarworks.waldenu.edu/dissertations/5762>
- Pettit, S. L. (2017). Preparing teaching candidates for co-teaching. *Delta Kappa Gamma Bulletin, 83*(3), 15-23.
- Pratt, S. (2014). Achieving symbiosis: Working through challenges found in co-teaching to achieve effective co-teaching relationships. *Teaching and Teacher Education, 41*, 1–12. <https://doi.org/10.1016/j.tate.2014.02.006>
- Rabin, C. (2020). Co-teaching: Collaborative and caring teacher preparation. *Journal of Teacher Education, 71*(1), 135–147. <https://doi.org/10.1177/0022487119872696>
- Richards, S. B., Lawless Frank, C., Sableski, M.-K., & Arnold, J. M. (2016). *Collaboration among professionals, students, families and communities*. New York, NY: Routledge.
- Roth, W. M., Robin, K., & Zimmermann, A. (2002). Coteaching/cogenerative dialoguing: Learning environments research as classroom praxis. *Learning Environments Research, 5*(1), 1–28. <https://doi.org/10.1023/A:1015662623784>

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- Roland, E., & Jones, A. (2020). Co-teaching difficult subjects: critical autoethnography and pedagogy. *Teaching in Higher Education*. <https://doi.org/10.1080/13562517.2020.1839747>
- Scantlebury, K., Gallo-Fox, J., & Wassell, B. (2008). Coteaching as a model for preservice secondary science teacher education. *Teaching and Teacher Education*, 24(4), 967–981. <https://doi.org/10.1016/j.tate.2007.10.008>
- Sharma, M., & Cobb, C (2018). Exploring co-teaching with a social justice perspective: A conceptual study. *Journal on Excellence in College Teaching*, 29(1), 153–176.
- Steele, J.S., Cook, L., & Ok, M.W. (2021). What makes co-teaching work in higher education? Perspectives from a merged teacher preparation program. *Issues in Teacher Education*, 30(1/2), 4–31.
- Sundqvist, C., Björk-Åman, C., & Ström, K. (2021). Co-teaching during teacher training periods: experiences of Finnish special education and general education teacher candidates. *Scandinavian Journal of Educational Research*. 67(1), 20-34. <https://doi.org/10.1080/00313831.2021.1983648>
- Zhang, P., & Feng, Y. (2020). Implementation of team teaching in construction management education. *International Journal of Learning and Teaching*, 6(4), 230–235. <https://doi.org/10.18178/ijlt.6.4.230-235>
- Zuber-Skerritt, O. (2002). A model for designing action learning and action research programs. *The Learning Organization*, 9(4), 143–149. <https://doi.org/10.1108/09696470210428868>
- Zuber-Skerritt, O. (2011). *Action leadership: Towards a participatory paradigm*. In: Action Leadership. Springer, Dordrecht. https://doi.org/10.1007/978-90-481-3935-4_8
- Zuber-Skerritt, O., Wood, L., & Louw, I. (2015). *A participatory paradigm for an engaged scholarship in higher education: Action leadership from a South African perspective*. B Leiden, The Netherlands: Brill. <https://doi.org/10.1163/9789463001847>
- Zuber-Skerritt, O. (2015). Participatory action learning and action research (PALAR) for community engagement: A theoretical framework. *Educational Research for Social Change*, 4(1), 5–25.
- Zuber-Skerritt, O. (2018). An educational framework for participatory action learning and action research (PALAR). *Educational Action Research*, 26(4), 513–532. <https://doi.org/10.1080/09650792.2018.1464939>

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Chapter # 4

TIME ALLOTTED FOR NIGHTTIME SLEEP AND THE PRESENCE OF FATIGUE IN PUPILS FROM THREE HIGH SCHOOLS IN BOTOȘANI COUNTY

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ABSTRACT

Fatigue is a physiological phenomenon that occurs after sustained effort and disappears through active and passive rest. The studied group consists of 246 pupils from the 9th and 11th grades from three high schools in Botoșani county – a theoretical high school, a national college and sports high school. Most pupils say they sleep for 6-7 hours (37.80%) or 7-8 hours (33.73%). Fatigue is often present in 46.34% of cases. When they wake up in the morning, 44.30% of pupils feel tired. The majority of pupils from the 11th grade feel tired at the end of the week, while those from the 9th grade feel tired at the beginning of the week. During the day, fatigue appears mostly in the middle of the school day (36.17%) with insignificant differences between grades or schools, but significant when correlating night sleep with the time of day when fatigue appears ($p < 0.01$). Napping is rarely present in the majority of pupils (46.74%). Most of the surveyed pupils have headaches or eye pain when fatigue occurs. Fatigue is present especially in pupils who recognize a short time spent sleeping at night. Recovery through sleep during the day is rarely present.

Keywords: fatigue, insufficient sleep, napping, school.

1. INTRODUCTION

Fatigue is a physiological phenomenon that occurs when the body exceeds effort capacity. Special attention should be paid to this phenomenon in young people who are undergoing the processes of growth and development, but who must also adapt to school demands (Albu, Hodorcă, Onose, Negrea, & Crăcană, 2016).

Fatigue disappears after passive rest (sleep) or after active rest (recreational activities). Passive rest is represented by sleep during the day and especially during the night. Issues related to sleep duration, its variability, efficiency and falling asleep must be addressed. (Albu, Dima, Abdulan, & Carausu, 2018). Sleep duration (expressed in hours per day) is the time between going to bed and waking up. The National Sleep Foundation recommends 8-10 hours of sleep for people over 14 years old (Hirshkowitz et al., 2015). Sleep variability is assessed by the differences between the number of hours slept on weekdays and on weekends. Sleep efficiency is assessed by the actual time spent asleep. High efficiency occurs when most of the time is spent sleeping and not trying to fall asleep. In teenagers a special problem is the trend of a late bedtime. Falling asleep after 10:00 p.m. and waking up at 7:00 am does not ensure 8 hours of sleep per night (Kracht et al., 2019; Rasouli et al., 2021).

Unfortunately, recreational activities can become a problem if the time allotted for them is too long – for example time spent on the computer can reach several hours per day.

Obviously, in this context, active rest leads to a reduction in the number of hours of sleep and to the appearance of chronic fatigue - it can also lead to computer addiction which is dangerous (Baciu, 2020). There is currently much discussion about addictive phenomena, especially those related to overeating associated with reduced interest in physical activity and changes in sleep-related behavior. People who do not have food addiction rarely experience moments of sudden sleepiness during the day (3.8 ± 5.0 days in the last month) while those with severe eating problems frequently have such moments (6.4 ± 7.7 days in the last month) (Tan Ee Li, Pursey, Duncan, & Burrows, 2018).

Other situations are those where young people have eating problems manifested by insufficient intake. These imbalances are associated with slow growth, high stress, and impaired sleep. There are pupils who, due to an unbalanced diet, have problems with sleep quality (55.7% of students have such problems) (Rasouli et al., 2021).

Parents should pay attention to these issues and intervene when needed. A study carried out on a group of teenagers from Iasi shows a modest level of parents' interest for pupils' leisure activities (rarely - 38.00%) or even an absence (never - 20.36%) so it is unlikely that there is special concern towards sleep time (Albu et al., 2018).

Educational programs should also focus on understanding the importance of nighttime sleep and napping in maintaining good health and ensuring good school performance. Programs that teach meditation exercises have increased the time allocated to sleep in pupils from 6.92 hours to 8.08 hours, an important element because it can be used in the therapy of patients with various addictions (Soriano-Ayala, Amutio, Franco, & Mañas, 2020).

There are aspects that need to be carefully monitored even for young people who do not have addictions because as they get older, the sleep time decreases, which is concerning. This trend is clear in Ecuador's pupils. Children sleep on average 8.96 hours per day, young adolescents 7.96 hours and older adults 7.08 hours with statistically significant differences. Unfortunately, in 72.1% of situations the time allotted for sleep is insufficient (Villa-González, Huertas-Delgado, Chillón, Ramirez-Vélez, & Barranco-Ruiz, 2019).

The objectives of the study:

- the differentiated evaluation by grades and schools, of the time allotted for nighttime sleep;
- establishing the correlation between the time allocated to night sleep and the appearance of fatigue;
- assessment of the moment during the day and week when the fatigue manifests itself;
- identifying the clinical signs that appear in the fatigued pupils observed during the study;
- assessing the frequency of naps in surveyed pupils.

2. METHOD

The study was carried out in 2019 on a group of 246 pupils from three high schools in Botoșani County. There are 123 pupils in the 9th grade and 123 in the 11th grade. There are 69 pupils from a theoretical high school, 100 pupils from a national college and 77 pupils from sports high school.

These three types of schools were chosen in order to assess if there is any difference based on effort levels and academic programs.

The theoretical high school is located in a small town with 10,000 inhabitants. Theoretical high schools generally demand an average level of intellectual effort, with more mathematics, science and language classes (for a total of 14-17 hours per week) and low level of physical effort (1 hour of Physical Education per week).

The national college is a high school in Botoșani city. National colleges are theoretical high schools so they have the same academic programs, but there are higher expectations on school performance. Children who study at national colleges tend to, on average, get better marks than those who study in other types of schools and win more national and international school-related contests (in mathematics, physics, biology, foreign languages etc.). High academic performance is one of the prerequisites in order for a high school to obtain the title of “Colegiu Național” (National College) in Romania (Ministry of National Education Order no. 3732, May 20, 2013).

A sports high school demands below average level of intellectual effort (a total of 9-12 hours of mathematics, science and language classes) and high level of physical effort (a total of 10-12 hours of practical P.E. every week) (Ministry of Education, Research and Innovation Order no. 3410, March 16, 2009).

The 9th and 11th grades were chosen because there are clear differences between overall levels of school demands. The 9th grade is the start of high school, there are fewer classes per day and the subjects taught are not as difficult. By contrast, in the 11th grade there are more classes, the subjects are more difficult and there is generally more homework. This is also the period where many pupils start preparing for the end-of-high-school Baccalaureate exam.

A survey was conducted about the time allotted for nighttime sleep, the presence of fatigue, the time of day / week when it occurs and the presence of sleep during the day. The pupils were handed a questionnaire and verbal instructions were given on how to answer the questions. The questionnaire was anonymous and voluntary.

Nighttime sleep was estimated based on the question:

- “How many hours do you sleep on average per night?” – the possible answers were: “6-7 hours; 7-8 hours, 8-9 hours; over 9 hours”.

Fatigue was assessed with the help of four questions:

- “Do you feel tired?” – “often, rarely, never”;
- “How do you feel when you wake up in the morning?” – “rested, tired, very tired”;
- “During the week, when do you feel tired?” – “at the start, in the middle, at the end”;
- “During the day, when do you feel tired?” – “in the morning, during the day, in the evening”.

The presence of sleep during the day was also studied:

- “Do you sleep in the afternoon?” – “every day, often, rarely, never”.

The clinical signs that appear in conditions of fatigue were assessed: “Do you have a headache; Do your eyes hurt; Do you have insomnia; Do you feel anxious; Do you have a hard time falling asleep”. The results were interpreted insisting on the correlations between nighttime sleep and the presence of fatigue. They were processed using the Pearson’s chi-squared test.

3. RESULTS

High school students need 9 hours of sleep per day (Kracht et al., 2019; Hansen, Hanewinkel, & Galimov, 2022). Unfortunately, this result is present in only less than 30% of pupils (Table 1).

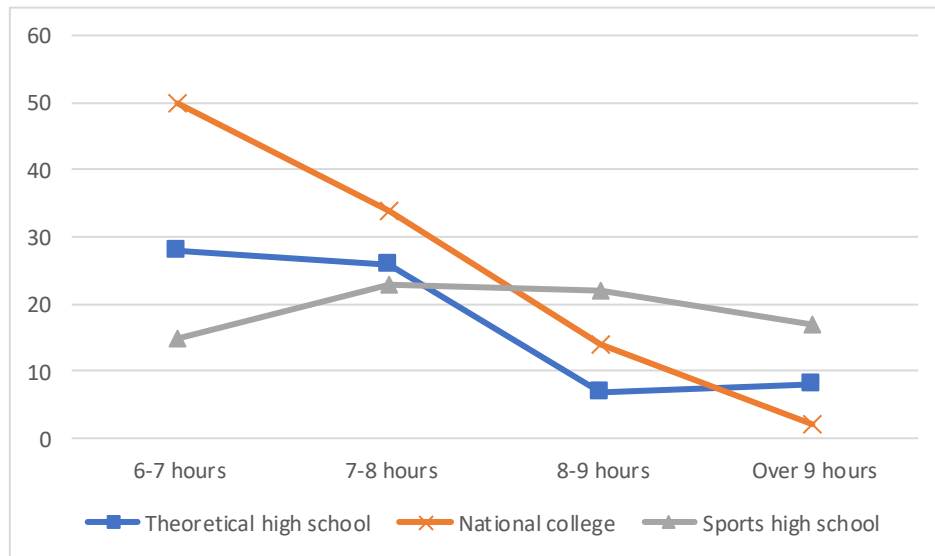
Table 1.
Time spent sleeping at night.

	6-7 hours	7-8 hours	8-9 hours	Over 9 hours	Total
9 th grade	52	38	23	10	123
11 th grade	41	45	20	17	123
Total	93	83	43	27	246
%	37.80	33.73	17.47	10.97	

The calculated differences are statistically insignificant ($p > 0.05$, $f = 3$, $\chi^2 = 3.912$) so this is a habit that exists in most pupils.

When looking at the different schools, there are interesting results because half of the students at the national college admit to having a reduced amount of time allocated to nighttime sleep. The calculated differences are statistically significant ($p < 0.001$, $f = 6$, $\chi^2 = 35.510$) (Figure 1).

Figure 1.
Time allotted for nighttime sleep among the three schools.



In this context, it is essential to assess the presence of fatigue. It is often recognized in 46.34% of cases. Out of the entire group we see that 6.50% of teenagers are never tired (Table 2).

Time allotted for nighttime sleep and the presence of fatigue in pupils from three high schools in Botoșani county

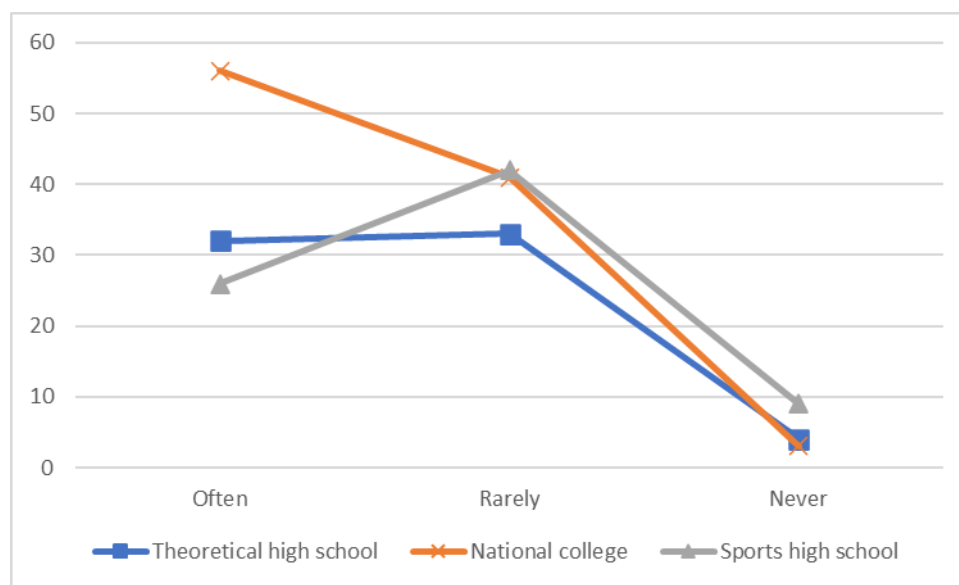
Table 2.
Frequency of fatigue.

	Often	Rarely	Never	Total
9 th grade	58	60	5	123
11 th grade	56	56	11	123
Total	114	116	16	246
%	46.34	47.15	6.50	
Correlation between nighttime sleep and fatigue				
6-7 hours	57	32	4	93
7-8 hours	32	44	7	83
8-9 hours	17	22	4	43
Over 9 hours	8	18	1	27

The calculated differences between the two grades are statistically insignificant ($p > 0.05$, $f = 2$, $\chi^2 = 2.420$). The correlation between the time allocated to night sleep and fatigue shows significant differences ($p < 0.05$, $f = 6$, $\chi^2 = 15.775$) which indicates the existence of a high percentage of students who sleep little and feel marked fatigue. There are also pupils who sleep more than 9 hours and who in most cases rarely feel tired.

In terms of schools, the situation is also worrying at the national college, where more than half of the students often feel tired. The differences obtained are statistically significant ($p < 0.05$, $f = 4$, $\chi^2 = 11.522$) (Figure 2).

Figure 2.
The presence of fatigue among the three schools.



After sufficient sleep, when waking up in the morning the pupil must feel well rested. Unfortunately, this response occurs only in 44.30% of situations (Table 3).

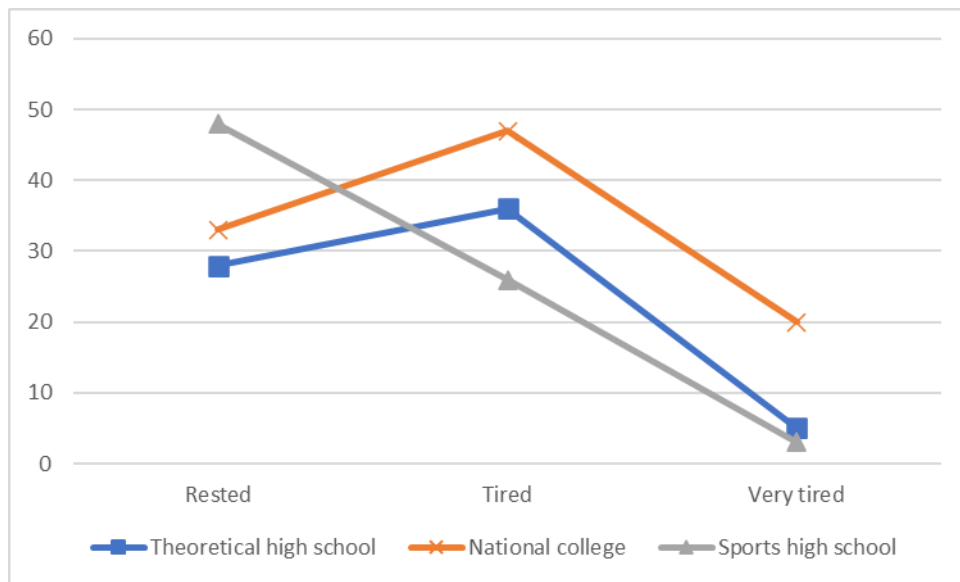
Table 3.
The presence of morning fatigue.

	Rested	Tired	Very tired	Total
9 th grade	41	66	16	123
11 th grade	68	43	12	123
Total	109	109	28	246
%	44.30	44.30	11.38	
Correlation between nighttime sleep and morning fatigue				
6-7 hours	24	53	16	93
7-8 hours	45	34	4	83
8-9 hours	21	16	6	43
Over 9 hours	19	6	2	27

The differences between grades are significant ($p < 0.01$, $f = 2$, $\chi^2 = 12.110$) and draw attention to the pupils in the ninth grade who often feel tired. The correlation between night sleep and morning fatigue shows statistically significant differences ($p < 0.01$, $f = 6$, $\chi^2 = 22.011$) which draws attention towards the pupils who sleep little and wake up tired and even very tired in the morning.

When waking up in the morning, many students from the national college feel very tired, an aspect that must be known and carefully evaluated. The differences calculated by schools are obviously statistically significant ($p < 0.001$, $f = 4$, $\chi^2 = 23.180$) (Figure 3).

Figure 3.
The presence of fatigue in the morning.



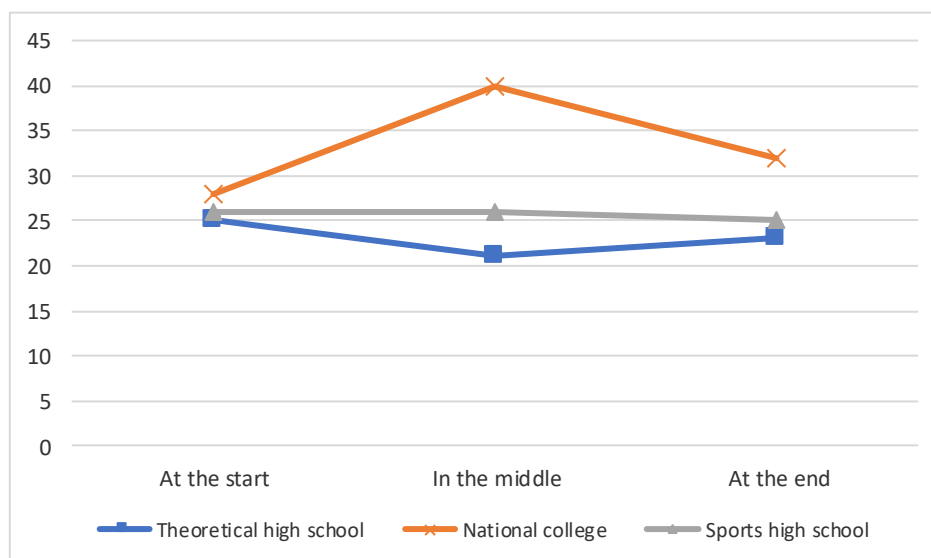
We should expect to see signs of fatigue at the end of the school week. In the studied group, signs of fatigue also appear at the beginning and middle of the week (Table 4).

Table 4.
The time of week when fatigue occurs.

	At the start	In the middle	At the end	Total
9 th grade	48	43	32	123
11 th grade	31	44	48	123
Total	79	87	80	246
%	32.11	35.36	32.52	
Correlation between nighttime sleep and fatigue during the time of the week				
6-7 hours	35	38	20	93
7-8 hours	24	28	31	83
8-9 hours	12	13	18	43
Over 9 hours	8	8	11	27

The differences between the two grades are statistically significant ($p < 0.05$, $f = 2$, $\chi^2 = 6.868$) and draw attention to students in the ninth grade who often feel tired. The correlation between sleep and the time of the week when fatigue appears shows statistically insignificant differences ($p > 0.05$, $f = 6$, $\chi^2 = 8.670$). When looking at schools, fatigue appears at the beginning, middle or end of the week without a specific pattern, so the calculated differences are statistically insignificant ($p > 0.05$, $f = 4$, $\chi^2 = 2.089$) (Figure 4).

Figure 4.
Fatigue during the week



Physiological fatigue normally occurs in the evening. In the surveyed students, fatigue is also manifested in the morning and during the day (Table 5).

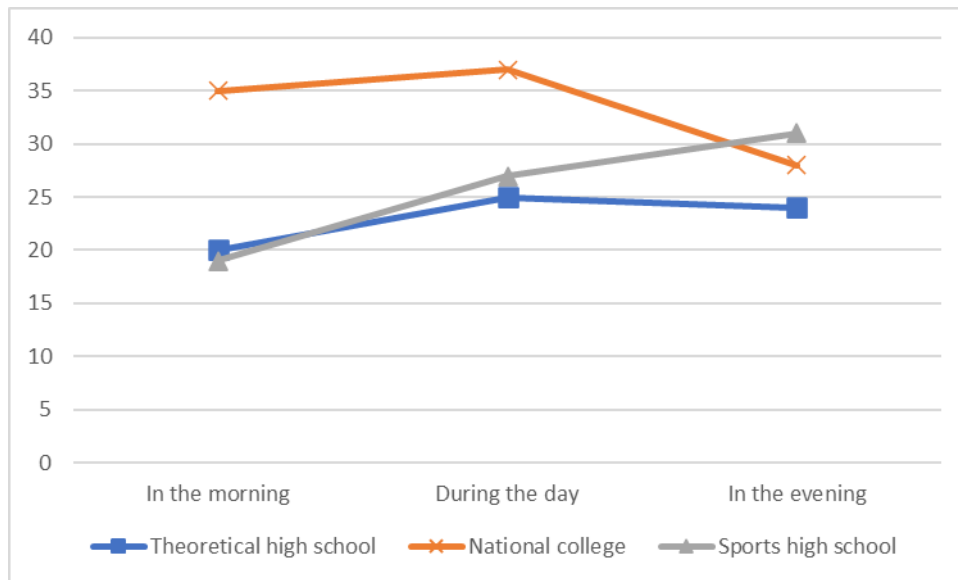
Table 5.
The time of day when fatigue occurs.

	In the morning	During the day	In the evening	Total
9th grade	44	43	36	123
11th grade	30	46	47	123
Total	74	89	83	246
%	30.08	36.17	33.73	
Correlation between nighttime sleep and fatigue during the time of day				
6-7 hours	33	41	19	93
7-8 hours	22	30	31	83
8-9 hours	15	11	17	43
Over 9 hours	4	7	16	27

Between the two grades the differences are insignificant ($p > 0.05$, $f = 2$, $\chi^2 = 4.204$) but the correlation between nighttime sleep and fatigue during the day shows statistically significant differences ($p < 0.01$, $f = 6$, $\chi^2 = 18.349$).

In all three schools, students feel tired in the morning, in the middle of the day or in the evening without a dominant situation, the calculated differences being statistically insignificant ($p > 0.05$, $f = 4$, $\chi^2 = 3.590$) (Figure 5).

Figure 5.
Fatigue during the day.



Theoretically, the problem of fatigue and insufficient nighttime sleep can be solved by sleeping during the day. This is present “often” or “every day” only in less than 20% of cases (Table 6).

Time allotted for nighttime sleep and the presence of fatigue in pupils from three high schools in Botoșani county

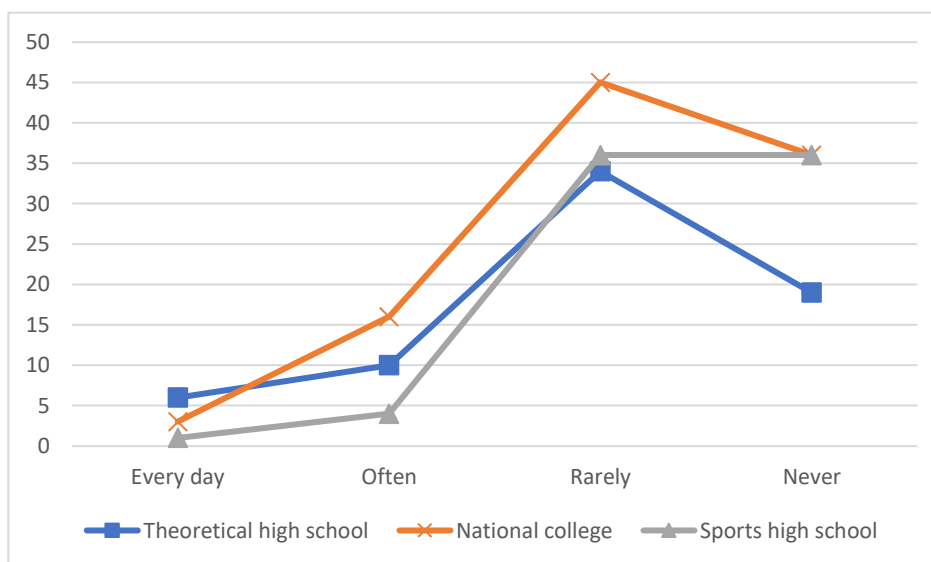
Table 6.
Napping (by grade).

	Every day	Often	Rarely	Never	Total
9 th grade	3	14	66	40	123
11 th grade	7	16	49	51	123
Total	10	30	115	91	246
%	4.06	12.19	46.74	36.99	
Correlation between nighttime sleep and daytime sleep					
6-7 hours	4	9	43	37	93
7-8 hours	5	15	34	29	83
8-9 hours	1	6	22	14	43
Over 9 hours	0	0	16	11	27

Between the two grades the calculated differences are insignificant ($p > 0.05$, $f = 2$, $\chi^2 = 5.572$). When looking at the correlation between nighttime sleep and daytime sleep we see statistically significant differences ($p > 0.05$, $f = 6$, $\chi^2 = 10.740$).

Sleeping during the day solves the problem of marked fatigue, but this is a modest concern for high school students with a sports program where most of the answers are rarely or never, so the calculated differences are statistically significant ($p < 0.05$, $f = 6$, $\chi^2 = 14.732$) (Figure 6).

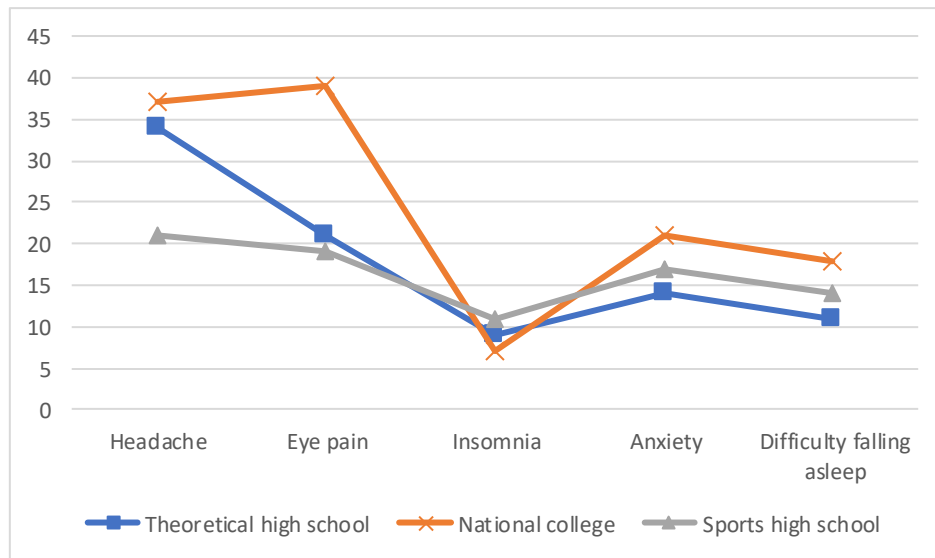
Figure 6.
Napping (by school).



From a medical point of view, special attention must be paid to the clinical signs that appear in conditions of major fatigue. There are students who mark two or three clinical signs, an aspect that becomes worrying. The dominant symptoms are headaches and eye

pain, probably generated by high intellectual effort associated with a high time spent in front of the computer. The differences among schools are insignificant except for headaches which are dominant in the high school students from the theoretical high school ($p < 0.05$, $f = 2$, $\chi^2 = 7.542$).

Figure 7.
Clinical signs of fatigue.



4. DISCUSSION

The study is oriented on two directions represented by the assessment of the results by grade and school. Assessing the differences between the two grades is important because the body's physical and mental effort capacity gradually increases with age.

Special attention must be paid to the different types of schools because in elite high schools the demands are much higher. Teaching staff are oriented towards stimulating the ability to innovate, in order to improve on one's own talents. There is a desire for self-improvement, for competitiveness that is frequently associated with intense demands and fatigue (Ma, Liang, Liu & Li, 2018).

Even if the curriculum is the same in all high schools, the demands are different due to the different teaching methods of the teaching staff and especially their varied requirements (Sousa, 2019).

Specialists recommend 9-11 hours of sleep per day for teenagers under 14 years old, and 8-10 hours of sleep a day for those over 14 years old or 9-12 hours for those aged 9-12 years and 8-10 hours for 13-18-year-olds (Kracht et al., 2019; Hansen et al., 2022). Unfortunately, in the studied group such an answer is present only in a quarter of cases. In a study carried out on adolescents in Iasi, similar results to those in the studied group appear, which indicates the existence of a habit pupils develop related to an insufficient number of hours slept per night (Albu et al., 2016).

In adolescents in the United States of America, insufficient sleep is present in only 25% of responses, being recognized by 24.98% of boys and 32.2% of girls (Jacobs, 2019).

Adolescents in urban parts of Mexico experience an average sleep time of 10 hours, a response that occurs in both sexes, in public and private schools and that is adapted to the age requirements (Galván et al., 2017)

Teens' unhealthy living habits often persist or worsen even after high school. In a group of young people aged 18-20 from Japan, there are cases where the number of hours of sleep per night is 4 or less (6.3% of responses) or 5 hours (22.4% of responses) with the dominant response being 6 hours in 45.0 % of cases, which is totally insufficient even for a young adult (Nakanishi et al., 2018). The situation is even more worrying in the case of students who are preparing for a medical career and who often recognize a sedentary lifestyle and a small number of hours of sleep per night. Future specialists will need to advise adolescents on a healthy lifestyle that they themselves do not practice (Saiyida, Afshan, Abdul, & Syeda, 2019). The different results obtained highlight the importance of the correct orientation of educational programs. Unfortunately, in Romania there is little interest directed towards learning and implementing a healthy lifestyle, which has repercussions on the health of young people and their future development.

Marked fatigue is present in 46.34% of cases, with 55.68% of pupils waking up tired and even very tired in the morning. The percentage is similar to that of the study conducted on adolescents in Iasi, which is a cause for concern (Albu et al., 2016). Physiological fatigue occurs in the evening after a day of intense activity or at the end of the week. In our group, fatigue occurs in the evening only in a third of cases and it appears at the end of the week with the same frequency. Similar results are present in the study carried out in Iasi, so this is an issue that should be in the attention of specialists.

Many problems arise because the lack of parental supervision leads adolescents in the studied group to an unhealthy lifestyle that can have serious repercussions on their health and their school results (Albu et al., 2018). Parents need to be actively involved in students' lives even if they are older and want to be independent. Parental involvement means, among other things, taking an interest in school performance and school activities, spending quality free time together, talking to teachers and the establishment of rules with clear consequences (Erdener & Knoepfel, 2018). The family environment is essential for the development of healthy living habits and this implies avoiding excessive alcohol consumption, smoking, unsafe sexual practices, drug abuse or engaging in antisocial behaviors. Unfortunately, in many families these elements are considered the obligation of the school and not the parents so they are neglected (Harris et al., 2017; Richardson, McCarty, Radovic, & Ballonoff Suleiman, 2017). It is necessary to develop an adequate relationship between the school and the family, that is, a true partnership. Unfortunately, the educational system is not prepared for such an endeavor, and parents often do not understand the recommendations of teachers related to the need to develop students' independence (Palmieri & Palma, 2017).

When fatigue arises, adolescents turn to various stimulants that briefly remove the feeling of fatigue, but which are not recommended. Adolescents in rural and urban schools in Rhode Island sleep an average of 8.8 hours per night. Only a third of young people (38%) feel comfortable during the day. There are small problems of staying awake during the day in 49% of young people or even bigger problems of doing so in 10% of cases, which they try to solve by drinking alcohol, smoking or even by taking drugs (Miller, Janssen, & Jackson, 2017). Adolescence is a difficult period during which young people can create a healthy way of living. However, this type of lifestyle is something that adolescents rarely want.

The clinical signs present in fatigue conditions are an alarm signal related to the possibility of evolution towards chronic fatigue which is associated with the onset of

serious health problems. It is necessary to carefully evaluate this problem and the health status of adolescents, especially those who recognize marked fatigue (Salam, Das, Lassi, & Bhutta, 2019).

5. CONCLUSION

The study is oriented on two directions represented by the evaluation by grade and school. The evaluation among the three types of school is essential because at elite high schools the demands are high, thusly insufficient sleep and the appearance of fatigue symptoms are common and worrying aspects. The time allotted for nighttime sleep is, in most cases, insufficient; therefore, it is not possible to remove the fatigue that appeared during the day and the previous week. Fatigue is felt intensely by half of the teens in the group. They wake up tired and even very tired in the morning. Physiological fatigue occurs in the evening and at the end of the work week, but such answers appear in only a third of cases. The correlation between hours slept and the presence of fatigue often indicates significant differences that underline the risk of progression towards chronic fatigue or overwork. The problem can be partially solved by sleeping during the day but young people are not interested in this way of relaxation. In many cases naps are rarely present or are missing entirely.

Such studies are essential for adolescents' health and for the formation of a healthy lifestyle that can be maintained throughout life. Future studies should focus on school programs and demands, especially in elite schools where the level of competition is higher.

REFERENCES

- Albu, A., Hodorcă, R. M., Onose, I., Negrea, M. & Crăcană, I. (2016). The evaluation of the scholar fatigue phenomenon and some causative factors in a group of teenagers from Iasi. *Global Journal of Sociology: Current Issues*, 6(2), 44-49.
- Albu, A., Dima, F., Abdulan, I. & Carausu, M. (2018). Evaluation of school fatigue and social relationships in a group of students from general knowledge high schools in Iasi country. *Education Journal*, 7(1),1-4.
- Baciu, A., 2020. Medical and social consequences of digital addiction. *Medical Anthropology*, 22(3), 141-147.
- Erdener, M. A. & Knoeppel, R. (2018). Parent perceptions of their involvement in schooling. *International Journal of research in Education and Science*, 4(1), 1-13. doi:10.21890/ijres.369197
- Galván, M., Monroy-Campos, A., López-Rodríguez, G., Unzaga, M. G., Olivio, D. Jhazmín, H. C., ... & Hugo, A. (2017). Physical activity in Mexican urban school children: difference by nutritional status and school type. *Global Advanced Research Journal of Medicine and Medical Sciences*, 6(12), 362-368.
- Hansen, J., Hanewinkel, R., & Galimov, A. (2022). Physical activity, screen time and sleep: do German children and adolescents meet the movement guidelines? *European Journal of Pediatrics*, 181(5), 1985-1995. doi: 10.1007/s00431-022-04401-2
- Harris, S., Aalsma, M., Weitzman, E., Garcia-Huidobro, D., Wong, C., Hadland, S. E., ... & Ozer, E. M. (2017). Research on clinical preventive service for adolescents and young adults: where are we and where do we need to go? *Journal of Adolescent Health*, 60(3), 249-260.
- Hirshkowitz, M., Wihthon, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., ... Adams Hillard, P. J. (2015). National Sleep Foundation's sleep time duration recommendations: methodology and results summary, *Sleep Health*, 1(1), 40-43.

- Jacobs, M. (2019). Latent class analysis of adolescent health behaviors. *Journal of Community and Preventive Medicine*, 2(1), 1-10.
- Kracht, C., Chaput, J. P., Martin, C., Champagne, C., Katzmarzyk, P. & Staiano A. (2019). Associations of sleep with food cravings, diet, and obesity in adolescence. *Nutrients MDPI*, 11(12), 2899.
- Ma, X., Liang, J., Liu, J., Li, X. (2018). An empirical study of the cultivation of student's innovation ability by flipped classroom. *Education Journal, SciencePG*, 7(6), 146-156.
- Miller, M. B., Janssen, T., & Jackson, K. (2017). The prospective association between sleep and initiation of substance use in young adolescents. *Journal of Adolescent Health*, 60(2), 154-160.
- Ministry of Education, Research and Innovation Order no. 3410, March 16, 2009 (Romania). *Privind aprobarea planurilor-cadru de învățământ pentru clasele a IX-a - a XII-a, filierele teoretică și vocațională, cursuri de zi* [Regarding the approval of the educational framework plans for the 9th - 12th grades, the theoretical and vocational programs, day courses]. Retrieved from <https://monitoruloficial.ro/Monitorul-Oficial--PI--545--2009.html>
- Ministry of National Education Order no. 3732, May 20, 2013 (Romania). *Pentru aprobarea Metodologiei de acordare a titlului de Colegiu național/Colegiu unităților de învățământ preuniversitar* [Regarding the approval of the Methodology for awarding the title of National College/College of pre-university education units]. Retrieved from <https://monitoruloficial.ro/Monitorul-Oficial--PI--311--2013.html>
- Nakanishi, J., Suematsu, Y., Arimura, T., Kuwano, T., Shiga, Y., Kitajima, K., ... & Miura, S. I. (2018). Recommendations of lifestyle modification according to a survey of first-year university students. *J.Clin.Med. Res.* 10(10), 772-780. doi: 10.14740/jocmr3574w
- Palmieri, C. & Palma, M. (2017). The relation between school and community as an opportunity to re-think teaching, *New Trend and Issues Proceeding on Humanities and Social Sciences*, 4(1), 496-503.
- Rasouli, A., Mohiti, S., Javadi, M., Panjeshahin, A., Karemi, M. & Shiri-Shahsavari, M. R. (2021). The effect of daily fast-food consumption, family size, weight-caused stress and sleep quality on eating disorder risk in teenagers. *Sleep Breathing Physiology and Disorders*. 25(3), 1527-1533. doi: 10.1007/s11325-020-02189-9
- Richardson, L., McCarty, C., Radovic, A., & Ballonoff Suleiman, A. (2017). Research in the integration of behavioral health for adolescents and young adults in primary care settings: a systematic review. *Journal of Adolescent Health*, 60(3), 261-269.
- Saiyida, K. F., Afshan, A., Abdul, R. K. & Syeda, F. (2019). Distribution and determinant of sedentary lifestyle among health care professionals. *Pakistan Journal of Medicine and Dentistry*, 8(2), 80-86.
- Salam, R., Das, J., Lassi, Z., & Bhutta, Z. (2019). Adolescent health and well-being: background and methodology for review of potential intervention. *Journal of Adolescent Health*, 59(4), S4-S10.
- Soriano-Ayala, E., Amutio, A., Franco, C., & Mañas, I. (2020). Promoting a healthy lifestyle through mindfulness in university students: a randomized controlled trial. *Nutrients MDPI*, 12(8), 2450.
- Sousa, J. M. (2019). Aiming at an emancipatory curriculum. *Education Journal, SciencePG*, 8(3), 89-96.
- Tan Ee Li, J., Pursey, K., Duncan, M., & Burrows, T. (2018). Addictive eating and its relation to physical activity and sleep behavior. *Nutrients MDPI*, 10(10), 1428.
- Villa-González, E., Huertas-Delgado, F., Chillón, P., Ramirez-Vélez, R., & Barranco-Ruiz, Y. (2019). Associations between active commuting to school, sleep duration and breakfast consumption in Ecuadorian young people. *BMC Public Health*, 19, 85.

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Chapter # 5

TOWARDS A GENERALIZATION: WHAT STUDENTS LEARN ABOUT MULTIPLICATION

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ABSTRACT

This chapter examines and analyzes students' learning about aspects of the concept of multiplication with a focus on perceptions and representations, and how they apply this to handling multiplicative situations and patterns in the multiplication tables. The analysis has been performed in the context of the generalization process related to teaching activities, with a focus on students' perception of multiplication. The theoretical approach is based on Davydov's (1990) view of theoretical generalization as a perception-conception-elementary concept (PCE model). The current mathematical content was classified according to: (1) multiplicative structures (Vergnaud, 1983); and (2) basic laws of algebra (van der Waerden, 1971). The relationship between students' learning and the teaching process was studied in order to identify students' learning in action. The study comprises two teachers and 40 students in two classes in grade 3 and was followed up two years later in grade 5 with one teacher and 25 students. The findings of this study can provide knowledge about students' learning about multiplication using structures and multiplication tables in a conceptual context.

Keywords: multiplication, multiplicative structures, basic laws of algebra, teaching and learning multiplication.

1. INTRODUCTION

The development of instructions for promoting mathematical strategies, such as supporting teachers in understanding mathematical concepts, and when and how students are ready to learn such concepts, are essential prerequisites for students' learning (Ball, Thames, & Phelps, 2008). The guiding principle of teaching plays a key role in helping students to generalize essential-intuitive-primitive models of multiplication into general and more abstract models. Teaching activities guide students through the various stages of transforming a problem situation and identifying the crucial relationships within it. This constitutes the concept of multiplication as a basic level of multiplicative thinking (Kaput, 1985).

Previous studies have noted that students' early encounters with mathematical structures and patterns supports their mathematical development in subsequent years (Mulligan & Mitchelmore, 2009). A range of different conceptual dimensions of multiplication will also increase the opportunity for students to choose suitable strategies when dealing with multiplication situations (Thompson, 2017). The development of students' strategies and conceptual knowledge of multiplication are two coherent processes. The students' learning is also dependent on the teaching process and the content of teaching the concept of multiplication (Chin, Jiew, & Taliban, 2019). Another theoretical-empirical view is that a key element of students' learning of multiplication is the multiplicative structures and basic laws (multiplication) of algebra and how to apply them in different

contexts. This can provide a conceptual basis for the students' learning of multiplication and algebra and help them to continuously process mathematical thinking (Karlsson & Kilborn, 2018).

Multiplicative thinking is one of the “big ideas” of mathematics and provides students with tools for learning different kinds of contents during their early school years. According to Hurst & Hurrell (2014), however, the nature of students' learning of multiplication in primary and middle school is mostly procedural. The issue of learning multiplication and multiplication tables through empirical learning has also been addressed by researchers such as Gierdien (2009) and Downton (2015). Their empirical studies show that students' learning is basically a matter of memorizing formulas, facts and procedures and they attribute this to culturally based teaching methods. Other studies highlight a focus on multiplication as repeated addition (Askew, 2018; van Dooren, de Bock, & Verschaffel, 2010). According to Fischbein, Deri, Nello, and Marino (1985), students in grades 5, 7 and 9 often intuitively use a primitive model of repeated addition. At the same time, most researchers agree that the structural characteristics of multiplication play an important role in learning the concept of multiplication (Park & Nunes, 2001; Sherin & Fuson, 2005) and how students develop multiplicative thinking (Heng & Sudarshan, 2013). The development of conceptual thinking and its significance for students' multiplicative thinking is described by Wright (2011), who points out that students' previous experiences of applying a concept are crucial for identifying relationships in different contextual situations, thereby activating the students' knowledge as a resource for learning multiplication.

Another theoretical approach to conceptualization and generalization is described by FeldmanHall et al. (2018), who emphasizes that generalization is a logical device usually associated with the process of learning. As a teaching method, generalization is closely associated with the process of “formation” of mathematical concepts as a basis for learning as a mental activity in the transition from perception to concept, e.g., “... a generalization is made – that is, similar qualities in all objects of the same type or class are acknowledged to be general” (Danilov & Esipov, 1957 p. 77). Empirical studies about generalization and conceptualization in the teaching and learning process are described by Kennedy (1997), Onwuegbuzie and Leech (2009) and Williams and Young (2021).

To summarize: students' learning about the concept of multiplication is a complex process that includes an individual's mathematical development within the framework of the generalization process, as well as decisive factors such as which content is actually taught in teaching.

2. BACKGROUND LITERATURE VIEW

The background research for this study includes findings related to generalization and multiplication, mathematical structures and multiplication, as well as guided learning.

2.1. Generalization and Multiplication

A relationship between students' experiences and formal mathematics in terms of concrete-abstract can be based on inner conceptual relationships of mathematics. The transition from concrete to abstract in this process provides aspects such as students' preliminary intuitive knowledge, perceptions and the interaction between them (Hiebert & Behr, 1988; Fennema et al., 1996). These authors also agree that more research and more knowledge is needed about students' development of conceptually required learning processes.

Empirical studies illustrate that early grade students are able to reason multiplicatively (Steffe, 1994; van Dooren, de Bock, Janssens, & Verschaffel, 2008). Other studies address

to students' multiplicative reasoning and thinking, focusing on how students learn multiplication by additive reasoning (Larsson, Pettersson, & Andrews, 2017; Kaufmann, 2018) and by multiplicative reasoning (Sullivan, Clarke, Cheeseman, & Mulligan, 2001; Siemon, Bredd, & Virgona, 2017). Additive and multiplicative reasoning are two different domains for the generalization and conceptualization of multiplication. According to Behr, Harel, Post, and Lesh (1992) students chose additive reasoning intuitively because multiplicative reasoning is more abstract. A transition from an additive to a multiplicative model requires a conceptual change in students' thinking from a linear approach representing just one unit to a rectangular approach presenting two units (Fernandez, Linares, van Dooren, de Bock, & Verschaffel, 2012).

2.2. Mathematical Structures and Multiplication

The generalization of arithmetic in an algebraic context, especially in the lower grades, has been discussed by other researchers (Mason, 2009; Stephens, Ellis, Blanton, & Brizuela, 2017). Their discussions focused on how an extension of arithmetic in a conceptual sense can be performed. These discussions were followed up by Kieran (2004), who focused on conceptual expansion during students' early years. From a mathematical perspective of view (van der Waerden, 1971), multiplication is an arithmetic operation which, for natural numbers, involves repeated addition and, for other number ranges, is defined by expanding this while preserving the basic laws of algebra. This means that repeated addition only applies when the multipliers are natural numbers. For other number ranges there is a need for adding new conceptual components. Vergnaud (1994), Nunes and Bryant (2010) and Clark and Kamii (1996) describe such multiplication structures. According to Vergnaud (1983), multiplicative structures rely partly on additive structures; but they also have their own intrinsic organization which is not reducible to additive aspects. He defined the concept of multiplication as a relationship between two quantities related to multiplicative situations.

2.3. Guided Learning

Researchers such as Davydov (1990) and Hershkowitz, Schwarz, and Dreyfus (2001) highlight the importance of the guiding principle of instruction. Davydov emphasizes the importance of teachers' focus on the students' perceptions, observations and reflections and their ability to distinguish between essential and crucial conceptual relationships and non-essential relationships. It is also important for the students to verbalize their thoughts and to generalize concepts. Guided learning is a continuous and systematic process that takes place between educators and learners. The key aspect of guiding is "the sensitive, supportive intervention of a teacher in the progress of a learner who is actively involved in some specific tasks, but who is not quite able to manage the task alone" (Mercer, 1995, p. 74).

The present study does not attempt to investigate an epistemological context related to the generalization of multiplication by multiplicative structures, such as different multiplication models. The study is based on a socio-cultural paradigm and examines students' learning of multiplication by generalizing the concept of multiplication, using multiplicative structures and the basic laws of algebra, and how to apply this to understanding and systematizing patterns in the multiplication tables according to Davydov's (1990) and Vergnaud's (1983) theoretical approach. The research questions are:

(RQ1) How do students visually express their conceptual generalizations (grade 3)?

(RQ2) How do students apply their conceptualization of representations of multiplication, including segments such as *identifying*, *classifying* and *systematizing structures of multiplication*, to solving multiplication table tasks (grade 5)?

3. THEORETICAL FRAMEWORK AND DESIGN

Davydov's (1990) model emphasizes the connection between generalization and conceptualization. According to Davydov, generalization – a phenomenon related to mental processes – is used to describe different aspects of students' learning. The empirical-theoretical approach adopted by Davydov indicates that generalization and conceptualization are key components in teaching school mathematics. A consequence of generalization is that students' understanding of the nature of facts can be expressed verbally and recognized in a familiar setting.

Mathematical activities in teaching are necessary prerequisites for developing the ability of students to generalize and conceptualize. Such activities must be planned with emphasis on the content of concepts and the teacher-student discourse, in which students analyze, constitute, recognize and produce verbal responses. Davydov interprets the generalization process as comprising three linked elements: perception, conception and concept. Students' apprehension of a concept is attributable to generalized perceptions and conceptions of many similar objects with a focus on the crucial properties of the objects. The transition from perception to concept is not an easy process to grasp for primary school students. For them, generalization is a form of representation of "elementary concepts". For the purposes of this study, the model of generalization used is the "perception-conception-elementary concept" (PCE).

According to Davydov, the transition from perception to concept takes place through different forms of visualization: *symbolic* (graphic, drawing), *verbal* (explanation of different situations, stories), *natural* (everyday situations, physical objects) and *artificial* (classroom discourse and context). Attributes for students' ability to generalize comprise being familiar with concepts and their crucial properties and *applying* the concepts in practice and in different contexts to generate *new knowledge*. In the primary grades, generalization as a transition from perception to concept is related to the *representations of elementary concepts* by students' ability to *identify*, *classify* and *systematize* them. According to Vergnaud (1983), different multiplicative problems can be described by different multiplication models. These models can be divided into three classes as a basis for multiplicative structures: the *mapping rule* (MR), also known as *repeated addition*; *multiplicative comparison* (MC), also known as *enlargement*; and *Cartesian product* (CP).

In order to extend the mathematical content of multiplication, the algebraic laws of multiplication were taken into account (van der Waerden, 1971). The commutative, associative and distributive laws, in interaction with multiplicative structures, enabled the discovery of different dimensions of the concept of multiplication and crucial patterns in the multiplication tables. Davydov's theory (1990) of the generalization of mathematical concepts constitutes the design of the study and Vergnaud's (1983) and van der Waerden's theoretical models for the content are the focus of this study.

4. METHOD

4.1. Variation Theory

Variation theory (Marton, 2015), with its roots in phenomenography, is a general theory of learning. For learning to take place, there must be a focus on the crucial aspects of the "*object of learning*". There must also be a degree of variation in some of these crucial aspects, while other aspects remain constant. From the teacher's perspective, this requires a good overview of and insight into the content of the object, as well as knowledge of the subject in question (Shulman, 1986), otherwise the teacher will neither be able to plan sustainable teaching nor identify crucial aspects of students' conceptions of the actual

phenomenon. In this study, variation theory is used as a methodological design in order to qualitatively analyze the wide range of conceptual properties for multiplication in students' learning. This is related to the teaching process and activities, emphasizing multiplicative structures, the basic laws of multiplication, and how students apply this to multiplication situations related to patterns in the multiplication tables.

4.2. One-on-one Interviews

4.2.1. Interview Structure


During the interviews, 12 different questions were asked about multiplicative situations (see Table 1 and Table 2).

Table 1.
Interview questions, part 1.

Multiplication

MR structure

(1) How many flowers are there in the picture? Describe this (a) as addition.
(b) as multiplication.




(2) Write as multiplication: (a) $5+5+5+5+5=$ __; (b) $4+4+4+4+4+4=$ __

MC structure

(3) A pear costs eight kronor and an apple costs ten kronor. (a) How much do five pears cost?
(b) How much do five apples and one pear cost?

CP structure

(4) Describe and count by multiplication how many dots there are in the following picture:



(5) Describe in the same way using a picture: (a) the multiplication $6 \cdot 7$. (b) the multiplication $3 \cdot 7$.

Representation of multiplication

(6) Draw a picture of the multiplication $5 \cdot 3$.

Table 2.
Interview questions, part 2.

The basic laws of algebra

The commutative law

(7) Which sum is greater: $7+7+7+7$ or $4+4+4+4+4+4+4$? Explain how you worked this out.

The distributive law

(8) The circumference of a rectangle is $7+4+7+4$ centimeters. Choose the correct answers: The circumference is (a) $4 \cdot 7$ centimeters, (b) $2 \cdot 7+2 \cdot 4$ centimeters, (c) $2 \cdot (7+4)$ centimeters.

Multiplication tables

(9) Show how it is possible to find $8+8+8$ in the multiplication table.
(10) Look for $3 \cdot 8$ and $8 \cdot 3$ in the multiplication table. What did you find?
(11) Show how it is possible to find $8 \cdot 6$ in the multiplication table if you know that $8 \cdot 5=40$.
(12) Where are the even and odd numbers in the multiplication table?

The interview questions have been developed from Vergnaud's theory of multiplicative structures: the mapping rule (MR), multiplicative comparison (MC) and the

Cartesian product (CP), and from van der Waerden's (1971) definition of the basic laws of algebra but were extended to incorporate different multiplicative problem situations. Regarding *Table 2 (Part 2)* the students received support and guidance during the interviews. The same questions were used during the interviews in grade 5 as in grade 3, in order to identify conceptual developments in students' learning.

4.3. Data Collection

The study participants comprised two teachers and 40 students in two grade 3 classes, followed up two years later by 25 of the same students, who were now in grade 5. Data were collected by observing the teaching process and conducting one-on-one interviews with students in both grade 3 and grade 5. All data were transcribed and systematized for analysis related to the theoretical tools.

5. DATA ANALYSIS

In order to answer research questions RQ1 and RQ2, a two-level qualitative analysis was conducted. The quantitative data from the interviews with the students is only intended to be a background for reflecting on the fundamental differences between the qualitative and the quantitative data. The aim of the analysis was to understand the qualitative dimensions of students' learning regarding perceptions and representation of the concept of multiplication.

6. FINDINGS OF THE STUDY

6.1. Observations

Finding 1

During one lesson (T1) in grade 3, the teaching activity was based on the picture in Figure 1. The task was formulated thus: *Describe the picture as addition and as multiplication.*

Figure 1.
Picture from the textbook Favorite Mathematics (2013).



The students wrote their answers on whiteboards. When the students showed their answers, the teacher then asked them if the various answers were right or wrong.

Teacher: All of you have written $3+3+3+3$. Let's write the sum 12.

....

Teacher: *As a multiplication we have $4 \cdot 3$.* [Writes $4 \cdot 3 = 12$]

They then discuss the answer $3 \cdot 12 = 12$ and found that it was wrong.

Teacher: *Now we have $3 \cdot 4 = 12$. Earlier we had $4 \cdot 3 = 12$. What do you think?*

Student 1: *There are 4 groups and 3 in each group.*

Teacher: *Do you agree?*

Student 2: *Yes, there are 3 groups and 4 in each group. (Wrong!)*

Teacher: *Do you agree?*

Students: *Yes.*

Towards a generalization: what students learn about multiplication

....
Teacher: *Finally, we have $2 \cdot 6 = 12$. (Correct)*
Students: *Wrong.*
Teacher: *Yes.*

The object of learning was addition as an introduction to multiplication. The answers show the students' varying perceptions, as described in their explanations.

Finding 2

During another lesson (T2) in grade 3, multiplication as repeated addition was introduced using a picture of 10 circles in a 2 x 5 pattern.

Teacher: *What kind of multiplication fits this picture?*
Students: [Silence. No response]
Teacher: *Multiplication?*
Student 1: *25.*
Teacher: *Are there 25 circles here on the board? No, there are not 25 circles. How many rows of circles are there?*
Student 2: *2*
Teacher: [Writes 2] *How many circles are there in each row?*
Student 3: *5*
Teacher: *5. [Writes times 5] And how many circles will there be? 2 times 5 equals...*
Student 3: *10*
Teacher: *Yes, and now let's count the circles: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, so it can't be 25. I can only find 10 circles.*

The object of learning was repeated addition. A logical approach had been to start with $2 + 2 + 2 + 2 + 2$ and express this as $5 \cdot 2$ circles. In the same way, the rows contain $5 + 5$ circles, which can be expressed as $2 \cdot 5$ circles. Student 1 explained by focusing on 5 and 5 and used multiplication and student 3 gave a correct answer. Provocative was that teacher instead of explaining 25 as $5 + 5$, counted the circles one by one. The researchers paid attention to how the teacher lost track and focused on proving that there were just 10 circles.

6.2. Interviews

The interviews in grade 3 show that most students were interested and happy to describe and explain the various multiplicative situations. However, the students' perceptions and experience of multiplication had limitations regarding the concept of multiplication. (Figure 2). This became obvious in question 6: *Draw a picture of the multiplication $5 \cdot 3$* . Only every second student gave the correct answer (Table 3).

Table 3.
Students' answers to question 6.

Answer	15	18	20	No answer
Number of answers	20	10	1	9

Figure 2.
Examples of how students described the multiplication $5 \cdot 3$ using pictures.

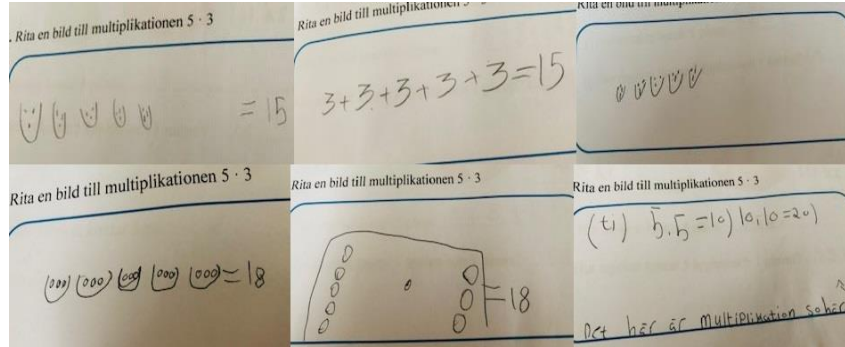


Figure 2 shows that the students drew different representations of multiplication. Dominant was repeated addition and equals groups. The students also described multiplication using calculations ($5 \cdot 3 = 18$ and $5 \cdot 5 = 10 \dots$). During the interviews, the researchers guided the students with follow-up questions and discussions. At the end of the interviews, all students were able to describe both multiplication and repeated addition as equal groups. However, the students found it difficult to identify the structure of multiplication as a rectangular structure and its commutativity. It was also difficult to understand Cartesian structure and commutativity.

The interviews in grade 5 showed that only a few students were able to identify the property of commutativity. During the interviews, one of the questions was: *Which sum is greater, $4 + 4 + 4 + 4 + 4 + 4 + 4$ or $7 + 7 + 7 + 7$? Explain how you worked this out* (Table 2, question 7).

Student 1: *It's $7 + 7 + 7 + 7$*

Interviewer: *Why, can you explain?*

Student 1: *Because 7 is bigger than 4*

Student 2: *I think it's the one with the 4s*

Interviewer: *Can you explain why?*

Student 2: *$4 + 4$ equals 8. And there are just four 7s. So I think this one is bigger.*

The students' explanations were based on a comparison of two natural numbers, 4 and 7.

During the interviews the students' got problems when they had to analyze patterns in 3 times, 5 times, 6 times and 8 times tables (see Table 2, questions 9 to 12). An interesting observation was that just a few of the grade 5 students knew the multiplication tables by heart and just one of them was able to identify a repeated addition in the multiplication table (see Table 2, question 9, MR structure), the commutativity in question 10, and to describe multiplication using enlargement (see Table 2, question 11, MC structure). This showed the importance of the students' perceptions and the development of MR into MC and CP. The students' interpretation of multiplicative situations illustrated that their representations of multiplication were limited. During the interviews time, with careful guiding from researchers, the situation was different. Now, all the students were able to understand the different structures in the multiplication table. However, it was still difficult

for them to change from repeated addition (MR structure) to Cartesian representation (CP structure) in the multiplication table.

7. CONCLUSION AND DISCUSSION

RQ1: How do students visually express their conceptual generalizations?

This study shows that a generalization of multiplication, particularly of concepts such as MR to MC and CP and the basic laws of algebra, is a difficult process for students to grasp. The students' perceptions of multiplication in grade 3 varied significantly and they expressed themselves using various explanation, although there were limited possibilities for further development. The results in grade 5 show that the generalization of multiplication from MR to CP plays a key role in students' perception of multiplication. It should be noted that the students' perception is the first level of the PCE model, and if this level is not achieved, generalization of the students' learning of the concept of multiplication, and their learning as a process, will not occur (Davydov, 1990).

It should be noted that the students' representations of multiplication in grade 5 were only performed as equal groups or repeated addition, although similar tasks were discussed in detail, as early as grade 3. The students' difficulties with the CP structure are explained by Behr et al. (1992), who stated that students chose additive reasoning intuitively because multiplicative reasoning is more abstract. This study shows that students are still more confident with the MR structure in grade 5 and that teaching ought to provide more effective ways for students to develop multiplication (Mason, 2009; Stephens et al., 2017). All tasks in grade 3 invited students to develop multiplication, but with no conceptual support from their teachers, and a suitable variation (Marton, 2015). It was difficult for the students to shift between an additive and a multiplicative model (Askew, 2018). This demonstrated that it is also important for teachers to use guided learning (Davydov, 1990; Hershkowitz et al., 2001) and mathematical communication with the clear object of learning and a structured and relevant content (Mercer, 1995). The teacher's role is to support and guide students in generalizing multiplication and perceiving abstract multiplicative structures.

RQ2: How do students apply their conceptualization of representations of multiplication, including segments such as identifying, classifying and systematizing structures of multiplication, to solving multiplication tables tasks?

This study shows that students' conceptualizations of multiplication were under development. Most of them were able to identify, classify and make representations of multiplication using an MR structure such as repeated addition and equal groups in grades 3 and 5 (Fernandez et. al., 2012). At the beginning of the interviews in grade 5, few students were able to identify CP structures, use them to analyze multiplication and identify patterns in the multiplication tables, not even the four students who knew the multiplication table by heart. At the end of the interviews, most of the students were able to discuss multiplicative situations and read the multiplication table using MR and MC structures (Kieran, 2004). They were also able to identify the relationships between even and odd products, commutativity and symmetry in the table, and sometimes even patterns in the 5- and 9-times tables. However, unless such aspects are highlighted in teaching, students will not be aware of them. The examples from the interviews show that a combination of challenging tasks and conceptual support encourages students to develop new ways of thinking.

REFERENCES

- Askew, M. (2018). Multiplicative reasoning: Teaching primary pupils in ways that focus on functional relations. *The Curriculum Journal*, 29(3), 406–423.
- Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education*, 59(5), 389–407.
- Behr, M., Harel, G., Post, T., & Lesh, R. (1992). Rational number, ratio and proportion. In D. A. Grouws (Eds.). *Handbook of research on mathematical teaching and learning* (pp. 296–333). New York: Macmillan.
- Chin, K.E., Jiew, F.F., & Taliban, E. (2019). Conceptions in making sense of multiplication. *EURASIA Journal of Mathematics, Science and Technology Education*, 15(12). <https://doi.org/10.29333/ejmste/105480>
- Clark, F., & Kamii, C. (1996). Identification of multiplicative thinking in children in grades 1–5. *Journal for Research in Mathematics Education*, 27(1), 41–51. <https://doi.org/10.2307/749196>
- Danilov M. A., & Esipov B. R. (1957). *Didaktika [Didactics]*. Moscow: Publishing House of the RSFSR Academy of Pedagogical Sciences.
- Davydov, V. V. (1990). *Types of generalization in instruction: Logical and psychological problems in psychological problems in the structuring of school curricula*. Reston, VA: National Council of Teachers of Mathematics.
- Downton, A. (2015). Links between multiplicative structures and the development of multiplicative thinking. In K. Beswick, T. Muir, & J. Fielding-Wells (Eds.), *Proceedings of the 39th Conference of the International Group for the Psychology of Mathematics Education* (pp. 217–224), Australia: School of Education Publications.
- FeldmanHall, O., Dunsmoor, J. E., Tompary, A., Hunter, L. E., Todorov, A., & Phelps, E. A. (2018). Stimulus generalization as a mechanism for learning to trust. *Proceedings of the National Academy of Sciences*, 115(7), E1690–E1697.
- Fennema, E., Carpenter, T. P., Franke, M. L., Levi, L., Jacobs, V. R., & Empson, S. B. (1996). A longitudinal study of learning to use children's thinking in mathematics instruction. *Journal for Research in Mathematics Education*, 27(4), 403–434. <https://doi.org/10.2307/749875>
- Fernandez, C., Llinares, S., van Dooren, W., de Bock, D., & Verschaffel, L. (2012). The development of students' use of additive and proportional methods along primary and secondary school. *European Journal of Psychology of Education*, 27(3), 421–438. <https://doi.org/10.1007/s10212-011-0087-0>
- Fischbein, E., Deri, M., Nello, M. S., & Marino, M. S. (1985). The role of implicit models in solving verbal problems in multiplication and division. *Journal for Research in Mathematics Education*, 16(1), 3–17.
- Gierdien M. F. (2009). Musings on multiplication tables and associated mathematics and teaching practices. *Pythagoras*, 0(70), 16–31.
- Heng, M. A. & Sudarshan, A. (2013). “Bigger number means you plus!” - Teachers learning to use clinical interviews to understand students' mathematical thinking. *Educational Studies in Mathematics*, 83(3), 471–485.
- Hershkowitz, R., Schwarz, B.B., and Dreyfus, T. (2001). Abstraction in Context: Epistemic Actions. *Journal for Research in Mathematics Education*, 32(2), 195–222.
- Hiebert, J., & Behr, M. (Eds.). (1988). *Number concepts and operations in the middle grades*. Reston, Virginia: National Council of Teachers of Mathematics.
- Hurst, C. & Hurrell, D. (2014). Developing the big ideas of number. *International Journal of Educational Studies in Mathematics*, 1(2), 1–18.
- Kaput. J. J. (1985). *Multiplicative word problems and intensive quantities: An integrated software response* (Technical Report). Cambridge, MA: Harvard Graduate School of Education, Educational Technological Center. Retrieved from <https://files.eric.ed.gov/fulltext/ED295787.pdf>

- Karlsson, N., & Kilborn, W. (2018). *Det räcker om de förstår den. En studie av lärares och elevers uppfattningar om multiplikation och multiplikationstabellen* [It is enough if they understand it. A study of teachers' and students' perceptions of multiplication and the multiplication table]. Huddinge: Södertörn University, Studies in Higher Education.
- Kaufmann, O. T. (2018). The problem of distinguishing multiplicative from additive reasoning in primary school classroom context. *European Journal of Science and Mathematics Education*, 6(3), 100–112.
- Kennedy, M. M. (1997). The connection between research and practice. *Educational Researcher*, 26(7), 4–12.
- Kieran, C. (2004). Algebraic thinking in the early grades: What is it? *The mathematics educator*, 8(1), 139–151.
- Larsson, K., Pettersson, K., & Andrews, P. (2017). Students' conceptualizations of multiplication as repeated addition or equal groups in relation to multi-digit and decimal numbers. *Journal of Mathematical Behavior*, 48, 1–13. <https://doi.org/10.1016/j.jmathb.2017.07.003>
- Marton, F. (2015). *Necessary conditions of learning*. London: Routledge.
- Mason, M. (2009). *Critical thinking and learning*. Hoboken, NJ: Wiley Blackwell.
- Mercer, N. (1995). *The Guided Construction of Knowledge: Talk Amongst Teachers and Learners*. Toronto: Multilingual Matters Ltd.
- Mulligan, J., & Mitchelmore, M. (2009). Awareness of pattern and structure in yearly mathematical development. *Mathematics Education Research Journal*, 21(2), 33–49.
- Nunes, T., & Bryant, P. (2010). Paper 4: Understanding relations and their graphical representation. In T. Nunes, P. Bryant, & A. Watson (Eds.), *Key understandings in mathematics learning*. Retrieved from <https://www.nuffieldfoundation.org/wp-content/uploads/2019/12/Summary-of-findings.pdf>
- Onwuegbuzie, A. J. & Leech, N. L. (2009). Generalization practices in qualitative research: A mixed methods case study. *Quality & Quantity*, 44(5), 881–892.
- Park, J.-H. & Nunes, T. (2001). The development of the concept of multiplication. *Cognitive Development*, 16(3), 763–773.
- Sherin, B., & Fuson, K. (2005). Multiplication strategies and the appropriate of computational resources. *Journal for Research in Mathematics Education*, 36(4), 347–395.
- Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4–14.
- Siemon, D., Bredd, M. & Virgona, J. (2017). From additive to multiplicative thinking – The big challenges of the middle years. In J. Mousley, L. Bragg & C. Campbell (Eds.), *Mathematics – Celebrating Achievement. Proceedings of the 42nd Conference of the Mathematics Association of Victoria*, Melbourne: MAP.
- Steffe, L. (1994). Children's multiplying schemes. In G. Harel & J. Confrey (Eds.), *The development of multiplicative reasoning in the learning of mathematics* (pp. 3–39). Albany: State University of New York Press.
- Stephens, A. C., Ellis, A. B., Blanton, M. & Brizuela, B. M. (2017). Algebraic thinking in the elementary and middle grades. In Compendium for Research in Mathematics Education. J. Caj (Eds.), *National Council of Teachers of Mathematics* (pp. 386–420). Reston, VI, USA.
- Sullivan, P., Clarke, D., Cheeseman, J., & Mulligan, J. (2001). Moving beyond physical models in learning and reasoning. In M. van den Heuvel-Panhuizen (Eds.), *25th Conference of the International Group for the Psychology of Mathematics Education* (Vol. 4, pp. 233–240). Utrecht, The Netherlands: Freudenthal Institute, Utrecht University.
- Thompson, K. M. (2017). *Targeting difficult multiplication problems: Increasing multiplication fact fluency through a learning trials intervention* (Doctoral dissertation, University of Tennessee). Retrieved from https://trace.tennessee.edu/cgi/viewcontent.cgi?article=5385&context=utk_graddiss
- van der Waerden, B.L. (1971). *Algebra*. New York: Springer Verlag.
- van Dooren, W., de Bock, D., & Verschaffel, L. (2010). From addition to multiplication ... and back: The development of students' additive and multiplicative reasoning skills. *Cognition and Instruction*, 28(3), 360–381.

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- van Dooren, W., de Bock, D., Janssens, D., & Verschaffel, L. (2008). The linear imperative: An inventory and conceptual analysis of students' overuse of linearity. *Journal for Research in Mathematics Education*, 39(3), 311–342.
- Vergnaud, G. (1983). Multiplicative structures. In R. Lesh & M. Landau (Eds.), *Acquisition of math concepts and processes* (pp. 127–174). New York: Academic Press.
- Vergnaud, G. (1994). Multiplicative conceptual field: What and why? In G. Harel & J. Confrey (Eds.), *The development of multiplicative reasoning in the learning of mathematics* (pp. 41–59). Albany: State University of New York.
- Williams, A. M. & Young, J. (2021). Reliability generalization meta-analyses in mathematics education research: A research synthesis. *International Journal of Education in Mathematics, Science and Technology (IJEMST)*, 9(4), 741–759. <https://doi.org/10.46328/ijemst.1434>
- Wright, V. J. (2011). *The development of multiplicative thinking and proportional reasoning: Models of conceptual learning and transfer* (Doctoral dissertation, University of Waikato). Retrieved from <https://researchcommons.waikato.ac.nz/handle/10289/5984>

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Chapter # 6

ONLINE TECHNOLOGIES IN TEACHING AND LEARNING Lessons learnt while teaching during COVID-19 pandemic in Romania: Towards a “dual” education system

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ABSTRACT

The education – as processes and systems, teachers and students – was affected by corona-virus pandemic, across the world. Since pandemic imposed rigorous social distancing, the education process has migrated to online environment, supported by appropriate technologies, with multi-sided effects on students, teachers, and technology producers. Thus, amid its profound negative impact, corona-virus pandemic functioned as an *accelerator of using new online teaching technologies*. The authors' scope of work encompassed a variety of education levels (from elementary to higher education) in Romanian educational environment. This chapter aims at summarizing major lessons learned by the authors' direct experiences of teaching under pandemic in *two different education settings* (international school, university) – with the general objective to formulate recommendations to: (i) teachers; (ii) students; (iii) education policymakers; as well as specific objectives: to identify similarities and significant differences among students by age and level of education; and eventually formulate recommendations for technology producers. Essentially qualitative, the research methodology included secondary research (literature survey) and primary research methods (observation, interview and survey) – based on the authors' direct experience, yet teaching both local and international students. This study contributes at filling a literature gap, and opening further research paths in the field of online education.

Keywords: online teaching, teaching technologies, technology accelerator, COVID-19 pandemic, elementary education, higher education, hybrid learning, Romania.

1. INTRODUCTION

The emergence of the corona-virus – in China (December 2019) then in Europe (the first case confirmed in France on 25 January 2020; and in Romania a month later, on 26 February 2020) – was just the beginning of the corona-virus crisis. On the 13th of March 2020 Europe became “the epicentre of the #COVID19 pandemic, with more reported cases and deaths than the rest of the world combined, apart from #China” and more cases were reported in Europe daily “than were reported in China at the height of its epidemic” (Fredericks, 2020), quoting a declaration of the World Health Organization (WHO) Director-General. The very same day of 13 March, the European Commission (EC) has launched a coordinated answer to mitigate the socio-economic impact of the COVID-19 pandemic. A Google search for “covid 19” displayed, in fractions of a second, 4,82 billion results on 22 August 2022 as compared to 5.71 billion results on 23 September 2020 (Scarlat & Stănculescu, 2021). This demonstrates (i) brusque, huge *interest on the pandemic matter worldwide*, and (ii) relatively steady high level of interest in it for about two years.

The corona-crisis has been the dominant element of the socio-economic environment worldwide, for the next two years. According to Holmes (2020) corona-crisis was impacting

“companies, employees and consumers” as well as the global megatrends themselves (Angus & Evans, 2020). The financial and capital markets have suffered significant impact as result of corona-crisis – as Sands (2020) has pictured a post-corona- crisis finance world. According to Euromonitor (2020, p. 3), “*Covid-19 has transformed the economic and consumer landscape*. It has changed the way we as consumers live, work and shop. Uncertainty remains high.” Kamal (2020) has signalled the “triple-edge sword of COVID-19” – *i.e.* the triple impact of corona-virus pandemic (productive, disruptive and destructive nature of the pandemic) while using digital technologies.

Gross Domestic Product (GDP) contractions in low-income countries – as India and Mexico – demonstrate that “COVID-19 curbs do not worth economic pain” or, in other words, “severe lockdowns [produce] economic damage” (Wheatley, 2020). The unexpected corona-crisis has brought unexpected side effects – as illicit trade in times of corona-crisis (Chavarria, Walker, & Bahamon, 2020).

In Europe, the economies of the EU member states react slightly differently to coronavirus. In Germany, Sita, Dutton, and Ha (2020) have described a rapid evolution amidst the crisis as far as changing the consumer landscape, how consumers shop and pay. The technology plays a mounting role, changing the balance between leisure and experiences “out of home” *versus* “in the home”.

At the organization level, *corona-crisis was definitely a threat*, and organization’s strategies were challenged. However, their leaders behaved differently facing threats. Turning threats into opportunities (assuming *strategic changes*) is an evidence of remarkable leadership (Șișu & Scarlat, 2020).

Besides the general negative effects on countries, organizations and people – temporary lockdown, social media discontinuance intention (Liu, Liu, Yoganathan, & Osburg, 2021); grief feeling was seriously analyzed (Kübler-Ross & Kessler, 2014; Kessler, 2019; Beriatino, 2020) – the *education system* was among the most affected (Cho, 2021). Treve (2021) has analyzed the challenges in higher education, and Aboagye, Yawson, and Appiah (2021) focused their research on challenges faced by students. Scholars emphasized the negative effects during covid-impacted virtual teaching and learning (Das, Srivastava, Tripathi, & Das, 2022) as well as psychological and motivational aspects (Abdimusa, Kumatbekov, Ismailova, Shchedrina, & Kulanina, 2022). As far as education (as area of interest), two relevant face-to-face surveys are presented below.

A survey conducted in September 2020 aiming to analyze a set of press releases – issued by the European Commission (2020) during the first 6 months of pandemic (13 March – 22 September 2020) and e-mailed by the EC office in Romania – displayed the interest for corona-virus pandemic (49.6% from total) – from which 44% were healthcare- related and 24% economy-related, while *education was not among top three areas of interest* (Scarlat & Stănciulescu, 2021, pp. 85–86), counting for less than 10%.

A quick survey exercised two years later (22 August 2022) using the Google search engine – checking two sets of relatively equivalent keywords (“corona-virus impact on ...” and “covid impact on ...” respectively) by four categories of relative interest (Economy, Education, Healthcare and Society) – displays a different picture (Table 1):

- (i) Economy tops the ranking as far as “COVID / corona-virus impact” by subjects of interest;
- (ii) *Education becomes second to economy as subject of interest*, overcoming the Healthcare.

Table 1.
Level of interest relative to the corona-virus impact [by number of items].

Interest ranking	Impact on	Impact of	
		“Corona-virus impact on ...”	“Covid impact on ...”
I	Economy	13,300	17,100
II	Education	7,570	14,200
III	Healthcare	4,350	7,890
IV	Society	3,020	4,020

Source: author (22 August 2022)

The conclusion is that *education sector* (all levels) *has emerged as a significant area of interest for investigation during and post corona-crisis*, while education in the *average countries like Romania* seems to enjoy less attention – as compared to the world powerhouses and major European countries. In other words, since the pandemic seems to go down, despite significant amount of literature on COVID-19 and its effects, *the literature on corona-virus impact on education system in Romania is rather limited*. Therefore, this chapter aims to contribute at filling this gap by investigating the effects of online education technologies as result of corona-virus pandemic at two levels in two Romanian education setting: an international school and a technical university (Table 2), over a longer period (2020–2022) – characteristic for pandemic in Romania.

Table 2.
Levels and focus of investigations.

Level of education	Influence of online technologies on education process
Higher education – master studies	Focus on students: The students’ results of using the online teaching technologies (attendance, performance and satisfaction) – during pandemic as compared to the pre-pandemic period.
Elementary and upper elementary	Focus on teachers: The teachers’ use and intention to use online educational technologies; perceived advantages and disadvantages of using digital resources.

Consequently, the rest of this chapter is structured as follows: secondary research on pandemic teaching environment; presentation of two qualitative studies conducted by authors in two areas, at two levels – elementary and master studies (as shown in Table 2); results discussion; recommendations; limitations and further research paths; conclusions.

2. PANDEMIC TEACHING ENVIRONMENT

Not long after the first case was confirmed, almost a global quarantine was installed. In Romania, all sectors have suffered alterations. Different industry sectors (*e.g.* tourism, retail) changed their leadership, business strategies and aspects related to employees or consumer behaviour. Many businesses were forced to close their doors, while others (*e.g.* delivery services, online sales, online marketing) were on a win.

The introduction of technology and the internet have changed the people’s life from many perspectives. Vasile, Boboc, and Ghiță (2020) show in their report that the work-from-home practice, not very often met in our country, was adopted by most of the companies (65% of employees have worked from home), and 40% assess their work as more efficient. In education specifically, Hossain et al. (2021) signal not only challenges but also opportunities – as opportunity of m-learning during pandemic.

Worldwide, 1.2 billion students could not attend school or university because of the COVID-19 pandemic (Li & Lalani, 2020). Dhawan (2020, p. 7) noted that amid emergence of new teaching technologies, “online teaching is no longer an option, it is a necessity”.

Online teaching came with challenges for both teachers and students. The flexibility and creativity in schools of all levels were called in action – in order to organize and conduct online teaching activities, despite teaching staff was not prepared for such a challenge (Bell et al., 2021). Teachers had to adapt their methods and use new technologies to cope with the new way of teaching (Schleicher, 2020). Innovative professors adapted social network services for online teaching (Ghobrani, Benzert, & Balas, 2022).

Barbu (2020) presents the results of a study completed by Forbes Romania in which 603 students, teachers and parents have participated. According to this survey, the most used communication platforms have been Zoom (21%), WhatsApp (23%), Google Classroom (13%) and Facebook (11%). *Table 3* also displays a list of open educational websites and other educational resources, as well as educational websites.

Table 3.

List of platforms and educational websites used by Romanian teachers [August 2020].

Platforms		
1.	Zoom	Program for video teleconference
2.	Google Meet	Video-communication service developed by Google
3.	Microsoft Teams	Platform designed for business communication
Educational websites		
4.	Twinkl	British online educational publishing house
5.	Krokotak	Educational website with free printable materials
6.	Didactic	Educational website where teachers can download and upload materials for free
7.	Emalascoala	Educational website with articles, printable materials and ideas for teachers
8.	Livresq	Educational website and interactive platform where teachers can create and up/download materials, lesson plans, etc.
9.	Digitaliada	Digital and interactive program that help teachers to use digital educational content in their lessons

Source: adapted after Forbes Romania (Barbu, 2020)

According to the same survey, communication platforms, websites, online libraries, virtual museums and other applications that are used during teaching activities have been used only 2.82%. The specialised platforms in e-learning have been underused, too. Only a percent of 2.6% of teachers claim that they have carried out their teaching activity through platforms (such as Google Classroom, Moodle, *etc.*). Another small percentage of teachers (2.8%) claim that they used Zoom, Meet, Teams or Skype, while teaching.

Table 4 presents the applications mostly used in teaching during the early pandemic period. To the total of learning instruments, applications such as Kahoot, Padlet, Wordwall *etc.* are added (Botnariuc et al., 2020).

Table 4.
List of applications used by Romanian teachers [August 2020].

Applications		
1.	Wordwall	Digital instrument based on a collection of words organised in different ways: wall, bulletin board, match up, missing word, <i>etc.</i>
2.	Skype	Telecommunication application
3.	Kahoot	Ideal for recaps and evaluations
4.	Mentimeter	It's an application through which the teacher may present content and also receive feedback in real time
5.	Padlet	Perfect for presentations and teamwork, and as organizer
6.	Canva	A platform dedicated to graphic design used to create media content presentations, posters, documents, worksheets, charts
7.	ThingLink	Ideal for virtual tours, using digital objects or to combined different images/links/words
8.	Imapuzzle	It's a perfect instrument for math lessons. The teacher can easily create a puzzle and add some math exercises to it
9.	Edpuzzle	Ideal for music lessons, communication or any teaching material based on a video
10.	Liveworksheets	Application for creating digital worksheets
11.	Quizizz	Application for online questionnaires

Source: adapted after Forbes Romania (Barbu, 2020)

There are a few comments to be made as results of secondary research:

- Interestingly, among educational platforms mostly used (some depicted in Table 3), there are social media (*e.g.* Facebook), while Microsoft Teams (specialized educational platform) – used in several higher education institutions – is not in the top.
- The specialized e-learning platforms have been underused because of their novelty and, sometimes, because they were costly.
- Basic internet-based communication technologies were used as education means because they were freely available and already popular among parents, students and teachers – *before* the pandemic.

One of the explanations is that Forbes Romania survey was conducted during the early phase of pandemic. In addition, the study was focused on elementary and pre-university education (one third were math professors, and one fifth were teachers for primary schools). The sample was pretty balanced urban *versus* rural (students 57% *vs.* 43% teachers and 52% urban *vs.* 48% rural).

Therefore, the authors decided to fill the research gap as follows:

- To observe a larger period of time, covering the first two years of corona-virus pandemic;
- To focus on limited number of education settings, but at extreme levels (elementary and higher education) and open to international students;

Thus, one international school and one leading university (for master studies) were selected with the main objective to note the effects of online education (*i.e.* use of teaching technologies) on process participants (teachers and students) – as indirect result of the corona-virus pandemic. Both were explorative, qualitative studies.

3. QUALITATIVE STUDIES IN ROMANIAN EDUCATION SETTINGS

The specific research objectives, methods and instruments used are different and adapted for each case. So the results are presented.

As depicted in Table 2, the focus in each case is different – from the standpoint of educational process – for each educational setting: the focus is on teachers in case of the international school, and the focus of the research is on the students in case of the technical university.

3.1. A survey in a private, International School

The education setting is a private school in Bucharest, open to international students (from pre-school to high school). The purpose was to understand the teachers' view on the digitalization process, during exclusive online teaching and currently (technology-mediated face-to-face teaching). The specific research questions were: (i) Which were the most used digital platforms, educational websites and online applications while teaching during corona-virus pandemic? (ii) What is the proportion of teachers that intend to continue the use of educational technologies when return to classroom teaching? (iii) What is the proportion of teachers that use the digital technologies daily? (iv) Which are the perceived advantages and disadvantages of using digital resources?

The source of data was the school teaching staff, and the research method was the questionnaire-based survey (Bird, 2009). In several situations, interviews completed the results of the survey. The study was conducted in 2022, and referred to the pandemic period (2020–2022).

The questionnaire has been emailed and also distributed through social networks, using the extension Google forms. The questionnaire contained questions to assess the teachers' demographic profile and questions related to the use of digital technologies during the educational process. The total number of respondents was 86, most of them (70%) involved in primary teaching; 20% in middle school and high school, 10% in pre-school. As seniority, 40% were experienced teachers (more than 10 years); 30% between 6 and 10 years; 20% between 3 and 5 years; and 10% were teachers with less than 3 years of experience. As declared by responding teachers, the most used (exclusively for online teaching) digital platforms, educational websites and online applications while teaching during corona-virus pandemic are displayed in Table 5.

*Table 5.
The most used educational platforms, websites and online applications, by Romanian teachers during corona-virus pandemic.*

Platforms	Educational websites	Online applications
Microsoft Teams Zoom	Twinkl Emalascoala Krokotak Didactic	Wordwall Kahoot Canva Nearpod Genially Learning Apps Baaboozle Pinterest

Source: author (first semester 2022)

The proportion of teachers that declared their *intention to continue the use of educational technologies when return to classroom teaching* is overwhelming (90%) – as opposed to 10% of teachers that will give them up in classroom teaching. The same percentage (90%) of the teachers uses the digital resources almost daily – as compared to 10% only that does not. Correlation analysis points to the same majority group of teachers.

The last group of questions had open answers, as every teacher had the opportunity to list the advantages and disadvantages of using digital resources while teaching (Table 6).

*Table 6.
Advantages and disadvantages of using digital resources, by Romanian teachers during corona-virus pandemic.*

Advantages	Disadvantages
Higher motivation and growing interest among students	Weak internet connection that interrupt teaching sessions
Increased inter-activity during teaching sessions	Longer time spent for developing the teaching materials
Perform activities that are difficult to be carried out in the classroom	Insufficient training for teachers
Quick and direct (not-mediated) feedback	High cost of technology

Source: author (first semester 2022)

Comparing the results of authors’ 2022 survey to Forbes Romania 2020, there are notable trends relative to both technology users and used teaching technologies:

- Changes in the hierarchy of all categories of technologies used – platforms (increased use of Microsoft Teams associated with decreased use of Zoom); educational websites (stability of the top four websites – Twinkl, Krokotak, Emalascoala, Didactic – associated with disappearance of Livresq and Digitaliada); and online applications (consolidation of top three – Wordwall, Kahoot and Canva – associated with larger number of abandonment as well as newcomers, as seen by comparing the results from Tables 3–5);

- Spectacularly increased percentage of technology users and technology used (from under 3% to 90%) – which both display close correlation.

Nevertheless, it should be mentioned that results of the comparison (2022 vs. 2020) have an indicative value only (they cannot be extended to across schools), because the surveyed samples have limited similarity (population surveyed), and also differences as segment surveyed (single education unit from urban environment, open internationally); this is an area for further, deeper investigation. Even in this case, there is a lesson to learn: *dissemination of the good practices from this urban international school.*

3.2. Observing Master Classes at a Leading Technical University

The education setting is a large technical university located also in the capital city that has a long tradition and runs higher education degree programmes at all levels (undergraduate, master and doctoral research programmes). The area of this qualitative study is very narrow (a master course) and the research objectives are so specific.

Since the majority of master students have engineering background, the use of online technologies was not a problem; nor for professors.

Moodle was already familiar as communication media between students and professors, and *Microsoft Teams* was the online teaching platform promoted across university since pandemic restrictions were in place. Thus, the research focus is on the results of using the online teaching technologies (attendance, performance and satisfaction) – during pandemic as compared to the pre-pandemic period.

Just one master course (taught in English, open to international students) was observed, along three semesters (spring semester 2020, 2021 and 2022), with three different cohorts of students (Table 7). The course was taught in the second (final) year of the master programme, along 14 weeks, totalling 56 hours (split equally for lectures and applications).

The results are compared to those reported by the preceding three cohorts – *i.e.* the three years prior the corona-virus pandemic (2017-2019). In principle, mixed challenges – cross-cultural teaching-learning (Bauler, 2019) in international environment (Appiah-Kubi & Annan, 2020) – make teaching online more complex; however, the demographic structure of students did not change significantly during the period in discussion.

There are two notable comments related to the figures exhibited in Table 7.

Table 7.

Three cohorts of students attending the same course during pandemic [2020–2022].

Year	Number of students			Exam results		Average grade**	No. online semesters
	Enrolled	Gave up	Active*	Failed	Passed		
2017	65	24	36	1	40	7.55	0
2018	55	4	43	6	45	7.64	0
2019	34	6	27	1	27	8.22	0
2020	38	4	28	0	34	8.06	0.5
2021	44	2	13	0	42	7.98	2.5
2022	60	5	14	5	50	7.24	4.0

*Active students are meant students that actively attended classes (asked & answered questions, were involved in debates, submitted optional assignments, *etc.*)

**Grading system: 1-to-10 scale; 10 = max; 5 = min for passing.

Source: author.

The data presented in *Table 7* are comparable – as during the period under scrutiny (six academic years, 2017–2022) the course was taught by the same teaching team (professor and teaching assistant); it kept the same framework (syllabus, teaching objectives, grading system, difficulty of assignments and exams); nevertheless, the content was updated yearly and teaching methods have changed during pandemic.

The abandon rate (number of the students giving up for different reasons against total number of students) – 8% during pandemic – is considered reasonable (between 4%–8%) according to Genesys (2019). The exception (unusual high rate in 2017) was most likely caused by changes in administrative regulations.

To note that circumstances of the spring semester 2020 were somehow particular – in that respect of restrictions (that imposed the online teaching) have occurred during semester. This is why the last column in *Table 7* displays only half-semester of online teaching during spring semester in the academic year 2019–2020 (respectively 2.5 online teaching in 2020–2021, and all four semesters of online teaching in 2021–2022 *i.e.* cohort of students admitted in 2020 had full online teaching / learning experience).

The method of research and collecting information was direct observation, completed with consultation of academic and personal records, course evaluations, and random interviews by the end of semester.

The main research questions were: (i) How was the master students’ attendance and activity during the pandemic as compared to the pre-pandemic period? (ii) What was the master students’ performance (exam results) as compared to the pre-pandemic period? (iii) Which are the main comments (both students’ and professor’s) regarding the online teaching during pandemic?

The *students’ activity* can be assessed by the *activity rate* (or *active attendance rate*) – defined as number of active students (*Table 7*) divided by total number of enrolled students. The examination of data displayed in *Table 7* provides the following results of the activity rates during the pandemic: 74% (28/38) in 2020; 30% in 2021; 23% in 2022. Hence, two obvious comments:

- During pandemic, the students’ activity rate continuously decreased;
- The average activity rate during pandemic (39%) is significantly inferior to the pre-pandemic attendance rate (82%) which was at relatively stable levels (between 78–88%).

The *students’ performance* can be assessed by two indicators: the *rate of passing* (number of passing students as percentage from total number of students presented at the exam) and the *yearly average passing grade* (already calculated in *Table 7*). Based on the data presented summarized in *Table 7*, the following values for the rate of passing during the pandemic were: 100% in 2020 (34/34), 100% in 2021, and 91% in 2022. Hence, the observations:

- The rate of passing during the pandemic was pretty stable at high levels; the decrease from 2022 probably needs a separate discussion;
- The average passing rate during pandemic (96%) is fairly higher than in pre-pandemic period (93%) – which is not necessarily surprising as both are at high levels.

The analysis of the yearly average passing grades is finer and completes the picture – as it displays:

- Significant negative (descending) trend during pandemic; following to
- Positive trend during pre-pandemic period.

The negative trend of the average passing grade during pandemic is similar to the variation of average passing grade against number of semesters of online learning experienced by students (number of online semesters, per Table 7).

As far as *students' satisfaction* (Cao, 2022), the overall feedback (Clayson, 2021) was positive – as the passing rates have remained at high levels. However, the declining average grades during the pandemic demonstrate a certain frustration. This was consistent with the results of informal interviews with both students and professors: by the end of teaching semesters 2020–2022 many professors – and, surprisingly, a good part of students – frankly declared that they were *lacking the direct social contact and classroom environment*.

The author's experience of the last semesters of online teaching is frustrating: to talk to computer displays actually, rarely animated by students' faces – less than 10% post live image of them. Rough statistics show an average percentage of about 50% connected students during the course (numbers largely fluctuate during the course – as there were students that reported connection problems and late connections). Disappointingly, four rounds of blitz attention tests conducted during the last two semesters have shown that only 12-15% of students as being really active during the course (Scarlat, 2022).

4. RESULTS DISCUSSION

The period under scrutiny covers the corona-virus pandemic (early 2020 – mid 2022); in this period the *population's interest for education matter has raised* from non-significant (September 2020) *to second place* (right after economy matter) in August 2022, mainly because of the corona-virus impact on the education system.

The studies presented are two pieces in a larger puzzle, and both are meant to complete the literature gap on the subject of corona-virus impact on Romanian education system by turning classroom to online teaching. The target groups were students of two educational units situated at the extremes of the educational ladder: elementary and, respectively, master students. Therefore, the *focus of the research was on issues considered critical in each case*: how school teachers have adapted to the new online teaching technologies (themselves having their own dynamic during pandemic); and how master students performed during pandemic-driven online education – bearing in mind that both they and their professors (within a large technical university) were knowledgeable about online teaching technologies. *Actually, there were two evolutionary stages of the same educational process, each of them facing different challenges of the online education.*

Scrutiny of the elementary education – focused on professors.

The elementary education was unprepared for online teaching: when pandemic started, less than 3% of teachers carried out their teaching activity through online education platforms, and less than 3% have used communication platforms, websites, online libraries, virtual museums and other applications during their teaching activities.

The specialized platforms in e-learning have been underused, too. Along pandemic, the specific secondary survey highlighted spectacular increase of the percentage of technology users and technologies used for online teaching (from under 3% to 90%), apparently in close correlation. As a stimulating factor, it is worth to mention that the current generation of students has grown alongside technology, and they are familiar with all kinds of tech devices and applications (Bhasin & Rajesh, 2021).

The increased use of online teaching technologies was paralleled by changes in the hierarchy of in all technology categories – platforms, educational websites, and online applications:

- platforms (increased use of Microsoft Teams associated with decreased use of Zoom);
- educational websites (stability of the top four websites – Twinkl, Krokotak, Emmalascoala, Didactic);
- online applications (consolidation of the top three – Wordwall, Kahoot and Canva).

To note that *stability and consolidation are attributes of maturity*.

Overall, the results of this first study are in line with other studies conducted in Romania that highlight the side-effect of pandemic as *technology accelerator* (Scarlat & Stănciulescu, 2021; Scarlat, Stănciulescu, & Panduru, 2022).

Scrutiny of the higher education – focused on students.

The observation of the online teaching at master level (as a result of the corona-virus pandemic) does not reveal spectacular impact on students or professors during the pandemic (as compared to an equal ante-pandemic period) – from that standpoint of technology use. However, there are a few finer issues to be mentioned.

Amid pretty stable rate of passing the exam during pandemic (even at high levels), the negative trend reported both as activity rate and average passing grade should be emphasized – as they are undoubtedly the results of online teaching (see the number of semesters of online teaching experienced by the master students – Table 7). These observations should be correlated compared to and correlated with the master students’ and professors’ feedback and opinions (a certain degree of dissatisfaction because of lacking the *direct social contact and classroom teaching environment*). In addition, as a professor, it is frustrating to have a (yet virtual) dialog with students’ photos only (and not real people).

5. RECOMMENDATIONS

The experience of using online technologies in education is new for both educators and students. At elementary level, an important category of stakeholders are young students’ parents. In addition, educational institutions (either schools or universities) as individual organizations and/or as collective category of same type of educational institutions are key-stakeholders. For each of them are lessons learnt, experiences to share, and recommendations to be made.

For parents (in case of elementary level), effective communication with educators, active engagement in, and deep understanding of the online education system is of key-importance; more critical as students are younger (even in that non-uncommon case when students are more technology-accustomed than their parents).

The authors’ teaching experience is that teaching online was an opportunity to learn regardless the previous technology experience, background or teaching experience. The main lesson learnt (and experience to share and recommendation to other teachers) is to continuously improve in finding the most suitable teaching technology out of available arsenal of methods and technologies. *Sharing the best practice* has to become the norm.

Another issue is linked to accidentally poor Internet connection – situations that require a solid preparation of teachers for any adverse, unexpected situation, *in addition to basic options* (face-to-face classroom teaching or online teaching – that already mean different teaching style and methods). Nevertheless, it should be mentioned that results of the comparison (2022 vs. 2020) have an indicative value only, because of the singularity of the surveyed samples. Even in this case, there is a lesson to learn: *dissemination of the good practices from this urban international school*.

The experience of online teaching at master level using Microsoft Teams platform – to interact with students without having live image (less than 10% of them post live images) – is frustrating twofold.

First, the students used to be 100% online as a device, and by choice as a person/individual (disappointingly, four rounds of blitz attention tests conducted during last two years have shown that only 12-15% of students were actively listening to the lecture). This issue of low involvement is partially addressed by gradually getting back to classroom teaching activities (Scarlat, 2022) or going to “dual” (*i.e. hybrid or blended*) teaching system (Zeqiri, Kareva, & Alija, 2021) – method of teaching that integrates traditional classroom teaching with new technology and digital media – aiming at allowing students more learning flexibility. Recommendations in this matter addressed to university policymakers had effect: some universities already decided to apply the “dual” system of teaching starting with the academic year 2022–2023.

Probably the better term for *dual education system* would be *balanced teaching* – balanced not only as classroom-online but also by discipline (area of knowledge), type and profile of the education institution, adapted to the cultural and social peculiarities of students, *etc.*

Secondly, from professors’ perspective, it is not fair to conduct a non-symmetrical communication (only professors have to post a live image). This situation is possible because there is no enforcement rule in this respect. This is a solid recommendation to schools’ and universities’ administrators to develop proper sets of regulations (rights and obligations) for access and use of online technologies (“online driving license” type) – still observing the GDPR principles.

There is also an important recommendation for the acquisition managers from all education institutions: when new equipment and/or technology are acquired (not only in case of online use), the appropriate training should be acquired as well – in order to properly train the teaching staff. In addition, after using the acquired equipment and/or technology, the feedback collected during usage should be directed to the equipment/technology supplier.

6. LIMITATIONS AND FUTURE RESEARCH PATHS

The main limitation is the singularity of samples investigated. Therefore, it should be mentioned that survey results have an indicative value only (they cannot be extended to across schools or universities), because the surveyed samples are limited (as organization and population surveyed); these are large perspectives for further, deeper investigations: more education organizations (elementary schools, universities), more education levels (high schools, undergraduate programmes). Even comparative studies with similar education programmes from other countries are appealing research paths for further studies.

More specific studies related to higher education programmes (master programmes and master courses in particular) could be oriented toward the hypothetical correlation between students’ *activity rate* and *average passing grade*. Also, the decrease of *passing rate* from 2022 probably needs a deeper and further longitudinal investigation – in order to conclude a definite trend.

As this study was not focused on the influence of technologies on the conditions of teaching and learning as well as teaching process itself – all related but beyond the purpose of the study presented in this chapter – these might also be directions for future research.

7. CONCLUSION: LOOKING FORWARD!

The pandemic has definitely provoked a disruption in traditional education system, turning it towards online, and surprising many education institutions unprepared. However, a positive side effect was reported, at least in Romanian education system: pandemic as a *technology accelerator* – effect which was observed not only in education (Scarlat & Stănculescu, 2021) or provoking a so-called *digital acceleration* (Scarlat et al., 2022).

The authors’ research objectives were fully reached. The overall objective to contribute at completing the literature gap relative to turning the Romanian education system online under the corona-virus impact was completed with recommendations made to main stakeholders, and suggestions for further research.

This study identified both positive and negative effects of turning Romanian education online – in line with advantages and disadvantages of online teaching (Dhawan, 2020). Sood, Sharma, and Kumar (2022) show that synchronous teaching is one remarkable advantage brought by online technologies during corona-virus pandemic.

This study also identifies the tendency of two Romanian education institutions to evolve towards a dual (hybrid) education model (Zeqiri et al., 2021) or, as Edelhauser and Lupu-Dima (2021) described as a “mix-and-match” of tools and delivery methods, such as interactive e-learning courses, live and recorded lectures, and collaborative documents for group work; this model “can work well to provide a comprehensive learning experience” but it can also generate difficulties for both students and teachers.

A number of recent studies display research results and share the authors’ concern about future education, in particular the future of higher education (Sousa, Suleman, Mercadé Melé, & Molina Gómez, 2021; Torr, Kildunne, Clulow, & Sutcliffe, 2021; Almaraz-Menéndez, Maz-Machado, López-Esteban, & Almaraz-López, 2022; Colón & Alsace, 2022).

Donthu and Gustafsson (2020, pp. 287–288) cited five trends identified by Krishnamurthy (2020) related to the higher education system that “will undergo a decade of technology-led transformations”:

- (i) The *algorithm* as *professor*;
- (ii) The *university* as a *service*;
- (iii) The *university* as *assessment* powerhouse;
- (iv) Learning personalization to support *diversity*;
- (v) *Problem-solving* through *ethical inquiry* (given the exponential growth of the AI algorithms).

Shukla, Kolahal, Padmakumar, Jacob, and George (2022) argue that *open access* to educational resources is the future of learning, in line with *UNESCO Recommendation on Open Science* (UNESCO, 2021).

As far as educator’s role, Scarlat (2020, p. 279; 2021, p. 273) considers that on short term “the education system [...] will continue its mission and address the needs of the increasingly technologized society, while the educator’s role is undergoing a paradigmshift: from educator to master of new technologies as well as students’ mentor and guide to discern the right information from the available ocean of mixed information” and, on longerrun, “the future education will depend on future technologies and their impact on the human society, but mostly decisions made by humans; therefore, the education system and educator’s role will significantly depend on how the future humans (both educators and students) will evolve”. Or, in more dramatic terms, the human race suffocation or extinction as result of wrong technology decisions is an extreme possibility (Wiener, 1989; Martenson, 2011; Harari, 2016).

Today, the higher education is at a crossroads – as its future is intimately inter-linked with the future of human society as humankind. The humans are actually in front of largely spread options. It is up to us to make the right decisions.

REFERENCES

- Abdimusa, Z., Kuatbekov, A., Ismailova, N., Shchedrina, E., & Kulanina, S. (2022). Distance Education and the COVID-19 Pandemic: Psychological and Motivational Aspects. *International Journal of Web-Based Learning and Teaching Technologies*, 17(1), 1–16. <https://doi.org/10.4018/IJWLTT.305803>
- Aboagye, E., Yawson, J.A., & Appiah, K.N. (2021). COVID-19 and E-Learning: the Challenges of Students in Tertiary Institutions. *Social Education Research*, 2(1), 1–8. Retrieved from <https://doi.org/10.37256/ser.212021422>
- Almaraz-Menéndez, F., Maz-Machado, A., López-Esteban, C., & Almaraz-López, C. (Eds.) (2022). *Strategy, Policy, Practice, and Governance for AI in Higher Education Institutions*. Hershey, PA, USA: IGI (Idea Group Int.) Global. <https://doi.org/10.4018/978-1-7998-9247-2>
- Angus, A., & Evans, M. (2020, May). *Coronavirus: Implications on Megatrends* [Webinar]. Euromonitor International. <https://go.euromonitor.com/webinar-consumers-2020-covid-19-impact-on-megatrends.html>
- Appiah-Kubi, P., & Annan, E. (2020). A Review of Collaborative Online International Learning. *International Journal of Engineering Pedagogy*, 10(1), 109–124. <https://doi.org/10.3991/ijep.v10i1.11678>
- Bauler, C. (2019). Speech Acts and Cross-Cultural Pragmatics. In N. Erdogan & M. Wei (Eds.), *Applied Linguistics for Teachers of Culturally and Linguistically Diverse Learners* (223–238). Hershey PA, USA: IGI (Idea Group Int.) Global. <https://doi.org/10.4018/978-1-5225-8467-4>
- Barbu, B.P. (2020). *Studiu Digitaliada: Care sunt resurse digitale pe care le folosesc profesorii? / 'Digitaliada' [Study: Which are the digital resources that teachers use?]* Forbes Romania. Retrieved from <https://forbes.ro/studiu-digitaliada-care-sunt-resurse-digitale-pe-care-le-folosesc-profesorii-162110?>
- Bell, A.R., Banu, D.E., Bordea, C., Bularca, E.C., Lazăr, E.D., & Spuderca, L.M. (2021). Reflecting on Self-Reflection: Overcoming the Challenges of Online Teaching in a Romanian School through Action Research. In A. Slapac, P. Balcerzak, K. O'Brien (Eds.), *Handbook of Research on the Global Empowerment of Educators and Student Learning through Action Research* (pp. 316–342). Hershey, PA, USA: IGI (Idea Group Int.) Global.
- Beriatino, S. (2020, March 23). That Discomfort You're Feeling Is Grief [Interview with David Kessler]. *Harvard Business Review* online. Retrieved from https://hbr.org/2020/03/that-discomfort-youre-feeling-is-griefdose&utm_content=Saturday_10.09.21&utm_source=Campaigner&utm_medium=email
- Bhasin, N.K., & Rajesh, A. (2021). Impact of E-Collaboration between Indian Banks and Fintech Companies for Digital Banking and New Emerging Technologies. *International Journal of e-Collaboration*, 17(1), 15–35. Retrieved from <https://www.igi-global.com/article/impact-of-e-collaboration-between-indian-banks-and-fintech-companies-for-digital-banking-and-new-emerging-technologies/265267>
- Bird, B.D. (2009). The use of questionnaires for acquiring information on public perception of natural hazards and risk mitigation – A review of current knowledge and practice. *Natural Hazards and Earth System Sciences*, 9(4), 1307–1325. <https://doi.org/10.5194/nhess-9-1307-2009>
- Botnariuc, B.P., Cucuș, C.C., Glava, G.C., Iancu, I.E.D., Ilie, I.M.D., Istrate, I.O., Labăr, L.A.V., Pânișoară, P.I.O., Ștefănescu, Ș.D., & Velea, V.S. (2020). *Școala online. Elemente pentru inovarea educației. [Online school. Elements for education innovation]*. Bucharest, Romania: University of Bucharest Publishing House.

- Cao, W. (2022). Correlation of University Lecturer Leadership Styles, Students Satisfaction, and Learning Outcomes during the COVID-19 Pandemic. *International Journal of Technology- Enhanced Education*, 1(1), 1–17. <https://doi.org/10.4018/IJTEE.308468>
- Chavarría, L., Walker, Q., & Bahamon, D. (2020). *Illicit Trade in Times of Coronavirus* [White Paper]. Euromonitor International. Retrieved from <https://go.euromonitor.com/white-paper-consulting-2020-COVID-19-and-illicit-trade.html>
- Cho, Y. (2021). Education sector was affected by COVID-19. *Journal of International Business Research*, 20(3), 1–2.
- Clayson, D.E. (2021). *A Comprehensive Critique of Student Evaluation of Teaching. Critical Perspectives on Validity, Reliability, and Impartiality*. Routledge Research in Higher Education book series. New York, NY, USA: Routledge.
- Colón, G., & Alsace, T.O. (Eds.) (2022). *Bilingual Special Education for the 21st Century: A New Interface*. Hershey, PA, USA: IGI (Idea Group Int.) Global. <https://doi.org/10.4018/978-1-7998-9043-0>
- Das, S., Srivastava, S., Tripathi, A., & Das, S. (2022). Meta-Analysis of EMF-Induced Pollution by COVID-19 in Virtual Teaching and Learning with an Artificial Intelligence Perspective. *International Journal of Web-Based Learning and Teaching Technologies*, 17(4), 1–20.
- Dhawan, S. (2020). Online Learning: A Panacea in the Time of Covid-19 Crisis. *Journal of Educational Technology Systems*, 49(1), 5–22. <https://doi.org/10.1177/0047239520934018>
- Donthu, N., & Gustafsson, A. (2020). Effects of Covid-19 on business and research. *Journal of Business Research*, 117, 284–289. <https://doi.org/10.1016/j.jbusres.2020.06.008>
- Edelhauser, E., & Lupu-Dima, L. (2021). One Year of Online Education in COVID-19 Age, a Challenge for the Romanian Education System. *International Journal of Environmental Research and Public Health*, 18(15), 8129. <https://doi.org/10.3390/ijerph18158129>
- Euromonitor (2020). *The Coronavirus Era: How Will Consumer Markets Evolve?* [White Paper]. Euromonitor International Passport. Retrieved from <https://archive.researchworld.com/the-coronavirus-era-how-will-consumer-markets-evolve/>
- European Commission (2020). *Press releases by European Commission in Romania*: Retrieved from <http://ec.europa.eu/romania>
- Fredericks, B. (2020, March 13). WHO says Europe is the new epicenter of coronavirus pandemic. *New York Post*. Retrieved from <https://nypost.com/2020/03/13/who-says-europe-is-new-epicenter-of-coronavirus-pandemic/>
- Genesys (2019, June 10). *Determining Your Acceptable Abandon Rate*. Retrieved from <https://www.genesys.com/blog/post/determining-your-acceptable-abandon-rate>
- Ghobrani, R.E., Benzert, F.Z., & Balas, M. (2022). Educationalization Instagram for Virtual Instruction in COVID-19: A Pragmatic Framework. *International Journal of Web-Based Learning and Teaching Technologies*, 17(6), 1–16. <https://doi.org/10.4018/IJWLTT.287621>
- Harari, Y.N. (2016). *Homo Deus: A History of Tomorrow*. London, UK: Harvill Secker.
- Holmes, L. (2020, September). *Voice of the Industry: Coronavirus Impact on Companies, Employees and Consumers. Insights from global industry professionals* [Webinar]. Euromonitor International. <https://go.euromonitor.com/webinar-voi-200901-voi-survey-results.html>
- Hossain, S.F., Shan, X., Nurunnabi, M., Tushar, H., Mohsin, A.K., & Ahsan, F.T. (2021). Opportunities and Challenges of M-Learning During the COVID-19 Pandemic: A Mixed Methodology Approach. In J. Zhao & J. Richards (Eds.), *E-Collaboration Technologies and Strategies for Competitive Advantage Amid Challenging Times* (210–227). Hershey, PA, USA: IGI Global.
- Kamal, M.M. (2020). The triple-edged sword of COVID-19: understanding the use of digital technologies and the impact of productive, disruptive, and destructive nature of the pandemic. *Information Systems Management*, 37(4), 310–317.
- Kessler, D. (2019). *Finding Meaning: The Sixth Stage of Grief*. New York, NY, USA: Scribner.
- Krishnamurthy, S. (2020). The Future of Business Education: A Commentary in the Shadow of the Covid-19 Pandemic. *Journal of Business Research*, 117. <https://doi.org/10.1016/j.jbusres.2020.05.034>
- Kübler-Ross, E., & Kessler, D. (2014). *On Grief and Grieving: Finding the Meaning of Grief through the Five Stages of Loss*. New York, NY, USA: Simon & Schuster Ltd.

- Li, C., & Lalani, F. (2020, April 29). The COVID-19 pandemic has changed education forever. *World Economic Forum*. Retrieved from <https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning>
- Liu, H., Liu, W., Yoganathan, V., & Osburg, V.-S. (2021). COVID-19 information overload and generation Z's social media discontinuance intention during the pandemic lockdown. *Technological Forecasting & Social Change*, 166, 120600. Retrieved from <https://doi.org/10.1016/j.techfore.2021.120600>
- Martenson, C. (2011). *The Crash Course: The Unsustainable Future of Our Economy, Energy, and Environment*. Hoboken, NJ, USA: Wiley.
- Sands, K.D. (2020). *Shifts in Consumer Finance after Coronavirus* [White Paper]. Euromonitor International. Retrieved from https://go.euromonitor.com/white-paper-cf-2020-impact-of-coronavirus-on-consumer-finance.html?utm_campaign=SC_20_08_13_Coronavirus_Consumer_Finance&utm_medium=Email&utm_source=1_Outbound
- Scarlat, C. (2020). Today's Higher Education at a Crossroads: Is the Educator's Role Undergoing a *Paradigm Shift*? In M. Carmo (Ed.), *Education and New Developments 2020*. Proceedings of the International Conference "Education and New Developments" – END 2020, Zagreb, Croatia, 27-29 June, 2020 (pp. 276–280). Lisbon, Portugal: inScience Press. <https://doi.org/10.36315/2020end059>
- Scarlat, C. (2021). Today's Higher Education at a Crossroads. The *Critical Point and Paradigm Shift* in the Educator's Role. In M. Carmo (Ed.), *Education Applications & Developments – EAD VI, Advances in Education and Educational Trends Series* (pp. 265–277). Lisbon, Portugal: inScience Press. <https://doi.org/10.36315/2021ead21>
- Scarlat, C. (2022). Teaching Project Management Principles by Proverbs in Culturally and Linguistically Diverse Environments: Ten Years of Experience with International Students. In C. Smith and G. Zhou (Eds.), *Handbook of Research on Teaching Strategies for Culturally and Linguistically Diverse International Students* (pp. 118–146). Hershey, PA, USA: IGI (Idea Group Int.) Global. <https://doi.org/10.4018/978-1-7998-8921-2.ch007>
- Scarlat, C., & Stănculescu, G.D. (2021). Covid-19 Pandemic: Threat or Accelerator? The Case of Romanian Book Publishing Industry. In M. Al Haziazi, A., Al Hajri, K. Subramanian, S. Muthuraman (Eds.), *Co-creating the Post COVID-19 World: Exploring Sustainable Paths* (pp. 83–98). Muscat, Sultanate of Oman: Arab Open University. Retrieved from www.aou.edu.om
- Scarlat, C., Stănculescu, G.D., & Panduru, D.A. (2022). COVID-19 Pandemic as Accelerator: Opportunity for Digital Acceleration. *Journal of Internet and e-Business Studies*, 2022, Article ID 296375. <https://doi.org/10.5171/2022.296375>
- Shukla, S., Kolahal, A., Padmakumar, M.M., Jacob, L., & George, J.P. (2022) Open Educational Resources: The Future of Learning. *Open Educational Resources*, 288–313. <https://doi.org/10.4018/978-1-7998-9805-4.ch014>
- Sita, R., Dutton, S., & Ha, L. (2020). *The German Consumer. Rapid Evolution amidst the Crisis* [White Paper]. Euromonitor International. Retrieved from <https://go.euromonitor.com/white-paper-consumers-200917-german-consumer-eng.html>
- Schleicher, A. (2020). *The impact of Covid-19 on Education. Insights from education at a glance 2020*. OECD Report. Retrieved from <https://www.oecd.org/education/the-impact-of-covid-19-on-education-insights-education-at-a-glance-2020.pdf>
- Sood, P., Sharma, K.K., & Kumar, R. (2022). Online Synchronous Teaching during Pandemic: Investigation of Technology Efficacy and College Student Responses. *International Journal of Web-Based Learning and Teaching Technologies*, 17(6), 1–19. <https://doi.org/10.4018/IJWLTT.287620>
- Sousa, M. J., Suleman, F., Mercadé Melé, P., & Molina Gómez, J. (2021). New Research and Trends in Higher Education. *Education Sciences*, 11(9), 456.
- Șișu, M., & Scarlat, C. (2020). Entrepreneurial behaviour: Strategic changes and initiatives of the SMEs, members of an international group. *FAIMA Business & Management Journal*, 8(4), 19–32.

- Torr, R., Kildunne, A., Clulow, G., & Sutcliffe, M. (2021). *Time for Change Report 2021. Understanding global trends in academic culture*. Bingley, UK: Emerald Publishing.
- Treve, M. (2021). What COVID-19 has introduced into education: challenges facing Higher Education Institutions (HEIs). *Higher Education Pedagogies*, 6(1), 212–227. <https://doi.org/10.1080/23752696.2021.1951616>
- UNESCO (2021). *UNESCO Recommendation on Open Science*. Paris, France: United Nations Educational, Scientific and Cultural Organization. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000379949.locale=en>
- Vasile, V., Boboc, C., & Ghiță, S. (2020). *Industrial relations and social dialogue. Romania: Working life in the COVID-19 pandemic 2020* [Working paper]. Eurofund. Retrieved from <https://euagenda.eu/upload/publications/wpef21029.pdf>
- Wheatley, J. (2020, September 6). Covid-19 curbs ‘not worth economic pain’ for low-income countries. *Financial Times*. Retrieved from <https://www.ft.com/content/62358c60-f3f4-4961-a33f-76ab4ef91350>
- Wiener, N. (1989). *The Human Use of Human Beings. Cybernetics and Society* (Revised edition with a new Introduction by Steve J. Heims; first edition published in Boston, MA, USA: Houghton Mifflin, 1950). London, UK: Free Association Books.
- Zeqiri, J., Kareva, V., & Alija, S. (2021). Blended Learning and Student Satisfaction: The Moderating Effect of Student Performance. *Business Systems Research*, 12(2), 79–94. Retrieved from <https://doi.org/10.2478/bsrj-2021-002>

ADDITIONAL READING

- Bawa, P. (Ed.) (2022). *Preparing Faculty for Technology Dependency in the Post-COVID-19 Era*. Hershey, PA, USA: IGI Global.
- Carmo, M. (Ed.) (2020). Education Applications & Developments V. *Advances in Education and Educational Trends Series*. Lisboa, Portugal: inScience Press.
- Carmo, M. (Ed.) (2021). Education Applications & Developments VI. *Advances in Education and Educational Trends Series*. Lisboa, Portugal: inScience Press.
- Carmo, M. (Ed.) (2021). *Education and New Developments 2021*. Lisboa, Portugal: inScience Press.
- Carmo, M. (Ed.) (2022). *Education and New Developments*. Volume 1 & Volume 2. Lisboa, Portugal: inScience Press.
- Chang, M. (Ed.) (2003). *International Journal of Distance Education Technologies* (IJDET). IGI Global. Published quarterly since 2003; converted to full open access from 2022.
- Epstein, J.L., & Sheldon, S.B. (2022). *School, Family, and Community Partnerships. Preparing Educators and Improving Schools*. Third Edition. Routledge, Taylor & Francis Group.
- Grassetti, M.T., & Zoino-Jeannetti, J. (Eds.) (2020). *Next Generation Digital Tools and Applications for Teaching and Learning Enhancement*. Hershey, PA, USA: IGI Global.
- Raisinghani, M.S. (Ed.) (2006). *International Journal of Web-Based Learning and Teaching Technologies* (IJWLTT). Hershey, PA, USA: IGI Global. Continuous volume, est. 2006.
- Scarlat, C. (2020). Communication Revolutions that Marked the History of Education. Proverbs in Education – Theses and Paradoxes. In M. Carmo (Ed.), *Education and New Developments 2020*. Proceedings of the International Conference "Education and New Developments" – END 2020, Zagreb, Croatia, 27-29 June, 2020 (pp. 266–270). World Institute for Advanced Research and Science (WIARS), Lisboa, Portugal: inScience Press.

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Chapter # 7

DIGITAL CAPITAL AND SAFETY IN SOCIALIZATION PROCESS. AN ITALIAN CASE STUDY

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ABSTRACT

The process of digital acceleration, which in the last few years of the pandemic crisis has affected formal socialization contexts such as schools and families, has led to a critical reflection on the new responsibilities and skills of the digital citizen, in order to preserve his autonomy in the management of virtual dynamics while respecting certain ethical principles at the basis of navigation. These principles underpin the implementation of a digital culture in which the use of devices is guided by a sense of responsibility and respect for otherness. The new digital skills of the citizen go beyond specific access techniques and focus mainly on conscious digital behaviour at the basis of safeguarding various forms of individual and social well-being. Through the illustration of the main results of a national survey promoted by Sapienza University of Rome in 2020, the paper intends to provide a reflection on the degree of diffusion of digital awareness among Italian adolescents and on the impact of school and family digital capital in the development and implementation of such skills.

Keywords: digital safety, social capital, digital capital, socialization, children.

1. INTRODUCTION

Digital capital and safety are the two key concepts that underlie the leitmotif of this essay, therefore, it is fundamental to define them scientifically.

In the social sciences, the term "digital capital" means both internal and intangible resources (such as digital skills) and external and material resources (such as technologies), available within a specific Bourdeisian field (or social space), such as school or family, used by individuals to achieve specific goals (Ragnedda, 2018; Ragnedda, Ruiu, & Addeo, 2019; Cortoni, 2020). This definition can take on different interpretations depending on the point of view from which it is analyzed.

From a microsocial perspective, digital capital recalls both the behaviors of individuals, who use different devices, and their cultural capital in terms of digital skills (Paino & Renzulli, 2012; Pitzalis, Porcu, De Feo, & Giamboni, 2016; Magaudda as cited in De Feo & Pitzalis, 2014). In this sense, one can attribute a specific dimension of digital capital to the human capital of the actors involved, recalling their innate, cultural and cognitive characteristics (the so-called internal and fundamental capabilities of Nussbaum, 2010) that individuals also mobilize when they act digitally and that contribute to defining the type and level of people's digital skills.

Moving on to a macrosocial perspective, digital capital expresses both the technological infrastructure and investments in digital education promoted and initiated by public and private institutions, to improve its production and distribution system.

To define, instead, the concept of safety, in accordance with the *European Framework for Developing and Understanding Digital Competence in Europe (DIGCOMP)* (Kluzer & Rissola, 2015), it refers to a specific area of digital competence redirecting both to the trust

and ability of citizens to protect their privacy and reputation online, and to the ability to use the Internet to protect themselves from various Web risks that may be related to the device, threaten the individual's physical, psychological, social and emotional well-being and harm the environment. To this end, the main safety descriptors identified by the European Commission are four: 1. Protecting devices, 2. Protecting personal data and privacy, 3. Protecting health and well-being and 4. Protecting the environment (DIGCOMP 2.0, 2015; DIGCOMP 2.1, 2017) (Vuorikari, Punie, Carratero, & Van den Brande, 2016; Redecker, 2017).

The reflection on these concepts has acquired, in recent years, a central role in the international sociological scientific debate especially if related to the structural and sociocultural transformations induced by the advent of the so-called "platform society" (Van Dijck, Poell, & de Waal, 2018). This term refers to the central role played by digital platforms¹ (1) in directing processes of production, marketing and use of tangible and intangible assets, with inevitable repercussions on the dynamics of socialization, on the processes of building individual and social identities, as well as on the construction of social, communicative and participatory relations of citizens (Van Dijck, 2013). In the current infrastructure ecosystem, data represent the trading and socio-economic bargaining goods, that is all that information, or intangible resources, generated by the actions and interactions of users in the Network, encoded and stored by the digital system through algorithms (datafication). Thus, a true and proper system of the cultural industry is born in which "the ethical economy", which guides the creation of online content by users, clashes with the "capitalist economy" proper to the profit of large corporations. The result is a process of commodification of culture (Canevacci, 2001) produced from below, whose surplus value is often made available to other economic subjects, with the often unaware consent of the same user, through the acceptance of the conditions of use of the platform (commodification).

Moreover, by using the data shared by users, the platforms are able to constantly control and monitor the processes of action and interaction of users (feedback) through digital surveillance mechanisms and the storage of multiple user information in digital systems (data surveillance) (Lupton, 2015).

The global health emergency linked to COVID-19 has induced many radical changes in the management of work, relational, social, economic and, above all, educational dynamics through digital devices such as strategies to contain the pandemic and social distancing. During the lockdown, in the short term, the digital platforms have helped face the emergency becoming the main space (virtual) of interaction, socialization and communication of citizens, as well as the management of public and private functions of companies, contributing to ensure continuity in the dynamics of production and work. In the medium term, however, they have highlighted a series of limitations related to datafication and commodification.

A fundamental contribution to the discussion is given by the *accountability* of the citizen who, in exercising the rights of data protection within the new system of the cultural industry, generated by the *platform society*, has introduced the issue of *digital safety* into the contemporary public, political and scientific debate. *Digital safety* is digital competence in terms of user awareness, that the citizen must possess to understand the processes of datafication, personalization and commodification of information shared between companies or institutions and citizens online (Van Dijck et al., 2018). The issue becomes even more delicate if projected onto minors, hence some research questions that trigger our sociological

¹Digital platform means "a programmable digital architecture, designed to organize interactions between users... oriented to the systematic collection, algorithmic treatment, circulation and monetization of user data". (Van Dijck et al., 2018: p.27).

reflection: What is the digital safety degree of minors and what is the impact of the digital family and school capital in the maturation of such digital soft skills (Cortoni, & Lo Presti, 2018).

2. BACKGROUND AND RESEARCH DESIGN

A useful and relevant sociological reflection can be started from some scholarly contributions showing how the learning process of a minor is influenced by at least three main determinants that differentiate scholastic success: 1. social background; 2. school variables and 3. individual aspirations and orientations (Cherkaoui, 1979). Similarly, it is conceivable that the acquisition of digital skills for young people, such as safety, is related to the incidence of social, cultural, family and school capital on the stimulation of learning and the implementation of the skills of children (Coleman, 1966; Bourdieu, 1979; Gambetta, 1990; Cherkaoui, 1979).

The CENSIS report (2021) on the digitalization of Italians reveals data that confirm the directly proportional relationship that unites the sociocultural capital of the family and the school with the use of digital technologies. In this sense, it is possible to assume that the fragility of the digital capital of teachers and parents could be reflected onto young people, particularly with regard to the implementation of transversal digital skills, such as safety, which cannot be acquired experientially through the sole autonomous use of media.

Socialization agencies can make a decisive contribution, both materially and culturally, to provide minors with useful stimuli to the discovery of the technological world and especially to accompany them in the process of exploration by directing them to a critical reading of media content and a different fruitive awareness. Specifically, the school could intervene to reduce forms of socio-cultural inequality by favouring compensatory and supportive pedagogies, where family, cultural and material resources are lacking (Cherkaoui, 1979).

Reflecting also from a microsocial perspective, it is possible to observe how the influence of family and school social capital is reflected in the component of subjective motivation, which is at the basis of media use. In fact, the lack of transversal digital skills in teachers and parents often risks compromising the communicative effectiveness in the teaching/student (or child/parent) educational relationship, indirectly implementing demotivation, disinterest, boredom and passivity on the part of students (Capogna, Coccozza, & Cianfriglia, 2018).

The emotional involvement and the marked sensitivity towards the potential of digital media contribute to define the individual attitude, more or less proactive, when offered interactive services, influencing their perception and individual investment in terms of commitment and attention (these are further subjective variables that develop independently of the incidence of family and school capital and interrupt linear socialization, hinged in the *habitus* of Bourdieu).

In 2020, the Osservatorio Mediamonitor Minori of the University of Rome “La Sapienza” conducted a national quantitative survey on the dissemination of the competence of digital safety in a sample of 2708 Italian teenagers, from 37 upper secondary schools in 14 regions, and their families². Specifically, the survey focused on various social and cultural aspects by observing and analyzing, with a quantitative approach, digital and social capital:

²The sampling plan was factorial and typological and took two variables into account: a) the region of origin; b) the type of institution (high school or technical/vocational school). The draw was random, based on ministerial lists. In any case, the sample is not representative of the Italian adolescent population.

1. the schools involved, as per ownership of technological infrastructure, digital education services and investment, with possible repercussions on teaching methodologies in teacher classes;

2. adolescents, as per daily media behaviour and digital competence, with particular reference to the DIGCOMP safety area.

3. families, as per impact on the development of the safety of adolescents interviewed.

The survey was carried out from March to December 2020 through the online administration of 3 questionnaires (one for each target involved). In this essay, our focus will be mainly on the impact of school digital capital in the development of the safety area of digital competence of the sample of teenagers involved in the investigation.

3. DISCUSSION ON MAIN OUTCOMES

To answer the research questions posed in the first paragraph on the degree of dissemination of safety among Italian adolescents interviewed and the impact of school-related digital capital, we will start from the analysis of the digital school capital of the schools involved in the sample. The latter, in a macrosocial perspective, has been built after taking into account two main dimensions specific to schools of all levels: the technological infrastructure³ and the experimental training⁴. Therefore, through the construction of a typological index, we found 4 types of digital school capital:

1. the schools' typically highly limited digital capital with little investment in digital education and technology skills;

2. high digital capital of schools with a strong investment in both technological-digital and methodological-cultural dimensions;

3. infrastructural technological capital prevailing in schools with an imbalance on the infrastructural technological side;

4. experimental training capital prevailing in schools with an imbalance on the educational and experimental side (cf. table 1).

Table 1.
Digital capital of the schools involved in the survey.

<i>Typological index</i>	AV	%
Highly limited digital capital	10	30,3
Predominantly infrastructural technological capital	5	15,2
Predominantly experimental training capital	8	24,2
High digital capital	10	30,3
Total	33	100,0
Missing	4	
Total	37	

³In order to define the infrastructural technological dimension of the digital capital of the schools involved in the survey, the following information was taken into account: the number of research laboratories present in the facility, the number of workstations in the laboratory and the type of Internet connection. Crossing these variables we obtained the index of infrastructure endowment of the school, sub sectioned into (1) medium high endowment, when both the presence of laboratories and of the stations are medium low, and (2) medium low endowment, when the school has a large number of laboratories with an equally large number of workstations.

⁴In order to define the experimental training dimension of digital capital, a typological index has been constructed, as a result of the combination of two additive indices, one linked to training, with which we mean the participation of schools and teachers in educational projects on digitalization, and one related to the experimentation on the adhesion of sampled schools to projects of school experimentation with digitalization, both detected in the last 5 years.

Schools with a high digital capital certainly employ technologies as a support for the smooth running of the school's administrative and teaching activities. Specifically, the most widely available media for almost all subjects are IWB, tablets and PCs.

But how do these infrastructural investments, together with the educational investments of the school, contribute to changing the routine activities of its main actors? Starting from the international framework of DigCompEdu⁵ (2017) on digital competences for educators, as a useful tool for reading and analyzing the process of translation of the two dimensions of digital capital in school educational practices of teachers, one can say that schools with high digital capital integrate these technologies for the improvement of some educational activities such as: a) the implementation of communication and exchange of experiences and materials between colleagues in the perspective of technological innovation with greater continuity than schools with other types of digital capital (teaching and learning area); b) for individual professional updating (professional engagement area); c) for updating and implementing materials and resources already available and present in the school context (digital resources area); d) for classroom teaching innovation with students (teaching and learning area), e) for the implementation of the interaction between students even outside the school context (professional engagement area), f) for the investment on the implementation of the digital skills of their students (facilitating learners' digital competence area) and finally g) to respond to specific issues (e.g. SLD) and differentiate student learning processes (empowering learners area).

In contrast, schools with unbalanced digital capital towards digital teacher training and experimentation seem to invest the most frequently acquired know-how in: a) innovative strategies to manage collaboration between student workgroups (teaching and learning area); b) the search for digital resources to be used for one's own lesson, taking into account the educational objectives (digital resources area); c) the design of tests and in the management of the data of student evaluations (e.g. through summary databases) and in the elaboration of judgements starting from predefined specific evaluation headings (assessment area). Finally, schools with a digital capital focused on the technological dimension of infrastructure seem to prefer activities oriented to: a) external communication with families, other schools and students (professional engagement area); b) the exchange of materials and experiences between colleagues (teaching and learning area); c) as well as in the updating of material and resources already available and present in the school context (digital resources area).

Secondly, to understand the level of safety among adolescents we interviewed, we have created 4 additive indices corresponding to each descriptor:

1. the device's protection index, which takes into account the variables of their habit of protecting their devices through access codes and antivirus systems, emphasizing the ways and the frequency with which they update the password, as well as the degree of password sharing with friends and relatives.

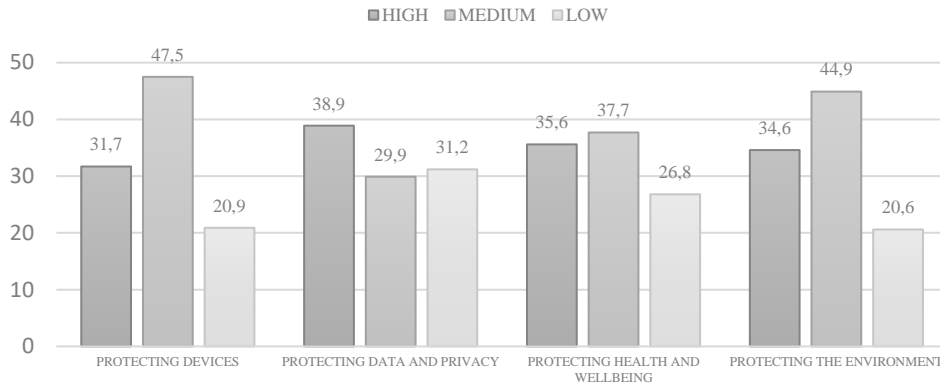
2. the data and privacy protection index, obtained by investigating both the way in which the terms and conditions of use are accepted, the degree of sharing of personal data and the type of activity carried out online.

3. the individual health and well-being protection index derived from specific physical, social, emotional or cognitive reactions encountered during or after the use of the media.

4. the environmental protection index on how technologies are disposed of and the characteristics considered important during the purchase and use of a device.

⁵DigCompEdu structures and summarizes the professional life of teachers into 6 main areas of competence (or moments of use): 1. Professional engagement; 2. Digital resources; 3. Teaching and learning; 4. assessment; 5. Empowering learners; 6. Facilitating learner's digital competence. For each, DigCompEdu identifies descriptors of digital competence to be analyzed in research perspective and aimed at profiling specific skills.

Figure 1.
Safety indices of Italian students involved in the survey (val.%).



When analyzing the data, it can be noted that the lower values of safety are mainly manifested in data and privacy protection and the protection of individual well-being. Specifically, 31.2% of the students seem to have a low data and privacy protection index. This figure is more widespread among students who come from families with a low cultural capital and are professional institute seniors in the regions of southern Italy. While 26.8% of students have a low awareness of individual well-being. These students also have a low family cultural capital and attend mainly the first classes of technical professional institutes in the regions of northern Italy.

Compared to the other two digital safety descriptors, only about 21% of respondents have a low safety level: as per device protection, such students have a low family cultural capital and are high school freshmen in the regions of northern Italy; in the second case on environmental protection, students with a low level of safety possess a medium-high cultural capital and are technical professional institute freshmen in the regions of northern Italy.

We cross-referenced the data of the school digital capital with the safety indices of the interviewed students, in order to verify the impact of schools on the development of this *digital soft skill*. It can be noted that the low index on data and privacy protection together with that on device protection are more widespread especially in schools with limited digital capital, or in those schools where there is very little investment in digital education and infrastructure.

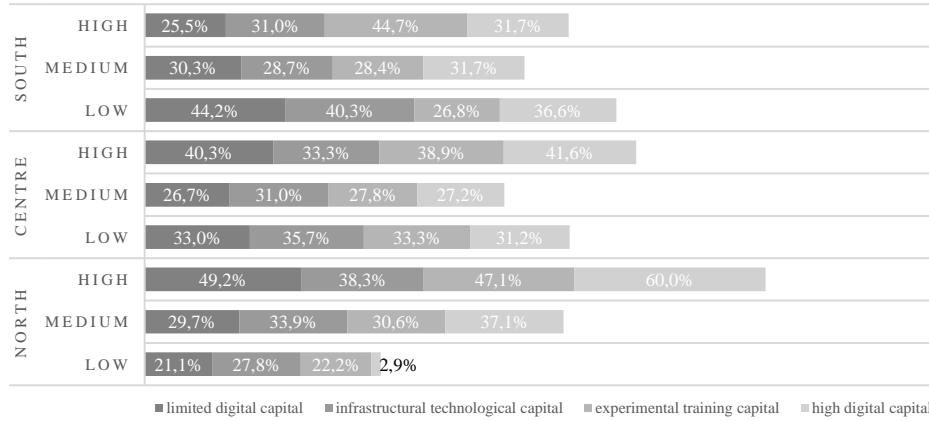
On the other hand, schools with digital capital directed towards training and experimentation seem to be positively making an impact especially on the development of a high safety with respect to environmental protection and the protection of the individual well-being of students (cf. table 2).

Table 2.
The influence of digital capital on student safety

		Digital capital of school				Total
		Highly limited digital capital	Predominantly infrastructural technological capital	Predominantly experimental training capital	High digital capital	
Protecting the environment	high	33,9%	34,3%	38,2%	29,7%	35%
	medium	44,4%	44,8%	46,1%	45,4%	45,2%
	low	21,7%	21%	15,7%	24,9%	19,9%
total		100%	100%	100%	100%	100%
Protecting personal data and privacy	low	35,7%	32,5%	25,9%	28,1%	30,9%
	medium	29,3%	31,9%	29,3%	29,3%	30,1%
	high	35%	35,5%	44,8%	42,6%	38,9%
total		100%	100%	100%	100%	100%
Protecting devices	high	30,2%	31,8%	33,3%	32,1%	31,9%
	medium	48,4%	46,3%	47,9%	47,8%	47,5%
	low	21,4%	21,9%	18,8%	20,1%	20,6%
total		100%	100%	100%	100%	100%
Protecting health and well-being	high	34,1%	34,4%	39,5%	30,5%	35,5%
	medium	39,8%	38,6%	36,1%	37,3%	38,1%
	low	26,2%	27%	24,4,8%	32,1%	26,4%
total		100%	100%	100%	100%	100%

With respect to this first framework, if we were to consider the territorial variable and focus the analysis within the Italian geographical areas, we could see relational differences attributable to the impact of additional school-unrelated, socio-cultural variables on the development of digital safety skills of young people. From a methodological point of view, in order to carry out these studies, we have implemented multivariate analyses in which we have isolated the relationship between the safety indices of the sampled adolescents and the school digital capital within three Italian macro-geographical areas (North, Central and South). An analysis of the results showed that schools with limited or unbalanced digital capital on infrastructure technology endowment have a particularly significant relationship with the development of a low index of data protection and privacy, this relationship is particularly evident in schools in southern Italy, in which there is also a significant relationship between a high index of data protection in students and the attendance of schools with a strong investment in digital training. In the areas of central and northern Italy, however, while on the one hand there remains the significant relationship between low safety index and schools equipped from the technological point of view and between high safety index and high school digital capital (for example, in northern schools with high digital capital, the number of students in the sample with a low safety level is close to 0), on the other, one can also notice that a high index on data protection is also present in some schools in northern Italy with a very limited digital capital. In this sense, we can assume that a good percentage of students acquire awareness of data protection outside the school context (e.g. in the family, through peers, and other territorial agencies), that play a compensatory role wherever school fails to arrive and to guarantee a support service (cf. *Figure 2*).

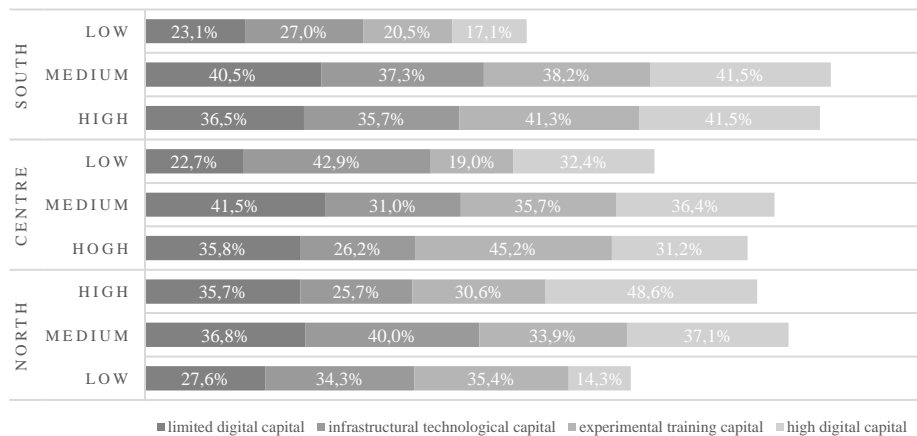
Figure 2.
Protecting personal data and privacy – Digital safety index of Italian students and digital capital of schools (2022).



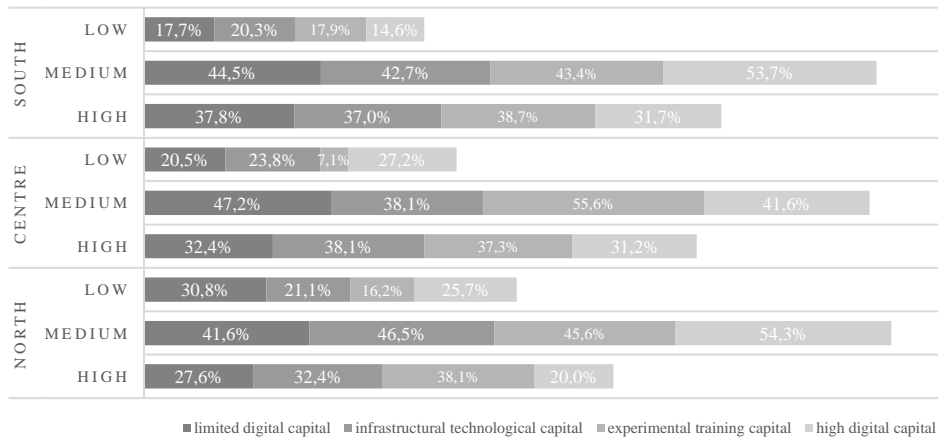
The indices of protection of individual and environmental well-being seem to be particularly high and significant (39% in the first case and 38.3% in the second case) in schools that declare a strong investment in media and communication training/experimentation regardless of their geographical area; similarly, in schools with a strong investment in technology or with a low digital capital, the index level on psychological and physical well-being is medium and that of environmental well-being is low.

In addition, the impact of the high digital capital of schools on the development of safety on personal protection is particularly evident mainly in the regions of southern Italy, while in the center and in the north there seems to be an inverse relationship between the school digital capital and the safety level on the protection of psychophysical well-being. In this sense, a greater investment by the school on the diffusion of digital soft skills in students in the regions of northern Italy is desirable (Cortoni, & Lo Presti, 2018) (cf. Figure 3).

Figure 3.
Protecting health and wellbeing – digital safety index of Italian students and digital capital of schools (2022).

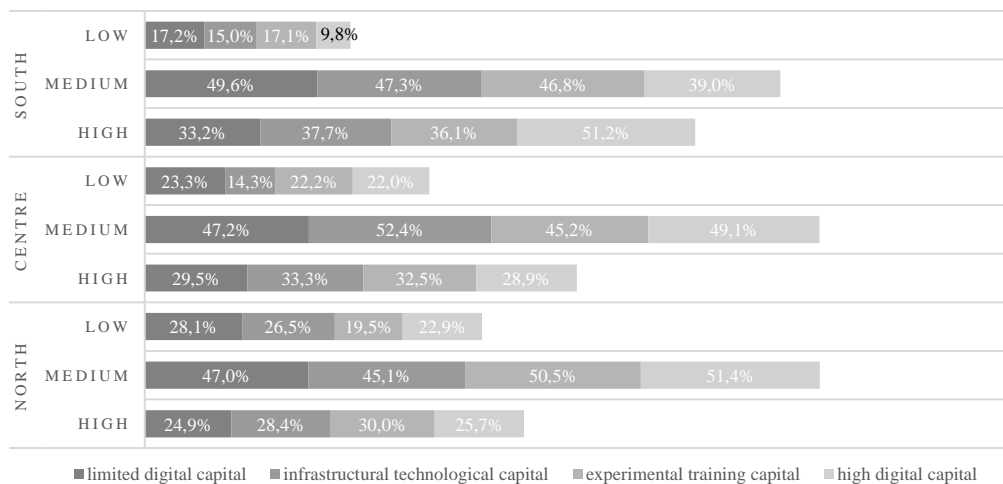


*Figure 4.
Protecting the environment – digital safety index of Italian students and digital capital of schools (2022).*



Finally, compared to the safety index on device protection, if schools with a highly limited digital capital do not contribute to the spread of greater digital awareness, the main contributing factor to a greater diffusion of this competence is above all investment on digital training ("Prevalent experimental training capital") in the central-northern areas and, in some cases, in the high digital capital (in the southern areas) (cf. *Figure 5*).

*Figure 5.
Protecting devices – digital safety index of Italian students and digital capital of schools (2022)*



Relationship between school and family digital capital on student safety

In order to analyze and deepen the relationship between school and family digital capital, we focused mainly on schools with high capital and with highly limited digital

capital. In both cases we analyzed the relationship between the digital capital of students and their families through bivariate statistical analyses (cf. table 3).

Table 3.
Relationship between safety indices of students and parents in schools with high digital capital.

Schools with high digital capital						
Safety index of protecting device for parents						
		High	Medium	Low	Total	
Safety Index of Protecting devices for students	High	count	6	1	4	11
		%	37,5%	10,0%	36,4%	29,7%
	Medium	count	8	7	5	20
		%	50,0%	70,0%	45,5%	54,1%
	Low	count	2	2	2	6
		%	12,5%	20,0%	18,2%	16,2%
Total		count	16	10	11	37
		%	100,0%	100,0%	100,0%	100,0%
Safety index of protecting personal data and privacy for parents						
		Low	Medium	High	Total	
Safety index of protecting personal data and privacy for students	Low	count	9	13	2	24
		%	31,0%	25,5%	12,5%	25,0%
	Medium	count	9	17	2	28
		%	31,0%	33,3%	12,5%	29,2%
	High	count	11	21	12	44
		%	37,9%	41,2%	75,0%	45,8%
Total		count	29	51	16	96
		%	100,0%	100,0%	100,0%	100,0%
Safety index of Protecting health and well-being for parents						
		High	Medium	Low	Total	
Safety index of Protecting health and well-being for students	High	count	13	8	11	32
		%	33,3%	26,7%	40,7%	33,3%
	Medium	count	14	10	10	34
		%	35,9%	33,3%	37,0%	35,4%
	Low	count	12	12	6	30
		%	30,8%	40,0%	22,2%	31,3%
Total		count	39	30	27	96
		%	100,0%	100,0%	100,0%	100,0%

From the general analysis of the results, within schools with high digital capital, it has been found that there is a direct relationship between the level of digital competence of students and their parents compared to the 4 safety indices described above (protection of the device; protection of data and privacy, protection of personal physical and psychological well-being...). However, it can be observed that students from schools with high digital capital have a high level of safety related to device protection and protection of psychological and physical well-being, even when they come from families with a low level of safety. This data suggests the impact that the school with high digital capital can have on students with low family digital capital.

This hypothesis is reinforced by the data implying that, in schools with very limited digital capital (cf. tab.4), the influence of digital family skills appears to be stronger. In this sense, there is a direct relationship between the development of safety indices in students and the safety indices of their parents. In other words, students with a high safety index, especially regarding the protection of devices and data, seem to come from families with a high level

of safety and vice versa. Regarding the index on the protection of individual well-being, however, neither the digital school capital nor the family capital seems to affect the development of the skills of the respondents. In fact, more than 60% of students with a high average safety level come from families with a low average digital competence level. This result suggests that the development of transversal competence linked to individual well-being is attributable to other socio-cultural variables, not necessarily linked to the media.

*Table 4.
Relationship between safety indices of students and parents in schools with highly limited digital capital.*

Schools with highly limited digital capital						
Safety Index of Protecting devices for parents						
		Safety Index			Total	
		High	Medium	Low		
Safety Index of Protecting devices for students	High	count	15	16	10	41
		%	30,0%	28,1%	24,4%	27,7%
	Medium	count	27	34	20	81
		%	54,0%	59,6%	48,8%	54,7%
	Low	count	8	7	11	26
		%	16,0%	12,3%	26,8%	17,6%
Total	count	50	57	41	148	
	%	100,0%	100,0%	100,0%	100,0%	
Safety index of protecting personal data and privacy for parents						
		Low	Medium	high	Total	
Safety index of protecting personal data and privacy for students	Low	count	47	56	28	131
		%	45,6%	30,9%	36,4%	36,3%
	Medium	count	32	58	18	108
		%	31,1%	32,0%	23,4%	29,9%
	High	count	24	67	31	122
		%	23,3%	37,0%	40,3%	33,8%
Total	count	103	181	77	361	
	%	100,0%	100,0%	100,0%	100,0%	
Safety index of Protecting health and well-being for parents						
		High	Medium	Low	Total	
Safety index of Protecting health and well-being for students	High	count	28	49	33	110
		%	22,8%	37,4%	30,8%	30,5%
	Medium	count	56	46	40	142
		%	45,5%	35,1%	37,4%	39,3%
	Low	count	39	36	34	109
		%	31,7%	27,5%	31,8%	30,2%
Total	count	123	131	107	361	
	%	100,0%	100,0%	100,0%	100,0%	

4. CONCLUSION

After the analysis of the research data, two main theoretical considerations emerge in response to the research questions illustrated in the first paragraph of this essay.

The first one concerns the digital capital of schools: schools with a high digital capital and, specifically, with strong investments in training and experimentation in the digital field, are those that are more oriented towards a process of inclusion of technologies both in the school context and in teaching and learning practices in terms of methodological innovation. Also, the implementation of resources for improving teaching performance and stimulating

student learning generates a process of inclusion of Digital Education in schools, not only instrumentally but also and above all methodologically.

Schools with high digital capital or investing in the educational dimension of digital capital have a significant impact on the development of their students' digital safety indices. Of course, schools are socialization agencies that build networks of collaborations and exchanges with the territory, which benefit from the infrastructure and services of the surrounding social context and reflect the socio-cultural basis shared in the surrounding area and with the families frequenting the schools. In this sense, the relationship between the development of school digital capital and that of the student's digital competence cannot be considered exclusive but reflects other sociocultural variables that revolve around the formal and informal socialization process of the students themselves. The analysis of the results shows, for example, that schools with a low digital capital in the regions of Northern Italy (i.e. those regions that have a higher level of economic development and therefore a higher level of socio-cultural territorial well-being than the regions of central and southern Italy) are able to ensure the introduction of a high level of safety in students, by virtue of the network they build with the territory and the mutual socio-cultural stimulation that they are able to guarantee to their students.

In addition to this, the contribution of digital family capital is able to intervene on the implementation of students' digital skills, especially when the school does not have adequate material and educational tools to supply to this function. The analysis of the results shows that there is a direct relationship between the digital skills of parents and students regardless of the school digital capital. However, schools with high digital capital seem to be more effective in implementing students' digital skills in those family situations where parental safety skills are particularly limited.

From the framework that has just been identified, it emerges that schools and families, as formal socialization agencies, are central to the development of learning and to the strengthening of their transversal skills and are able to ensure the implementation of the digital skills of young people also playing a role of mutual support and compensatory intervention. This is deemed especially true when one of the two agencies seems to manifest gaps in digital capital or sociocultural type. The collaboration between school and family, but also other agencies of territorial socialization, within an ecological perspective of the media (Postman, 1970; Granata, 2015) therefore seems to emerge as a key strategy to ensure the systematic dissemination of students' digital safety skills.

The data also show that the exclusive investment on the technological dimension of digital capital, without a focus on the cultural capital of digital resources, is particularly functional only to improve communication processes towards the external context, as well as updating resources for school management.

This information is inevitably reflected in the development of the safety of school actors, including students themselves. In particular, schools with low investments in digital capital contribute less to the development of safety, especially relating to data, privacy and device protection. The results of the research also show how the educational component linked to the literacy of school actors in the field of digital capital in schools is a fundamental aspect on which to invest in the future for the implementation of these skills in students.

This investment process becomes strategic and compensatory especially knowing that a low safety index is often linked to a family context with an equally low socio-cultural capital as well as, mainly, the attendance of technical professional institutes. For this reason, the competence of digital safety is considered a *digital soft skill* or a competence that cannot be learned by citizens through simple media experience, but through a path of digital literacy in educational contexts such as school or family; this aspect, however, is still poorly structured in the Italian government system towards secondary schools.

REFERENCES

- Bourdieu, P. (1979). *La Distinction. Critique sociale du jugement* [The Distinction. Social Criticism of Judgement]. Paris: Editions de Minuit
- Canevacci, M. (2001). *Antropologia della comunicazione visuale. Feticci, merci, pubblicità, cinema, corpi, videoscape* [Anthropology of visual communication. Fetishes, commodities, advertising, cinema, bodies, videoscape]. Milano: Meltemi
- Capogna, S., Cocozza, A., & Cianfriglia, L. (2018). *Le sfide della scuola nell'era digitale. una ricerca sulle competenze digitali dei docenti* [The challenges of schooling in the digital age. a survey of teachers' digital skills]. Roma: Eurilink.
- Cherkaoui, M. (1979). *Les paradoxes de la réussite scolaire: sociologie compare des systèmes d'enseignement* [The paradoxes of educational success: a comparative sociology of educational systems]. Paris: Presses Universitaires de France.
- Coleman, J. S. (1966). *Equality of educational opportunity*. Washington: US Government Printing Office.
- Cortoni, I. (2020). *Le competenze digitali nella scuola. Un'indagine dell'Osservatorio Mediamonitor minori della Sapienza di Roma* [Digital skills in schools. A survey by the Mediamonitor Minor Observatory of the Sapienza University of Rome]. Roma: Carocci
- Cortoni, I., & Lo Presti, V. (2018). *Digital Literacy e capitale sociale. Una metodologia specifica per la valutazione delle competenze* [Digital Literacy and Social Capital. A specific methodology for competence assessment]. Milano: FrancoAngeli
- CENSIS (2021). *55 rapporto CENSIS sulla situazione sociale del Paese* [55th CENSIS report on the social situation of the country]. Retrieved from <https://www.censis.it/rapporto-annuale/55%20rapporto-sulla-situazione-sociale-del-paese2021>
- De Feo, A., & Pitzalis, M. (a cura di) (2014). *Produzione, riproduzione e distinzione. Studiare il mondo sociale con (e dopo) Bourdieu* [Production, reproduction and distinction. Studying the social world with (and after) Bourdieu]. Napoli: CUEC
- Gambetta, D. (1987). *Were they pushed or did they jump? Individual decision mechanisms in education*. Cambridge: Cambridge University press.
- Granata, P. (2015). *Ecologia dei media. Protagonisti, scuole, concetti chiave* [Media ecology. Protagonists, schools, key concepts]. Milano: FrancoAngeli.
- Kluzer, S., & Rissola, G. (2015). *Guidelines on adoption of DIGCOMP*. Luxembourg: European Commission.
- Lupton, D. (2015). *Digital Sociology*. London: Routledge Pearson Education.
- Nussbaum, M. (2010). *Creating Capabilities*. Harvard: Belknap Press.
- Paino, M., & Renzulli, L. A. (2012). Digital Dimension of cultural Capital: The (In)visible advantages for students who exhibit computer skills. *Sociology of Education*, 86(2), 124-138.
- Pitzalis M., Porcu, M., De Feo, A., & Giamboni, F. (2016). *Innovare a scuola. Insegnanti, studenti e tecnologie digitali* [Innovating at school. Teachers, students and digital technologies]. Bologna: Il Mulino.
- Postman, N. (1979). *Teaching as a conserving activity*. New York: Delacorte Press
- Ragnedda, M. (2018). Conceptualizing digital capital. *Telematics and Informatics*, 35(8). 2366–2375.
- Ragnedda, M., Ruiu, M. L., & Addeo, F. (2019). Measuring Digital Capital: An empirical investigation. *New media and Society*. 22(5) 793-816. <https://doi.org/10.1177/1461444819869604>
- Redecker, C. (2017). *European Framework for the Digital Competence of Educators: DigCompEdu*. Luxembourg: Publications Office of the European Union.
- Van Dijck, J., Poell, T., & de Waal, M. (2018). *The Platform Society. public Values in a connective world*. New York: Oxford University.
- Van Dijck, J. (2013). *The culture of connectivity: a critical history of social media*. Oxford University press.
- Vuorikari, R., Punie, Y., Carratero, S., & Van den Brande, L. (2016). *Digcomp 2.0. The digital competence framework for citizens. Update phase 1: the conceptual reference model*. Luxembourg: Publication Office of the European Union. <https://doi.org/10.2791/11517>

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Chapter # 8

PROMOTING EPISTEMIC VIRTUES ACROSS THE CURRICULUM TO EDUCATE 21ST CENTURY CITIZENS

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ABSTRACT

In our Knowledge Society, the ease of access to information due to advanced and user-friendly technologies often gives us the illusion to know more than we do. This "epistemic disease" is a danger to both democracy and public health. The educational system must therefore encourage good epistemic habits consistent with responsible citizenship. From a didactic perspective, this requires updating the curriculum in light of the educational challenge of the 21st century: training students to be virtuous epistemic agents by fostering their epistemic cognition. In this article, I intend to provide teachers with some useful operational guidance to achieve this goal. To this end, the epistemological concept of the virtuous epistemic agent is converted into a didactically fertile construct in two steps: first, observable knowledge-friendly behaviors are identified that can be regarded as clues to the habitus of the virtuous epistemic agent; then some procedural principles are formulated to help teachers design instructional activities that foster students' commitment to enacting those kinds of behaviors.

Keywords: epistemic cognition, procedural principles, curriculum design, didactic transposition, epistemic practices, epistemic virtues.

1. THE NEED FOR EPISTEMIC RESPONSIBILITY IN AN ICT-BASED SOCIETY

Living in complex information ecosystems, where we are constantly exposed to information overload, makes issues of *who* and *what* to believe and *how* to integrate multiple sources of information into coherent and useful knowledge primary challenges for those tasked with selecting what is worth teaching and how to do it. Easy access to information – at least in some countries – enabled by increasingly advanced and user-friendly technological devices, has greatly influenced our intellectual lives, particularly the way we acquire information, form beliefs, and search for reasons to support them. However, the more powerful Information and Communication Technology, the greater the need for epistemic responsibility, i.e., the moral responsibility to behave in epistemically virtuous ways (McHugh & Davidson, 2020). Indeed, information overload contributes to instilling in us the reassuring but dangerous belief that we master authentic knowledge, even though this is not the case. In short, we often suffer from knowledge illusion, namely, we think we know more than we do (Sloman & Fernbach, 2017). This *epistemic disease*, fueled by increasing digitization, may hinder the development of 21st century citizenship skills, as well as the achievement of the Sustainable Development Goals set by the United Nations 2030 Agenda. Evidence of this is the Covid-19 infodemic, which clearly shows how the presumption of knowledge combined with "information disorder" can undermine people's ability to make decisions.

The World Health Organization labeled as “infodemic” the overabundance of information “including false or misleading information in digital and physical environments during a disease outbreak” (WHO, 2022) that makes it difficult to find one’s way around a given topic because of the difficulty of identifying reliable sources. The damage to public health that this information pathology can cause by prompting people to distrust scientific experts and health authorities can be further amplified by the filter bubble effect. This expression was coined by the American scholar Eli Pariser (2011) to refer to personalized information ecosystems generated by algorithms, such as, for example, Google’s personalized search and Facebook’s personalized news. These algorithms, based on the preferences previously granted by the user, tend to propose content similar to what the user likes. As a result, naïve epistemic subjects, being excluded from information that contradicts their standpoint, end up being isolated in their epistemic bubble or echo chamber (Nguyen, 2020). The knowledge illusion generated by the consensus of one’s group makes them more polarized and prone to conflict (Sunstein, 2009). In other words, interacting with a homogeneous network of like-minded friends makes people more likely to radicalize their positions, regardless of whether they have well-founded reasons to support them.

This natural tendency of the human mind is further reinforced by the many types of cognitive bias that influence our judgment and decision-making (Piattelli-Palmarini, 1994; Kahneman, 2011). Especially relevant to the problem at hand is the confirmation bias, i.e., our spontaneous inclination to search for, accept and interpret evidence in a way that supports what we are already convinced of. Confirmation bias hampers public evaluation of opinions and arguments, promotes social conformity, devaluation of expert views, and polarization and manipulation of opinions. Although philosophers of science, following Karl Popper (2014), suggest challenging a hypothesis by trying to disprove it, we are always looking for data that are consistent with our current beliefs (Kahneman, 2011). Thus, complying with the rules of scientific rationality requires a great cognitive effort from people as they need to get used to inhibiting their spontaneous intuitions.

In this context, whether information sharing can be the key resource of our society compared to those of the past also depends on the extent to which citizens are likely to enact knowledge-friendly behaviors while seeking new information and taking decisions. The education system needs, therefore, to encourage good epistemic habits consistent with responsible citizenship, by providing students with the conceptual, critical, and epistemic tools to effectively select, evaluate, integrate and make sense of different sources of information. From a didactic perspective, this goal can be pursued by updating the school curriculum (Martini, 2019) to meet the educational challenge of the 21st century: training students to be virtuous epistemic agents by fostering their epistemic cognition, i.e., the ability to produce, evaluate, justify and use knowledge in formal and informal contexts (Greene, Sandoval, & Bråten, 2016; Greene, & Yu, 2016). The questions addressed in this article are: Q1) What does it mean in practice to be a virtuous epistemic agent (VEA)? Q2) How can the school educate students to be virtuous epistemic agents?

In the following section, the construct of VEA is conceptually clarified by integrating the virtue epistemology perspective with proposals from scholars interested in the contribution of philosophy to educational research on epistemic cognition.

2. TOWARDS A DEFINITION OF A VIRTUOUS EPISTEMIC AGENT

Virtue epistemology is a collection of theories that share two commitments: First, epistemology is a normative discipline. Second, intellectual agents and communities are the primary focus of epistemic evaluation insofar as they embody and express intellectual virtues and vices (Turri, Alfano, & Greco, 2021). This particular approach within the field of epistemology has developed since the 1980s in the wake of established virtue ethics (Hursthouse & Pettigrove, 2018). The latter, which can be traced back to Aristotle and other ancient Greek and Roman thinkers, shifts the focus from general questions about what is good or bad, right or wrong, to more specific questions concerning individual behavior, such as “what am I supposed to do to be an ethical person?”. The same holds for virtue epistemology, whose purpose is no longer to reflect on knowledge from a “point of view from nowhere” (Pigliucci, 2020), but rather to focus on how the epistemic/intellectual virtues of individuals and communities (epistemic agents) affect their epistemic actions. In broad terms, intellectual virtues are understood as characteristics that promote intellectual flourishing, or which make for an excellent cognizer. Going into detail, virtue epistemologists are divided into reliabilists and responsibilists, depending on their views on the nature of epistemic virtues. Both refer to the Aristotelian conception of virtues, but they value different aspects of it, as the synoptical table below shows.

Table 1.
“Reliabilist” perspective and “responsibilist” perspective on epistemic virtues.

	Reliabilist perspective	Responsibilist perspective
Types of Epistemic Virtues	acute perception, introspection, sound reasoning, reliable memory, etc.	open-mindedness, accuracy, curiosity, objectivity, intellectual courage, intellectual perseverance, intellectual humility, intellectual responsibility, intellectual autonomy, etc.
Features of Epistemic Virtues	natural, hard-wired	acquirable through education
	reliably truth-conducive	not straightforwardly truth-conducive
	morally neutral	morally valuable
	passive (virtues, as natural faculties, are independent of any intentional action performed by the epistemic subject)	intentional, active (the subject is responsible for his/her epistemic actions)

Virtue reliabilists (e.g., Sosa, 2007) advocate a conception of intellectual virtues as innate reliable faculties – i.e., acute perception, introspection, sound reasoning, reliable memory – that enables us to form true beliefs. Insofar as these types of faculty-virtues are part of the individual’s natural endowment, for whose functioning he/she is not directly responsible, they are morally neutral, passive qualities.

Virtue responsibilists (e.g., Zagzebski, 1997), on the contrary, draw on Aristotle’s model of ethical virtues and maintain that intellectual virtues are excellent character traits such as, by way of example, open-mindedness, objectivity, intellectual perseverance, intellectual autonomy, intellectual humility, intellectual responsibility. These traits are not hard-wired but need to be acquired through education.

However, this distinction is criticized by some scholars (e.g., Baehr, 2006) as insensitive to the fact that different types of knowledge require the exercise of different epistemic virtues. As Jason Baehr (2006) points out, if by knowledge we mean ordinary and mundane truths, then it may be enough that our cognitive faculties are in good working order to reach them. Not so if we are interested in other valuable domains of human knowledge. For instance, acquiring disciplinary knowledge also requires us to exercise many intellectual character virtues supporting our cognitive faculties, such as intellectual carefulness, thoroughness, accuracy, intellectual honesty, and so on.

As is easy to see, this approach may offer interesting insights for educational research and thus deserves future study. However, for the sake of this article, I simply highlight another issue closely related to the debate on the two types of virtues, namely, how the intellectual character virtues can account for “higher degree” epistemic achievements such as wisdom and understanding (Greco, 2002). The topicality of considering other epistemic goals in addition to knowledge (e.g., Kvanvig, 2003) has also been brought to attention by some scholars interested in the implications of epistemic cognition for education.

According to Chinn and Rinehart (2016), educational researchers present too narrow a view of epistemology, neglecting the variety of epistemic aims and products focused by modern epistemological traditions, including arguments, theories, explanations, wisdom, understanding, and evidence. To fill this gap, Chinn and colleagues developed the AIR model of Epistemic Cognition (Chinn, Buckland, & Samarapungavan, 2011; Chinn & Rinehart, 2016) based on three components – Aims and values, epistemic Ideals, Reliable epistemic processes – whose relevance is warranted by philosophical scholarship and endorsed by other educational researchers (e.g., Duschl, 2008; Sandoval, 2016).

In this framework, intellectual virtues (virtues) are conceived as habits of mind (Chinn & Rinehart, 2016, p. 463), i.e., “learned, stable disposition” (Chinn et al., 2011, p. 156), that may foster (undermine) the achievement of valuable epistemic goals. This way of understanding epistemic virtues is of particular interest to the present contribution. Indeed, the concept of *habit*, introduced by Aristotle and made central by Dewey, has been extensively explored in the educational literature, which can therefore provide us with useful insights into how intellectual virtues can be acquired. However, before addressing Q2 I attempt to sketch out an initial response to Q1:

A VEA is an individual who exercises epistemic virtues and strives to avoid epistemic vices. By virtues (vices) we mean those habits of mind that promote (undermine) the achievement of valuable epistemic goals.

This provisional and partly tautological definition is clarified in the next section while trying to answer Q2.

3. TEACHING EPISTEMIC VIRTUES ACROSS THE CURRICULUM

Before explaining the learning of epistemic virtues in terms of acquiring mental habits, it is necessary to briefly clarify our position concerning reliabilists and responsibilists. Drawing from both perspectives, I label as epistemic virtues both character traits and cognitive faculties when employed to achieve worthy epistemic goals. Although perception, memory, reasoning ability, etc., are part of our natural endowment, their intentional use to perform goal-directed actions is our responsibility and can be improved through education. With this in mind, virtue lies not in the possession of an excellent cognitive faculty, but in the excellent epistemic use of this faculty. Since, as Dewey (1933)

argues, “education is concerned with the proper direction of natural powers” (p. 29), I claim that even reliabilist virtues – as intended above – can be conceived of as mental habits, that is, as collateral learnings (Dewey, 1953, p. 49) affecting the way we tend to think and cope with a variety of situations.

The principle of habit so understood obviously goes deeper than the ordinary conception of a habit as a more or less fixed way of doing things, although it includes the latter as one of its special cases. It covers the formation of attitudes, attitudes that are emotional and intellectual; it covers our basic sensitivities and ways of meeting and responding to all the conditions which we meet in living (Dewey, 1953, p. 27).

Insofar as we agree that one of the main office of education is to supply conditions that make for the cultivation of these enduring attitudes (Baldacci, 2012), curriculum updating should not be reduced to a mere quantitative increase in the knowledge to be taught. On the contrary, this revision should address, on a qualitative level, how the selected disciplinary content is didactically transposed (Schubauer-Leoni, 2008; Martini, 2018). To explain what I mean, I introduce the distinction between first- and second-level curriculum proposed by Baldacci (2006), which is related to Bateson’s (2000) hierarchical theory of learning.

According to Bateson (2000), learning is a complex process articulated on several levels; it follows that talking about it in generic terms is always a source of misunderstanding. Similarly, Baldacci acknowledges some conceptual confusion when discussing the construct of curriculum without being aware of the different logical levels of its objectives. In this regard, he argues that the curriculum structure can be organized on two levels, which correspond to the first two distinct logical types of learning identified by Bateson.

The first-level curriculum aims to promote proto-learning, i.e., the acquisition of disciplinary knowledge and skills. On the other hand, the second-level curriculum is concerned with deutero-learning, that is the development of habits of thought and actions, personal attitudes and interests, *formae mentis*, and particular ways of seeing and thinking, including those of disciplinary experts. Proto-learning is direct, explicit, and gives results in the short-to-medium term. Deutero-learning, on the other hand, is collateral as it only takes place in parallel and in connection with proto-learning, mostly implicit, and gives results in the medium-to-long term.

In light of this distinction, I argue that developing students’ epistemic virtues is a second-level curricular goal, involving long-term complex learning that can only occur collaterally to individual proto-learnings necessary to achieve worthy epistemic goals. Therefore, cultivating the *habitus* (e.g., Bourdieu, 1977; Baldacci, 2012) of the virtuous epistemic agent involves acquiring a set of knowledge, skills, and stable epistemic dispositions – epistemic virtues – to properly use and apply this knowledge and skills in a variety of contexts where epistemic goals are at stake.

From the perspective of educational practice, this higher-order learning requires students to undergo extensive cross-cutting training. This means that all school disciplines, or at least many of them, should provide students with meaningful learning activities that prompt them both to exercise epistemic virtues, while avoiding epistemic vices, and to reflect explicitly on what behaviors, depending on the circumstances, are to be held epistemically responsible.

In this regard, I intend to formulate some procedural principles, conceived as pragmatic patterns of behavior (Stenhouse, 1977), to help teachers design epistemic-oriented instructional activities. These activities must be varied and redundant to enable students to develop collateral learning in the form of habits of thought and action related to a variety of settings or typical situations. In other words, procedural principles are meant to suggest teaching situations eliciting the exercise of certain epistemic virtues. Thus, virtues are not taught in the abstract but are acquired in relation to types of contexts that encourage behaviors exemplifying them. This also allows teachers to draw students' attention to the context-sensitivity of epistemic virtues and to help them discriminate under what circumstances a given behavior may count as virtuous or vicious (Chinn et al. 2011, pp. 156-157). The principles are constructed in three steps, which are described in the next section.

4. DEFINING SOME INSTRUCTIONAL PROCEDURAL PRINCIPLES FOR DESIGNING EPISTEMIC-ORIENTED ACTIVITIES

Assuming that a VEA holds specific knowledge, skills, and stable epistemic dispositions, the *first step* toward constructing procedural principles was to interpret such knowledge and skills as occurrences of abstract epistemological categories that pinpoint the *structural epistemic components* of the VEA habitus.

These categories were selected based on a review of the philosophical and educational literature (e.g., Goldman, 1999; Chinn & Rinehart, 2016; Kelly, 2008; Sandoval, 2005) and match the components of Chinn's model of Epistemic Cognition: epistemic goals directed at epistemic products, reliable epistemic practices, epistemic standards/criteria. This allowed me to take a step toward operationalizing the construct of VEA, by replacing the provisional definition proposed in Section 2 with the following:

A VEA is an individual who is both capable – has necessary knowledge and skills or can acquire them – and disposed – expresses commitment to epistemic virtues – to pursue valued epistemic goals by engaging in reliable epistemic practices, and to use sound epistemic standards to evaluate epistemic products and practices as well as to justify these evaluations.

However, since these categories are very broad and independent of a specific knowledge domain, they fail to provide precise guidance to teachers, most of whom are not accustomed to fostering students' epistemic cognition during the didactic transposition of their disciplines. Therefore, I sharpened these general categories by identifying, for each of them, *operationalized subcategories* in the form of epistemically virtuous behaviors to be related to the procedural principles aimed at their development (*second step*). My working hypothesis is that by equipping teachers with cross-cutting procedural principles to adapt to their disciplines, they will be more likely to design epistemically oriented activities that encourage students to perform behaviors to be regarded as indicative of the VEA habitus.

The operationalization of the identified epistemological categories was carried out by exploiting the literature on epistemology (including social epistemology and virtue epistemology), education, and epistemic cognition, and by analyzing the set of media and information competencies outlined by UNESCO (Grizzle et al., 2021). The following are some instances of operationalized subcategories.

Concerning *epistemic goals directed at epistemic products*, some examples are provided by the following intellectually virtuous behaviors: seeking objective knowledge, understanding the ethical issues surrounding the access and use of information, creating meaning from information, gathering reliable information, collecting sound evidence, forming true belief within a discipline, constructing good explanations, providing sound epistemic justification of a knowledge claim and so on.

Under the category of *reliable epistemic practices* (e.g., Kelly, 2008; Sandoval, 2016; Chinn & Rinehart, 2016; Tombolato, 2020) fall the variety of practices, including all forms of reasoning – inductive, deductive, abductive, analogical, probabilistic, counterfactual, by falsification, etc. – that enable us to achieve worthy epistemic goals with the help of, or in the face of, others. These practices relate to how knowledge is acquired, constructed, validated, verified, evaluated, justified, communicated, and used effectively to solve problems and make decisions within an epistemic community. Epistemic practices encompass both the expert practices shared by the members of the scientific communities – disciplinary epistemic practices – and the practices that people ordinarily engage in to acquire, disseminate and communicate information.

Finally, *epistemic standards* cover the specific criteria used to evaluate and justify products and practices. They are, for instance, criteria for checking the soundness of an argument, identifying trustworthy sources of information, separating evidence from opinions, checking the adequacy of an epistemic representation, evaluating the credibility of an expert’s opinion, identifying biased procedures and reasoning, distinguishing good from bad explanations, distinguishing fruitful analogies from false or misleading ones, searching and verifying online information and so on.

Once the subcategories were identified and operationalized in the form of epistemic virtuous behaviors, the *third step* was to construct some procedural principles that can guide teachers’ professional actions. As Table 2 shows, each operationalized subcategory can correspond to numerous procedural principles, which translate these subcategories into actions that the teacher must perform to promote in learners those behaviors considered indicative of the VEA habitus (knowledge, skills, and epistemic dispositions).

Table 2.

Some examples of procedural principles referred to each general epistemological category characterizing the habitus of the virtuous epistemic agent.

<i>General epistemological categories</i>	<i>Operationalized subcategories (Epistemically virtuous behaviors)</i>	<i>Procedural Principles</i>
<i>Epistemic goals directed at epistemic products</i>	<i>Providing sound epistemic justification of a knowledge claim</i>	<i>Learners are more likely to develop the habitus of the virtuous epistemic agent if they are engaged in activities a) that require them to consistently justify their knowledge claims; b) that allow them to recognize if others’ knowledge claims are justified or not c) that allow them to distinguish epistemic from non-epistemic (e.g., pragmatic) justifications; d) that allow them to become acquainted with different types of epistemic justifications, both reliable and unreliable and so on.</i>

	<i>Forming true belief within a discipline</i>	<i>Learners are more likely to develop the habitus of the virtuous epistemic agent if they are engaged in activities a) that allow them to distinguish beliefs formed through reliable disciplinary practices from naïve beliefs; b) that prompt them to prove the truth of a knowledge claim within a discipline by referring to disciplinary modes of inquiry and knowledge-finding tools; c) that elicit them to reflect on how each discipline constructs, critiques, revises knowledge and proves the truth of its statements; d) that allow them to compare different disciplinary conception of what counts as evidence/proof, etc.</i>
	<i>Constructing good explanations</i>	<i>Learners are more likely to develop the habitus of the virtuous epistemic agent if they are engaged in activities a) that allow them to distinguish an explanation from a description within distinct disciplines; b) that require them to provide disciplinary explanations about a fact, a phenomenon, a mathematical formula; c) that expose them to different types of explanations (e.g., nomological-deductive, inductive-probabilistic, simulation-based) in relation to different disciplines and so on.</i>
<i>Epistemic practices</i>	<i>Constructing disciplinary forms of knowledge</i>	<i>Learners are more likely to develop the habitus of the virtuous epistemic agent if they are engaged in activities that allow them a) to become acquainted with disciplinary rules and constraints that bound scientific community members when constructing knowledge; b) to compare different forms of reasoning in relation to the achievement of disciplinary epistemic goals; c) to choose which epistemic practices (formal, empirical, experimental, etc.) are to be employed to address a given disciplinary or interdisciplinary problem and so on.</i>
	<i>Surfing the net to get reliable information</i>	<i>Learners are more likely to develop the habitus of the virtuous epistemic agent if they are engaged in activities that allow them a) to compare trustworthy websites with misleading ones, identifying some distinguishing features; b) to recognize when an authentic material is used in the wrong context; c) to compare articles providing facts from various viewpoints with biased articles; d) to try to create historical, scientific, etc. fake news to better understand how to debunk them; e) to check whether the article cites substantial and relevant evidence to support what is claimed and so on.</i>
	<i>Justifying knowledge, epistemic practices, forms of reasoning</i>	<i>Learners are more likely to develop the habitus of the virtuous epistemic agent if they are engaged in activities that allow them a) to become acquainted with how experts evaluate and justify the practices enacted to construct knowledge in their domain of expertise; b) to compare disciplinary and forms of reasoning and so on.</i>

<i>Epistemic standards</i>	<i>Distinguishing good from bad explanations</i>	<i>Learners are more likely to develop the habitus of the virtuous epistemic agent if they are engaged in activities that elicit them to compare good and bad explanations based on the following criteria: fit the facts to be explained, be falsifiable, not conflict with other facts, rely on valid inferences, avoid inferring causal relations from statistical correlations, distinguish relevant from irrelevant variables/facts, allow for new predictions (at least in some disciplines) and so on.</i>
	<i>Checking the soundness of epistemic justification</i>	<i>Learners are more likely to develop the habitus of the virtuous epistemic agent if they are engaged in activities that require them to evaluate a justification based on good epistemic criteria such as: coming from expert testimony, logical consistency (no contradiction), soundness of evidence, coherence with previous data (no counterevidence) and so on.</i>
	<i>Identifying biased procedures and reasoning</i>	<i>Learners are more likely to develop the habitus of the virtuous epistemic agent if they are engaged in activities that prompt them a) to evaluate the soundness of an inductive generalization by ascertaining whether there is a sufficient number of cases to draw a conclusion, whether the breadth of the conclusion is supported by the evidence, whether the forecast is expressed in probabilistic terms, etc.; b) to evaluate the reliability of an argument by checking whether it includes logical fallacies, whether its premises are tendentious or self-contradictory, whether it contains semantic ambiguities and so on.</i>

It is worth noting that epistemological categories and, consequently, procedural principles have been conceptually isolated, but it does not mean that they can be actually isolated. Insofar as they are closely interconnected, almost every teaching activity exemplifies many of them. Indeed, the epistemic goal aimed at an epistemic product presupposes both an epistemic practice of which that product is the result and epistemic criteria on which to rely to evaluate practices and products.

5. FUTURE RESEARCH DIRECTIONS

Within this framework, a future goal of the current research is to formulate additional cross-cutting procedural principles. However, a possible limitation of my working hypothesis concerns the fact that most teachers are not very comfortable with relating their discipline to epistemological issues affecting students' learning. I am not only referring to preschool and primary teachers, but also to many secondary school and university teachers. As a partial remedy to this obstacle, discipline-specific procedural principles can be formulated by carrying out a fine-grained operationalization of general epistemological categories. This further research goal requires in-depth theoretical and empirical investigation of the practice of disciplinary experts. Indeed, as some scholars (e.g., Knorr Cetina, 1999; Sandoval, 2016; Schwab, 1968) pointed out, different epistemic communities enact different epistemic practices, have different perspectives on objectivity and use different standards/criteria to justify their discipline knowledge claims, or to establish what counts as evidence. Moreover, pilot experiences will be undertaken in which teachers and

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researchers will co-design instructional activities based on the procedural principles. The goals of this collaboration are a) to enable the teachers involved to understand in practice how to use the principles to transpose their disciplines; b) to provide other teachers with concrete examples of the application of these principles; c) gather feedback on how to further refine these principles to better suit different school levels, and on how to effectively monitor students' learning progress.

Disciplinary procedural principles can facilitate teachers to the extent that they make explicit the syntax of the disciplines, that is, "the variety of modes of inquiry, of patterns of discovery and verification" (Schwab, 1968, p. 301). However, some epistemological awareness on the part of teachers is recommended to ensure that these principles can be used as effective instructional tools to meet the educational needs of 21st century students. This suggests that epistemology should be integrated into teacher professional development programs. However, we need to think carefully about *how to integrate* it so that it can truly influence teachers' instructional practices.

6. CONCLUSION

In this chapter, I have tried to provide an operational solution to the problem of training students to act epistemically responsible within the information ecosystems in which we live. This implies that learners develop the VEA habitus, characterized by praiseworthy dispositions such as epistemic virtues. Since these dispositions are second-level learning, teachers are provided with procedural principles to design instructional activities that enable students to develop epistemic virtues as collateral learning. This approach has a twofold advantage. On the one hand, it allows us to cope with the contextual specificity of epistemic virtues (vices). On the other, the sustained and conscious practice of virtuous behaviors helps students develop stable, long-lasting dispositions to act epistemically responsible when dealing with personal and professional issues and when exercising their citizenship rights.

REFERENCES

- Baehr, J.S. (2006). Character, Reliability and Virtue Epistemology. *The Philosophical Quarterly*, 56(223), 193–212.
- Baldacci, M. (2006). *Ripensare il curricolo: principi educativi e strategie didattiche* [Rethinking the curriculum: educational principles and teaching strategies]. Roma: Carocci.
- Baldacci, M. (2012). *Trattato di pedagogia generale* [Treatise on General Pedagogy]. Roma: Carocci.
- Bateson, G. (2000). *Steps to an ecology of mind*. Chicago: University of Chicago Press.
- Bourdieu, P. (1977). *Outline of a Theory of Practice*. Cambridge: Cambridge university press.
- Chinn, C.A., Buckland, L.A., & Samarapungavan, A.L.A. (2011). Expanding the dimensions of epistemic cognition: Arguments from philosophy and psychology. *Educational psychologist*, 46(3), 141-167.
- Chinn, C.A., & Rinehart, R.W. (2016). Epistemic cognition and philosophy: Developing a new framework for epistemic cognition. In J.A. Greene, W.A. Sandoval & I. Bråten (Eds.), *Handbook of epistemic cognition* (472-490). New York, NY: Routledge.
- Dewey, J. (1933). *How We Think*. Boston, MA: Heath.
- Dewey, J. (1953). *Experience and Education*. New York: Macmillan.
- Duschl, R. (2008). Science education in three-part harmony: Balancing conceptual, epistemic, and social learning goals. *Review of research in education*, 32(1), 268-291.
- Goldman, A. I. (1999). *Knowledge in a social world*. Oxford: Oxford University Press.

- Greco, J. (2002). Virtues in Epistemology. In P.K. Moser (Ed.), *Oxford Handbook of Epistemology* (287–315). New York: Oxford University Press.
- Greene, J.A., & Yu, S.B. (2016). Educating critical thinkers: The role of epistemic cognition. *Policy Insights from the Behavioral and Brain Sciences*, 3(1), 45-53.
- Greene, J.A., Sandoval, W.A., & Bråten, I. (Eds.). (2016). *Handbook of epistemic cognition*. New York, NY: Routledge.
- Grizzle, A., Wilson, C., Tuazon, R., Cheung, C.K., Lau, J., Fischer, R., ... , & Gulston, C. (2021). *Media and information literate citizens: Think critically, click wisely! Media and information literacy curriculum for educators and learners* (2nd ed.). Paris: UNESCO. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000377068>
- Hursthouse, R., & Pettigrove, G. (2018). Virtue Ethics. *The Stanford Encyclopedia of Philosophy* (Winter 2018 Edition). Retrieved August 17, 2022, from <https://plato.stanford.edu/archives/win2018/entries/ethics-virtue/>
- Kahneman, D. (2011). *Thinking, fast and slow*. New York, NY: Farrar, Straus and Giroux.
- Kelly, G.J. (2008). Inquiry, activity, and epistemic practice. In R. Duschl & R. Grandy (Eds.), *Teaching scientific inquiry* (99-117). Rotterdam, Netherlands: Sense.
- Knorr Cetina, K. (1999). *Epistemic cultures: How the sciences make knowledge*. Cambridge, MA: Harvard University Press.
- Kvanvig, J. K., (2003). *The Value of Knowledge and the Pursuit of Understanding*. Cambridge: Cambridge University Press.
- Martini, B. (2018). La dialettica sapere formale/sapere della pratica alla luce della dialettica sapere/sapere da insegnare [The dialectic of formal knowledge/knowledge of practice in light of the dialectic of knowledge/knowledge to be taught]. *MeTis-Mondi educativi. Temi indagini suggestioni*, 8(2), 50-67.
- Martini, B. (2019). Verso un Modello di curricolo Integrato [Toward an Integrated Curriculum Model]. *Pedagogia più Didattica*, 5(2), 1-10.
- McHugh, N.A., & Davidson, L.J. (2020). Epistemic Responsibility and Implicit Bias. In E. Beeghly & A. Madva (Eds.), *An Introduction to Implicit Bias: Knowledge, Justice, and the Social Mind* (174-190). New York, NY: Routledge.
- Nguyen, C.T. (2020). Echo chambers and epistemic bubbles. *Episteme*, 17(2), 141-161.
- Pariser, E. (2011). *The Filter Bubble: What the Internet is Hiding from You*. New York: Penguin Press.
- Piattelli-Palmarini, M. (1994). *Inevitable illusions*. New York: Wiley.
- Pigliucci, M. (2020). How to behave virtuously in an irrational world. *Disputatio. Philosophical Research Bulletin*, 9(13). Retrieved from <https://disputatio.usal.es/vols/vol-9-no-13/pigliucci-irrational/>
- Popper, K. (2014). *Conjectures and refutations: The growth of scientific knowledge*. London: Routledge.
- Sandoval, W.A. (2005). Understanding students' practical epistemologies and their influence on learning through inquiry. *Science education*, 89(4), 634-656.
- Sandoval, W.A. (2016). Disciplinary insights into the study of epistemic cognition. In J.A. Greene, W.A. Sandoval & I. Bråten (Eds.), *Handbook of epistemic cognition* (184-194). New York, NY: Routledge.
- Schubauer Leoni, M.L. (2008). Didactique [Didactics]. In A. van Zanten (Eds.), *Dictionnaire de l'éducation* (129-133). Paris: PUF.
- Schwab, J. J. (1964). Structure of the Disciplines: Meanings and Significances. In C. W. Ford & L. Pugno (Eds.), *The Structure of Knowledge and the Curriculum* (6-30). Chicago: Rand McNally.
- Sloman, S., & Fernbach, P. (2017). *The Knowledge Illusion: Why We Never Think Alone*. New York: Riverhead Books.
- Sosa, E. (2007). *A Virtue Epistemology*. Oxford: Clarendon Press.
- Stenhouse, L. (1975). *An introduction to curriculum research and development*. London: Heinemann.
- Sunstein, C. R. (2009). *Going to extremes: How like minds unite and divide*. Oxford: Oxford University Press.

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- Tombolato, M. (2020). *La conoscenza della conoscenza scientifica. Problemi didattici* [The knowledge of scientific knowledge. Didactic problems]. Milano: FrancoAngeli.
- Turri, J., Alfano, M., & Greco, J. (2021). Virtue Epistemology. *The Stanford Encyclopedia of Philosophy* (Winter 2021 Edition). Retrieved August 17, 2022, from <https://plato.stanford.edu/Archives/win2021/entries/epistemology-virtue/>.
- World Health Organization (WHO). (2022). *Infodemic*. Retrieved October 19, 2022, from https://www.who.int/health-topics/infodemic#tab=tab_1
- Zagzebski, L. (1997). Virtue in Ethics and Epistemology. *American Catholic Philosophical Quarterly*, 71(Supplement), 1–17.

ADDITIONAL READING

- Ausubel, D. (1968). *Educational psychology: A cognitive view*. New York, NY: Holt, Rinehart, & Winston.
- Baldacci, M. (2012). *Curricolo e competenze* [Curriculum and competencies]. Milano: Mondadori.
- Barnes, N., Fives, H., Mabrouk-Hattab, S., & SaizdeLaMora, K. (2020). Teachers' epistemic cognition in situ: Evidence from classroom assessment. *Contemporary Educational Psychology*, 60, 1-20.
- Blanco, F. (2017). Cognitive Bias. In: J. Vonk, T. Shackelford (Eds.) *Encyclopedia of Animal Cognition and Behavior* (1-7). Cham: Springer International Publishing.
- Develay M. (1995) (ed.). *Savoirs scolaires et didactiques des disciplines* [School knowledge and subject didactics]. Paris: ESF.
- Dewey, J. (1922). *Human nature and conduct*. New York: Holt.
- Duschl R.A. (1990). *Restructuring science education. The importance of theories and their development*. New York: Teachers' College Press.
- Elby, A., Macrander, C., & Hammer, D. (2016). Epistemic cognition in science. In J.A Greene, W.A. Sandoval & I. Bråten (eds.), *Handbook of epistemic cognition* (113-127). New York, NY: Routledge.
- Elgin, C.Z. (2013). Epistemic agency. *Theory and research in education*, 11(2), 135-152.
- Kelly G.J., & Licona P. (2018). Epistemic practices and science education. In M. Matthews (Ed.). *History, philosophy and science teaching: New research perspectives* (139–165). Dordrecht: Springer.
- Kitcher, P. (1990). The division of cognitive labor. *The journal of philosophy*, 87(1), 5-22.
- Lee, C.D., Goldman, S.R., Levine, S., & Magliano, J. (2016). Epistemic cognition in literary reasoning. In J.A Greene, W.A. Sandoval & I. Bråten (eds.), *Handbook of epistemic cognition* (165-183). New York, NY: Routledge.
- Martini, B. (2011). *Pedagogia dei saperi* [Pedagogy of knowledge]. Milano: FrancoAngeli.
- Schneuwly B. (2021). 'Didactiques' is not (entirely) 'Didaktik' The origin and atmosphere of a recent academic field. In E. Krogh, A. Qvortrup & S.T Graf (eds.), *Didactic and Curriculum in an Ongoing Dialogue* (164-184). New York: Routledge.
- Steup, M., & Ram, N. (2020). Epistemology. *The Stanford Encyclopedia of Philosophy* (Fall 2020 Edition). Retrieved December 7, 2022, from <https://plato.stanford.edu/archives/fall2020/entries/epistemology/>
- Tyler, R.W. (1949). *Basic Principles of Curriculum and Instruction*. Chicago, IL: The University of Chicago Press.
- VanSledright, B., & Maggioni, L. (2016). Epistemic cognition in history. In J.A Greene, W.A. Sandoval & I. Bråten (eds.), *Handbook of epistemic cognition* (128-146). New York, NY: Routledge.
- Vosoughi, S., Roy, D., & Aral, S. (2018). The Spread of True and False News Online. *Science*, 359(6380), 1146-1151.
- Young, M. (2013). Overcoming the crisis in curriculum theory: a knowledge-based approach. *Journal of Curriculum Studies*, 45(2), 101-118.

KEY TERMS & DEFINITIONS

Information overload: the result of exposing individuals to an amount of information that exceeds their ability to process it, with consequences for attention, comprehension, and decision-making ability.

Cognitive biases: systematic errors in judgment or decision-making that occur predictably under particular circumstances.

School curriculum: a theoretical and methodological device that allows knowledge, practices, and skills to be articulated coherently.

Epistemic bubble: a social epistemic structure in which other relevant voices have been left out, perhaps accidentally. An example is the network of one's Facebook contacts.

Echo chamber: a social epistemic structure from which other relevant voices have been actively excluded and discredited. Members of echo chambers, unlike members of epistemic bubbles, have been brought to systematically distrust all outside sources.

Didactic transposition: the process of transformation and adaptation that scholarly and expert knowledge undergoes to become suitable to be taught and learned. This process involves conscious choices about what to teach, how to teach it, and why to teach it.

Habitus: a set of stable, long-lasting dispositions to think and act in a certain way under certain conditions.

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Chapter # 9

WRITTEN FEEDBACK MESSAGES: CHALLENGES AND POSSIBILITIES TO SUPPORT STUDENTS' LEARNING

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ABSTRACT

This chapter presents two inquiries. The first corresponds to a part of a doctoral research regarding written forms of feedback. The study involves four teachers from three different primary schools in London. The main sources of data comprised teacher's interviews and the excerpts of written comments from their students' books. Analysis suggested that feedback focused on correcting basics errors, seeking further actions on the task at hand and contrasting the work with learning objective and success criteria. These findings encouraged a collaborative research work to undertake a second study by using the same methodological approach in another context, namely, Chile. The participants were 60 primary school teachers enrolled in a professional development programme. They selected pupils' writing assignments to provide written feedback for them. Data show that the teachers faced difficulties at the initial stages as their comments were evaluative, centred on what was missing, with little room for students' self-assessment. The participants greatly improved their elaborated comments by being more descriptive and stressing the task's features. Both studies provide insightful data in terms of the problematic nature of teachers' written feedback that might hinder pupils' possibilities to achieve a broader understanding of quality.

Keywords: quality, written comments, feedback messages.

1. INTRODUCTION

Feedback is recognized as a core issue within formative assessment. This main assumption entails not only the teacher's role in identifying the strengths and weaknesses of their students' work and providing advice for improvement, for it also involves pupils' own understanding of what quality means, which is a crucial aspect of learning (Sadler, 1989, 2007; Black & Wiliam, 1998). Nevertheless, the key point about how the information can be used as feedback seems not be straightforward. Hence, an exploration of the nature and purpose of feedback elucidating its effects on learning, continue to stimulate research and practice (Black & Wiliam, 1998, 2003, 2009, 2012; Black, Harrison, Lee, Marshall, & Wiliam, 2003; Kluger & DeNisi, 1996; Hattie & Timperley, 2007; Brookhart, 2008, 2009; Torrance & Pryor, 2001; Wiliam, 2018).

Sadler (1989) asserts that feedback implies provide information to support pupils in closing the gap between their actual understanding and the learning goal. This, in turn, brings to the fore three main conditions for feedback to occur, as this author states: firstly, it demands externalising aspects of quality out of the teachers' thought and making it accessible to pupils. This might be achieved by using descriptive statements and key exemplars to illustrate aspects of good work, especially when the learning task is in progress. Secondly, it requires expanding students' abilities to make complex and holistic judgements on their task which should be substantiated on intertwined criteria, trying to avoid the practice of sharing a check list that comprises separated fixed components against which their task will be assessed. Thirdly, feedback seeks to strengthening pupils' capacity for self-and- peer assessment by fostering them to make their own choices about the

pertinent strategies to enrich their tasks. Sadler's (2010) subsequent contribution add insights, particularly, into the process of transferring from feedback to self-monitoring as, in his view, students might face some interpretative challenges to understand concepts and criteria and when attempting to incorporate teachers' feedback into their knowledge base. Therefore, it can be invoked as required in future similar learning challenges. Sadler (2010) upholds that quality should be defined as an abstract notion that refers to the degree to which a piece of work as a whole comes to fulfil its intended aim. Following this idea, criteria, then, are conceived as those properties or characteristics that can be used to define and signify quality.

Research has given rise to different interpretations of Sadler work. for instance, Hargreaves (2005) notes an emphasis on performance, with teachers holding the main role in establishing the objectives. Within the same vein, Torrance's (2012) describes Sadler's notion of closing the gap as linear and procedural. In this chapter, a different interpretation of Sadler approach to feedback is adopted. This in line with Marshall (2004) who argues that the assessment activities and feedback within Sadler's proposal were not addressed to fixed goals. In contrast, she contends that there are too many different ways for deciding next steps in learning. In addition, Swaffield (2011) has also offered a different perspective by noting that it is the conditions that helps pupils' performance that are paramount within Sadler's view of formative assessment.

This book chapter examines some developments from two enquiries. The first, corresponding to a doctoral research carried out in England. The second, pertaining to a study undertaken in Chile. Both research endeavors were addressed from the teachers' perspectives trying to elucidate their own views on implementing written feedback, investigating what were the decisions that drove their actions and what they expected from their pupils to do in response to the feedback messages

2. THEORETICAL BACKGROUND

A range of studies explored feedback quality and how its differential properties yield distinctive consequences for teaching and learning.

Kluger & DeNisi's (1996) meta-analysis investigated the effects of feedback interventions on performance. Although their definition of feedback in an educational setting implies that the foremost role of the teacher takes precedent over the role of the students, these authors' review provide insights that revolve around the need to examine the nature of feedback processes. Bearing this in mind, they spotlight three main notions for feedback to be effective. The first, relates to giving pupils prompts regarding the ways they are approaching the task. The second, pertains to providing information about why students' answers are correct. The third, pertains to the link between assessment and the learning process, whereby, feedback would be more useful when the task is ongoing.

Hattie & Timperley (2007) conceptualise feedback by spotlighting its meaning and considering it as involving teachers, pupils, peers, parents, even the resources employed. They proposed a framework to explore how feedback works, which draws on Sadler's (1989) notion of closing the gap. The authors then devised a model of feedback where the crucial questions like *Where am I Going?*, *How am I going?* And *Where to next?*, work in an interrelated manner, and are accomplished at four different levels such as: a) *Task or product*, which stresses providing helpful information for knowing how to complete the work. b) *Processing of the task*, it relates to searching for and the use of strategies and processes implied in doing the task. c) *Self-regulation*, this leads to fostering pupils' self-assessment on their own work which should encourage their willingness to strive

further with the learning task. d) *Self as a person*, this consists of providing comments towards the person followed by very little or minimal information about the task.

Brookhart's (2008) contribution shed light on what would be demanded of teachers in terms of being able to provide feedback that helps pupils to improve. She brings to the fore the need for careful consideration about the content within the feedback messages. She suggests that when devising feedback teachers should make choices about focus, comparison, function, and valence. Each of these authors' notions are summarized below:

In relation to *Focus*, grounded on Hattie & Timperley's (2007) model, the author explains that feedback about the task might contribute to enhancing the specific piece of work produced at that moment, or correcting some misconceptions observed. Feedback about process gives pupils information about how they are approaching the task and about alternative strategies that might help them to improve or used next time, fostering further learning. Feedback on self-regulation could be effective to what extent it develops students' self-efficacy, by prompting them to make connections between their work and their conscious and intentional efforts to develop it. Feedback that addresses the self would not be beneficial because giving personal compliments like 'you are Brilliant!' without any other descriptions about the work being done it does not allow pupils having access to the reasons for good results. Likewise, when the task needs amendments, there is no information within feedback comments that pupils can use to refine their work.

Concerning *comparison*, Brookhart (2008) sustains that good feedback should be criterion-referencing, this means contrasting the quality of a piece of work with a standard. It is expected that it could help the pupils to better identify the next learning goal. On the opposite side, norm-referencing feedback is not recommended, comparing students' performance against other peers' performance gives rise to competitiveness and might encourage them to emulate others' pieces of work without access to understanding.

With regards to *function*, the author advocates for descriptive observations about the features of pupils' work in contrast with judgments that involve grades or evaluative comments. She also makes a note of caution in terms of pupils' interpretations of feedback as, by considering their previous good or bad school experiences, they might think of a judgment even though the teacher had provided a description. This warning resembles the main lessons that were obtained from the research's outcomes conducted by Butler (1988) that has been highlighted within Black & William's (1998) review. They point out that whereby feedback by comments can be very helpful for a student's task performance, when this is accompanied for feedback by grades it gradually makes their effects weaker.

With reference to *valence*, the author asserts the need for being positive within teachers' comments. This means that the descriptions might be directed to indicate the strengths of a piece of work and explaining how they are consistent with the criteria, or they may be oriented to point out what need to be enhanced followed by recommendations on how to do it. By contrast, feedback should not be negative with descriptions of what is wrong without offering suggestions to improve or highlighting in the first place what is missing within pupils' work.

All in all, Brookhart's (2008) view about the content of feedback messages was used as a framework in processing the results of the second study undertaken in Chile.

3. METHODOLOGY

The studies followed a qualitative paradigm (Mason, 2022; Berg & Lune, 2012; Silverman, 2011) seeking consistency with its focus on practices, interpretations and processes being carried out as well as addressing teachers' reflections in these respects. The enquiries sought to have access to the meanings that participants attributed to their

feedback strategies that were applied. These were small- scale studies that addressed how two different groups of participant teachers see themselves dealing with the object of the study (Hammersley & Atkinson, 2007).

3.1. Research Questions

Both studies have a broader scope and perspective, below the research questions that are answered in the context of this report are presented:

- How do teachers interpret feedback from a theoretical and practical standpoint in relation to their teaching and their students' learning?
- What are the teachers' feedback practices and the underlying principles that guide them in the actual conducting of classroom interaction and through pupils written assignments?

The focus within this chapter regards mainly to written forms of feedback.

3.2. Participants

In England, the teachers were selected on the basis of them having declared and being interest in implementing feedback as a strategy for formative assessment. Participants were also chosen taking into consideration different teaching experiences and backgrounds. They pertained to schools with distinctive sociocultural context. In addition to this, it was decided only those teaching Y5 or Y4 classes would be included, because these schools' years may have been less influenced by the external accountability purposes of assessment. Thus, the research involved three year 5 and one year 4 from three different primary schools in London.

For conducting this research, ethical approval was granted by the Social Sciences & Public Policy, Arts & Humanities and Law Research Ethics Subcommittee (SSHL RESC), King's College London. The corresponding approval number is: SSHL/12/13-34, 3 May 2013.

In Chile, 60 primary teachers took part of the initiative. A scholarship was granted for them to attend the two-years teaching professional development programme at the University of Concepción. They were taught, amongst other subjects, on written production assessment within the context of an assessment for learning approach. It would be important to note that since the year 2018 the National Curricula adopted an assessment policy that accentuates its formative purpose (Ministerio de Educación [MINEDUC], 2017). This framed the schools' concerns in terms of modifying not only the regulations but also, and still more important, the tenets that drive their assessment practices. This can help to contextualise the participants' engagement with discussing the rationale introduced by the assessment policy and its implications for their ensuing feedback practices. Throughout the training programme the teachers were involved within an iterative process of reflection that considered the findings from previous research, the analysis of their own examples of feedback messages and the enhancement of these exemplars.

Accordingly, the same tenet drove sampling selection through these studies. It was purposive, within a qualitative stance (Mason, 2002, Cohen, Manion, & Morrison, 2011). It was strategic or theoretical in nature, for it sought to capture diversity in relation to a wider universe, but did not involve pursuing representativeness (Mason, 2002).

For conducting this study, a formal authorization was given by the institutional coordinator of the programme.

3.3. Data Collection and Analysis

Within the study conducted in England a semi-structured format was adopted for carrying out interviews so as to explore the teachers' intentions in the feedback process with reference to pupils' written assignments. Data was gathered while the teachers

reflected upon their own examples of written feedback encompassed within their students' notebooks. To analyse the interview data, 'meaning coding', as suggested by Kvale & Brinkmann (2009) was applied. A number of steps were involved in this, as follows:

- Full transcription of the interview data was carried out.
- Numerous codes were assigned within the first phase.
- Data were constantly compared (Charmaz, 2006). This process was carried out within the transcripts, at different points of the interview and between the four participants teachers. Matrices that contained the codes were created, stemming from this contrasting and comparison process. Through devising these matrices, the researcher captured the similarities and differences as well as grasping in a systematic and consistent way the essence of what the participant were narrating.
- In the earliest stages of analysis the researcher's lens was centred on how the different activities or practices were implemented. Thus, provisional codes were devised. In the later steps of analysis, the material was examined with the aim of understanding the intentions behind the strategies they deployed. Then, a shift in the coding was gradually achieved portraying how specific parts of the activities provided feedback to learners. New codes were devised to capture not just the practices, but also the associated meanings (Charmaz, 2006; Hammersley & Atkinson, 2007; Cohen, et al., 2011; Kvale & Brinkman, 2009).
- To sum up, the codes characterized the main aspects of the written forms of feedback identified by the participant teachers. Then, the codes were expressed in the form of subcodes that portrayed the teachers' experiences. Subsequently different categories arose that pertained to particular aspects (meanings and actions) within each subcode and code (Charmaz, 2006; Kvale & Brinkman, 2009).

Regarding the study undertaken in Chile, the main source of data comprised feedback messages devised by teachers to their students' writing tasks which were allocated within the teachers' portfolio, using pseudonyms, to make them accessible for further discussion.

Data collection and analysis was comprised of several phases: studying theoretical insights and findings stemming from the research conducted in England, revising Brookhart' (2008) framework about the content of feedback messages, using that as categories to examine how teachers 'written comments were composed, which implied elucidating its Components: focus, comparison, function and valence, devising progressively the teachers 'portfolio, formative assessment of written comments by peers, enhancing quality of the written feedback in an iterative process of learning and reflection. Furthermore, it should be noted that some terms were modified in order to clarify its meanings by considering the Chilean context. For instance, instead of *feedback valence* we used *feedback orientation* to express the same meaning. The table 1, below, outlines the pivotal notions used in the analysis:

Table 1.
Analysis of feedback messages, based on Brookhart's (2008) proposal.

Components	Core questions	Determining messages' features
Focus	What did feedback messages refer to?	the task, the process, self-regulation / the person.
Comparison	What was the quality of the student's work compared to?	Criterion-referencing / Norm-referencing
Function	Did the feedback messages involve a task description, evaluative judgments, or grades?	Descriptive / evaluative
Orientation	Did the feedback information follow a positive stand, a negative orientation or did it focus on constructive criticism?	Positive / constructive criticism/ negative

Source: Ministerio de Educación – Universidad de Concepción (2020)

4. RESULTS AND DISCUSSION

4.1. Regarding the Study Conducted in England

The main findings concerning the areas developed by teachers in relation to written forms of feedback revolved around: basics of the writing, feedback related to content, and self-and-peer assessment challenges. In this subsection, a general overview of the coding process is presented (see table 2 below), Then, excerpts from the interviews will be used to exemplify relevant results:

Table 2.
General overview of the coding process.

Codes	Subcode	Categories
I. Basics of the writing	1.Underlining procedures	1.1 Spelling; 1.2 Punctuation 1.3 Grammar; 1.4 Strategy focusing; 1.5 Students self-correction
II. Content	2.Using written comments	2.1 Communicating L.O. met; 2.2 Giving positive information; 2.3 Seeking further action; 2.4 Assessing quality
III. Self-and-peer assessment: challenges	3.Working with learning objective and success criteria	3.1Unpacking the meaning by the student; 3.2 Referring back to individual targets; 3.3 Keeping the learners on track; 3.4 Expressing disbelief about peer marking.

Source: Yáñez- Monje (2017)

4.1.1. The basics of the writing

A common orientation towards correcting basic errors emerged from data, although with distinctive underlying emphasis. For instance, *Teacher 1* came up with a strategy focusing on marking misspelled words that were familiar to the students and those directly linked to the subject matter. This teacher's decision arose because of her being highly concerned with not discouraging students, who were very weak in spelling, by correcting all the mistakes in their work, as she reported:

...we went through a process of how much do you mark? How much do you say is incorrect? If you have a child who is a very weak speller, do you pick up every spelling mistake? Because that can be disruptive, if you have got so much on their work that is wrong, they find that very difficult. So you have to make a decision as to what you are going to mark and what you are going to ignore... (Teacher 1, School 1. Int-1:1).

Teacher 2 did not appear to use a selective strategy; he underlined all spelling and punctuations mistakes that needed to be amended but giving the students the responsibility of checking their own work and making corrections by themselves. In his third interview, this teacher made reference to the way in which he annotated students' pieces of writing.

...so again you see I have underlined that because she's spelt it wrong, what I haven't done is crossed out and written the right word because so what's that going to do? Nothing! Whereas if you have underlined it, that means the children's attention is brought there,

right I have done something wrong here, what is it? And they have to work out what is wrong and that's much more powerful than just saying, "Oh yes, I got that wrong but Teacher has corrected it..." (Teacher 2, School 2. Int-3: 4).

Teacher 3, began by stating that basic errors should not be at the center in marking, but in practice all these technical aspects did appear to take on more importance as she tended to spell out all these sorts of details within the children's work. Whilst *Teacher 4* reported spotlighting some aspects related to grammar, but not stressing what was wrong, and rather pointing out what was right. Hence, the results revealed differing choices made by the participants to deal with this part of the feedback process and their practices remained aligned with the strategies and procedures suggested within the policy documents of each school. Theoretically, the identified tendency towards correcting spelling, grammar and punctuation can be associated with what Marshall (2004) called the *goal model for writing*. She argues that the underlying principle that drives this model is that the skills required to produce good pieces of writing can be practised separately. She adds that identifying errors can make the process more quantifiable, because progression is interpreted retrospectively, thus leading to remedial actions that involve the teacher indicating how to put right what is wrong. However, it is important to mention that the participant teachers did not necessarily endorse the principles of this perspective. They held to different ways for implementing their ideas and applied an underlining procedure driven by different intentions and motives. However, despite these singularities in the teacher's work, the goal model seems to remain present throughout this part of their marking, which resulted in there being limited possibilities for the students' exploration of quality.

4.1.2. Written Comments

Three main dimensions were involved within the feedback messages devised by the participants as part of their written comments: communicating to their students whether they had met the learning objective or the success criteria, giving positive information by recognising students' effort, and providing advice on follow-up action. It could be said that the participants were using the same structure within the drafting of their comments, but the analysis of the content and the purpose of the conveyed messages, from their own perspectives, allow to understand what they believed quality involves in a piece of writing. *Teacher 1* accentuated mainly on the comprehension of the topic and adjusted her prompts to meet the needs of the pupils whom she considered to be low, middle, or high achievers. *Teacher 2* stressed the use of language to clarify meaning. *Teacher 3* placed emphasis on the key elements according to the conventions of a particular genre, as well as aspects of grammar or punctuation, where appropriate. In addition, their comments were posed with reference to a success criteria list. In the following extract she explains her focus on distinctive features consistent with the aim, context, and structure of different kind of texts:

... It was mainly looking at figurative language so most of the criteria had something to do with similes, metaphors, different types of figurative language. But maybe if it was a newspaper report, for example, you may vary the criteria, so that they're not expected to quote from a professional or things like that, that is more about the specific writing skills... (Teacher 3, School 3. Int-3: 5).

Teacher 4 also paid attention to the use of words and structures within specific sorts of texts. Moreover, she stated that written comments should be composed of differentiated questions attuned to children's abilities:

...it is tailored to each child so, for example, this child who I have got the book of in front of me, her work is of a really high standard. So I would use different language with her, more sophisticated language when talking to her and I would ask her completely different questions. While those other children, if they are one of my SEN children, some of my special needs children or just children with a lower ability, I would ask them simpler questions like ... (Teacher 4, School 4. Int-3:6).

These teachers' outlooks on their feedback messages were consistent with what was observed in the excerpts from the students' books. These examples suggest that quality was delineated according to the curriculum content. The judgments were made in terms of the particular words or phrases that characterized the kind of text intended to be produced. The sort of advice was offered as discrete points of information and not in the form of holistic comments. Consequently, it became more difficult to pay attention to the overall purpose of a piece of writing. This notion seemed to pervade the enactment of this feedback strategy by the four participants, but it was still more evident for those teachers whose written comments were linked to a list of specified and pre-established criteria. This has implications in the ways that teachers approach feedback, namely: a) In some cases, the students were able to follow the teachers' guidance and corrected isolated features of their work but remains unclear whether they could understand the reasons underpinning the teachers' advice. b) The messages focused on the particulars were tied to what the teachers asked the students to do in the follow up action or what they needed to do next. However, this last part of the message seemed to be overwhelmed by the emphasis on what was still missing, rather than telling the students how to make quality-based improvements in the current piece of work.

4.1.3. Can Students Recognise Quality in a Piece of Writing?

The results suggest that although written forms of feedback were highly structured in terms of making learning objectives and success criteria transparent, the teachers developed the view that pupils' engagement with these seem to have been problematic at the time that the study was undertaken. *Teacher 1* reported that the students had not yet grasped the intended goal that underpin specific tasks, thereby, they might not be able to analyse quality in their pieces of writing or on their peers' work.

...And unfortunately our children, because this is a fairly new process for us, our children are not yet trained. When you say to them, mark your own work ...you do need to train children in both, self-assessment and peer-assessment... (Teacher 1, School 1. Int-1:3).

Teachers 3 and 4, in a similar vein, both claimed that children were not skilled enough to recognise what quality meant and thus, be able to communicate its aspects to others. They also shared the opinion that this was particularly hard for those who were low achievers.

...especially for some children who might not have good reading skills, it would be really difficult for them to try to even read another child's work... So, although they can easily say something they do like and something they don't like, it's coming up with something to say like you

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could do this and so that is what I think they found most difficult. So, we decided to stop that. (Teacher 4, School 4. Int-3:6).

By contrast, *teacher 2* indicated that he had developed a strategy of using the learning objective flexibly. He had built up an idea of his students playing an active role in interpreting not only the criteria but also the comments given. Nevertheless, there was not further evidence from the data about how this method was unfolded or whether it thrived.

... but actually if you have got a group of kids that are able like these kids, I really need to think well they are all capable of unpicking what it is they done well and what it is they need to improve... (Teacher 3, School 3. Int-1: 6).

In sum, it seems that the teachers had very diverse theories of the pupils' abilities and how much they could do in response to their feedback. It could be said that, unlike Steve, some participants perceived that there were some types of students, at particular points, that were not able to undertake peer marking. This issue may be related to the teachers' philosophy in education from a widespread perspective, but it was an underlying belief that came up when they reflected on the enactment of their marking procedures.

All in all, the overarching lessons learnt from this study shaped our decisions for conducting another research initiative in Chile. It became transparent that there is a need for addressing in depth the teachers' work and reflection about the content of the written comments. This matters a great deal.

4.2. Concerning the Study Undertaken in Chile

Hereafter, the main changes produced over time within the drafting of the written comments are exposed. These covered the following dimensions:

4.2.1. Feedback Focus

Teachers evolved from providing undetermined information about the task at hand, '*Good Work!*', towards a more precise focus by explaining the specific characteristics of the piece of writing that define quality, some examples would be: '*You have chosen a pertinent dialogue to show the conflict between these two characters*' (Manuel's portfolio) or, '*The writing reflects the macrostructure of a new and it clearly refers to a real fact*' (María's portfolio). These excerpts mainly highlights the strengths of the work done.

The focus of feedback becomes increasingly more open from just rephrasing the students' answers into more appropriate forms, namely, from correcting the work for the pupil, to asking questions fostering children to think further on what would have been the strategy used to produce their writing, such as: '*Could you explain how do you came up with this idea to make your argument so convincing*' (Lucía's portfolio). This suggestion may foster the pupil to reflect further about his learning process during the engagement with the task.

4.2.2. Feedback Function

The intended purpose of the written comments given to the students' tasks was modified progressively from being normative and evaluative '*This is the best essay I've ever seen!*', to making reference to those criteria already discussed with the children by using descriptive judgments, such as: '*This work achieved both: the structure and the communicative intention are consistent with a letter to the editor*' (Juan Pablo's portfolio) or, '*There are coherence and cohesion amongst paragraphs, this allow that the theme remains clear throughout the text*' (Celeste's portfolio).

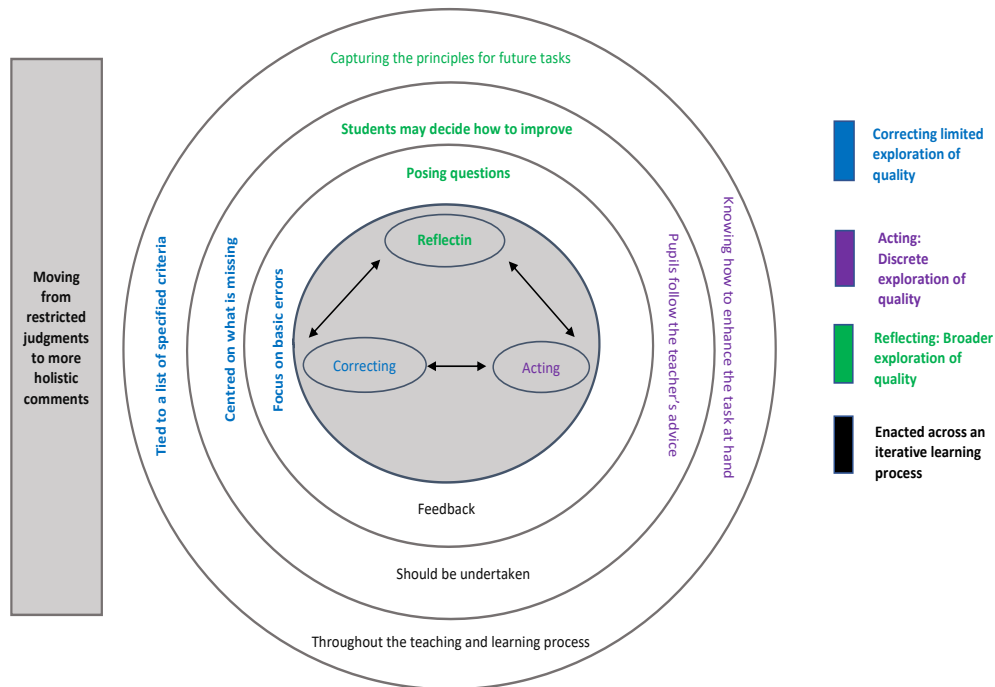
4.2.3. Feedback Orientation

The drafting of comments also changed from exerting a negative orientation by only pointing out what is wrong or missing ‘*You need to include this time connective!*’ Towards a more descriptive comments on what has been done well or suggesting on how to improve. For instance: ‘*The details you have provided, clearly support your opinion*’ (Juan’s portfolio).

Generally, it could be said that participants were on the road of improving their feedback practices. Having stated that, it is important to note that the 60 teachers that took part of this initiative progressed in very different ways and levels. Particularly, what still needed to be accomplished, across participants experiences, is how feedback suggestions can foster students’ self-regulation and autonomy. Within this perspective the nature of the written comments devised by the participant teachers reveals a strain in terms of how they promote the core aim of formative action.

All in all, referring back to both studies, it could be surmised that, despite the nuances and contextual issues some commonalities could be identified. The feedback messages fostered students correcting their work, acting on the teacher’s advice, reflecting on a broader sense capturing the concepts and principles they should use in future similar tasks. Although, this last purpose was observed only in a few cases. The Figure 1 illustrates the distinctive scopes that can emerge from feedback messages, according to the data examined. The figure 1 also reflects the implications for the components of the feedback messages and for students’ exploration of quality.

Figure 1.
Purpose and Scope of the feedback messages as part of the written comments.



5. FUTURE RESEARCH DIRECTIONS

Both studies might involve an insightful perspective for future extended research on formative assessment. This means that, by using similar methodological approaches it could be possible to achieve a broader understanding of how other teachers working in very different contexts may hold diverse views about the enactment of written form of feedback. Thus, upcoming contributions would involve further opportunities for teachers to reflect on their own positions and to what extent they influence their practices.

6. CONCLUSION

Despite the singularities on the ways that participating teachers enacted feedback practices from both studies the complex nature of the devised written comments was noted. This, regarding the extent to which they support pupils in the improvement of their pieces of work. Focusing on what elements were present or absent within the learning task, then giving advice so that the students might recall what to include next time has resemblance with a convergent view of assessment. (Torrance & Pryor, 2001).

The teachers expected pupils responded to their feedback. Thus, they asked further action. The character of these requirements or recommendations reflected the scope and the possibilities for students understanding of what count as good work. The data evoked testing and remediation which in turn meant restricted or limited exploration of quality by the students.

The notion that remained stable across the participants from both inquiries is that there is a need for expanding the students' opportunities to grasp a sense of quality. Nevertheless, in the actual drafting of written comments this purpose seemed to be entangled within other pedagogical priorities.

REFERENCES

- Berg, B. L., & Lune, H. (2012). *Qualitative Research Methods for the Social Sciences*. California: Pearson College Division.
- Black, P., & Wiliam, D. (1998). Assessment and Classroom Learning. *Assessment in Education. Principles, Policy & Practice*, 5 (1), 7-74.
- Black, P., & Wiliam, D. (2003). 'In praise of educational research': Formative assessment. *British Educational Research Journal*, 29 (5), 623-637. <https://doi.org/10.1080/0141192032000133721>
- Black, P., & Wiliam, D. (2009). Developing the theory of formative assessment. *Educational Assessment Evaluation and Accountability*, 21(1), 5–31. <https://doi.org/10.1007/s11092-008-9068-5>
- Black, P., Harrison, C., Lee, C., Marshall, B., & Wiliam, D. (2003). *Assessment for Learning: Putting it into Practice*. Maidenhead, England: Open University Press.
- Black, P., & Wiliam, D. (2012). Developing a Theory of Formative Assessment. In J. Gardner (Ed.), *Assessment and Learning* (pp. 206-229). California, CA: SAGE Publications.
- Brookhart, S. M. (2008). *How to Give Effective Feedback to Your Students*. USA: Association for Supervision and Curriculum Development (ASCD).
- Brookhart, S. M. (2009). *Exploring Formative Assessment*. USA: Association for Supervision and Curriculum Development (ASCD).
- Butler, R. (1988). Enhancing and undermining intrinsic motivation: the effects of task- involving and ego-involving evaluation on interest, and performance. *British Journal of Educational Psychology*, 58(1), 1 -14. <https://doi.org/10.1111/j.2044-8279.1988.tb00874.x>
- Cohen, L., Manion, L., & Morrison, K. R. (2011). *Research Methods in Education* (7th ed.). London, England: Routledge.

- Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. London, England: Sage Publications Ltd.
- Hammersley, M., & Atkinson, P. (2007). *Ethnography*. London: Taylor & Francis Group.
- Hattie, J., & Timperley, H. (2007). The Power of Feedback. *Review of Educational Research*, 77 (1), 81-112. <https://doi.org/10.3102/003465430298487>
- Hargreaves, E. (2005). Assessment for learning? Thinking outside the (black) box. *Cambridge Journal of Education*, 35 (2), 213-224. <https://doi.org/10.1080/03057640500146880>
- Kluger, A. N., & DeNisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis, and preliminary feedback intervention theory. *Psychological Bulletin*, 119 (2), 254-284. <https://doi.org/10.1037/0033-2909.119.2.254>
- Kvale, S., & Brinkmann, S. (2009). *InterViews: Learning the craft of qualitative research interviewing* (2nd ed.). California, CA: SAGE Publications.
- Marshall, B. (2004). Goals or horizons – the conundrum of progression in English: Or a possible way of understanding formative assessment in English. *The Curriculum Journal*, 15 (2), 101-113. <https://doi.org/10.1080/0958517042000226784>
- Mason, J. (2002). *Qualitative Researching* (2nd ed.). London: SAGE Publications.
- Ministerio de Educación – Universidad de Concepción. (2020). *Informe Final de Desarrollo Profesional Docente* [Final Report on Teacher Professional Development]. Concepción: Author.
- Ministerio de Educación. (2017). *Evaluación formativa en el aula. Orientaciones para docentes* [Formative assessment inside the classroom. Guidance for teachers]. Santiago, Chile: Author. <https://bibliotecadigital.mineduc.cl/handle/20.500.12365/17448>
- Sadler, D. R. (1989). Formative Assessment and the Design of Instructional Systems. *Instructional Science*, 18(2), 119–144. <https://doi.org/10.1007/bf00117714>
- Sadler, D. R. (2007). Perils in the meticulous specification of goals and assessment criteria. *Assessment in education: Principles, Policy & Practice*, 14 (3), 387-392. <https://doi.org/10.1080/09695940701592097>
- Sadler, D. R. (2010). Beyond feedback: developing student capability in complex appraisal. *Assessment & Evaluation in Higher Education*, 35 (5), 535-550. <https://doi.org/10.1080/02602930903541015>
- Silverman, D. (2011). *Interpreting Qualitative Data* (4th ed.). London: SAGE Publications Ltd.
- Swaffield, S. (2011). Getting to the heart of authentic Assessment for Learning. *Assessment in Education: Principles, Policy & Practice*, 18 (4), 433-449. <https://doi.org/10.1080/0969594x.2011.582838>
- Torrance, H., & Pryor, J. (2001). Developing Formative Assessment in the Classroom: Using action research to explore and modify theory. *British Educational Research Journal*, 27 (5), 615-631. <https://doi.org/10.1080/01411920120095780>
- Torrance, H. (2012). Formative assessment at the crossroads: conformance, deformative and transformative assessment. *Oxford Review of Education*, 38 (3), 323-342. <https://doi.org/10.1080/03054985.2012.689693>
- Wiliam, D. (2018). Feedback: At the Heart of – But Definitely Not All of – Formative Assessment. In A. A. Lipnevich & J. K. Smith (Eds.), *The Cambridge Handbook of Instructional Feedback* (pp. 3-28). Cambridge, England: Cambridge University Press. doi:10.1017/9781316832134.003
- Yáñez-Monje, V. (2017). Exploring Teachers' Interpretations of Feedback: Case Studies in Primary Classroom Settings (Doctoral's thesis, King's College London, England). Retrieved from [https://kclpure.kcl.ac.uk/portal/en/persons/veronica-yanezmonje\(9432e582-108b-489e-9db7-9aec91dd227d\).html](https://kclpure.kcl.ac.uk/portal/en/persons/veronica-yanezmonje(9432e582-108b-489e-9db7-9aec91dd227d).html)

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Chapter #10

COLLABORATIVE LEARNING ENVIRONMENTS

Learning with Tiny Articles as a participatory learning network

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ABSTRACT

Over the past years, the nature of teaching has fundamentally changed. The learning process is challenged by a more uncertain and complex world. First grade students face a difficult starting point. Confidence in one's own learning process, between learners and teachers, and the strengthening of one's own peer group need to be intensively promoted. In order to develop critical thinking as individuals in a heterogeneous community and to make fears and uncertainties accessible to a scientific discourse, a new teaching concept for bachelor students in Human Sciences was designed. To encourage collaboration and interdisciplinary thinking, a novel format of simplified peer-reviewed publications was developed, called Tiny Articles. Inspired from the research cycle, we implemented different phases of critical thinking, reflections and writing episodes. This created eventually a virtual "common brain". This accumulation of knowledge, ideas, and reflections was shared with lecturers and opened up discussions about learning difficulties or problems. Learning with Tiny Articles is presented as a successful way of networked learning and working in mixed teams.

Keywords: tiny articles, collaborative learning, common brain, shared reflections, learning dynamics, practical inquiry model.

1. INTRODUCTION

In winter semester 2021/2022, we started the new (or revised) study programs Bachelor of Arts Education, Bachelor of Science Psychology and Bachelor of Science Sport Science. During the conception phase, the department took new paths of cooperation by basing the curriculum of all three study programs on common interdisciplinary modules, which were profiled from a human sciences perspective. Thematic reference points are the human being as subject and object of human scientific research and the strengthening of the acting actors within scientific work and research.

The basic module "Learning and Working Strategies" for first grade students is accompanied by tutorial teaching in order to intensively support the transition and to create the prerequisites for independent study. Already experienced students, who are especially qualified and accompanied, establish a link between the beginning of studies and the subject discipline. Fears and uncertainties could also be addressed at eye level in a protected space and worked on in the form of dialogical feedback processes.

The organizational team designed a new module for a heterogeneous learning group that, due to the pandemic, would meet the needs of the students and at the same time provide a space of approaches and assumptions in order to stimulate a discussion. In face of the experience of social distancing, learning became also a retreat into solitude. This development motivated us to develop a concept that focuses on learning in community.

The content of the module focuses on scientific and epistemological principles, learning strategies in the course of studies and basic steps of human science research processes. These can be experienced by means of ongoing research activities at the participating institutes (psychology, sports science, pedagogy). In addition to the acquisition of professional competencies, the students' personal development was of particular importance for us. We promoted competencies such as interdisciplinary teamwork, the ability to form critical feedback and the reflection of knowledge potentials.

The module consists of two course formats and provides blended learning spaces in which teachers and students can interact dynamically. The impulse lectures are reflected continuously by the students in form of short texts (weekly Tiny Articles) with a predefined formatter (see chapter 3 Methods). These initial (pre-)scientific reflections are shared with other peers in a protected setting in the weekly tutorials. Here the Tiny Articles were read and feedback was provided by other students to create a peer-review process. With this approach, core elements of the scientific publication process based on established research methods were learned and practiced in an educational setting.

The use of digital media in a simulated open access process creates a dialogue-oriented participatory learning space whose core intention is a “review for research” rather than a “review of research” (Reimann, Sippel, & Spannagel, 2010, p. 224) in order to provide intensive learning opportunities. The recurrent writing and revision processes culminate in the search and justification process of a subjectively significant research question. This is always reflected, especially in the impulses of the lecture, with the meta-perspective on science, its potentials and also ethical limits. Following Huber (2004), this emphasizes the importance of cognitive, emotional, and social experience for the principle of inquiry learning. This comprises the initial interest, the questions and structuring tasks of the beginning, through the ups and downs of the process, feelings of happiness and uncertainty, to the insight or problem solution that is (co-)found by oneself (Huber, 2004, p. 33). We follow this teaching approach in our work by integrating the different perspectives of the learning process into the design of our course.

2. BACKGROUND

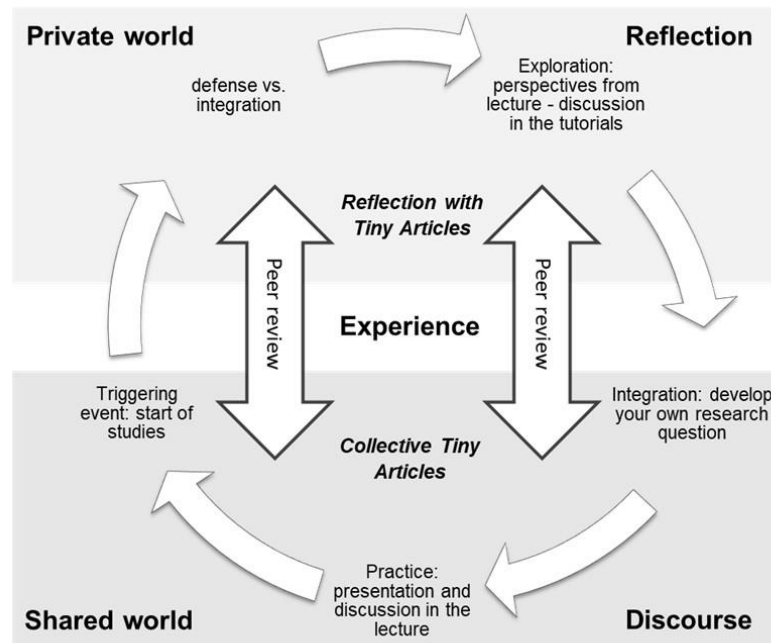
The Practical Inquiry Model by Garrison, Anderson, and Archer (2001), based upon the work of John Dewey, frames critical thinking as an autonomous, but collaborative, constructivist learning and problem-solving process in which the individual acquires knowledge or generates new knowledge together with the community (Jahn, 2019, p. 35). Their process model of a digital educational experience has been an inspiration for our learning concept with Tiny Articles.

In the Practical Inquiry Model, the scholarly research process occurs in four phases that alternate between the two spheres: a private and a shared world (Garrison et al., 2001, p. 9). The private world is accessible only to the learner. The shared world becomes a place of encounter and exchange. Following Jahn (2019, p. 35) we assume that profound experiences need both places to set cognitive processes in motion. The private world, with the help of recurring written reflections, provides a shared framework for recording one's own ideas, impulses, questions, and irritations and making them accessible to the other peers shared world. These first (pre-)scientific texts were the content reference point for the tutorial and were mutually reflected and commented on there with the help of practicing a scientific peer review process. The feedback generated there formed the basis for the revision and finalization of the weekly Tiny Articles in the private world. Gradually, collaboratively written Tiny Articles emerged, which were taken up and discussed in the lecture and thus

became part of the shared world. The approach deliberately accepts that initial reflections can be found in pre-scientific formats, and explicitly does not exclude oneself as a participant. Inspired by the phases of the Practical Inquiry Model (Swan, Garrison, & Richardson, 2009, pp. 46-47), the following stages can be identified in the concept of learning with Tiny Articles (Figure 1). Thus, at the beginning, the thesis was that the start of studies must be understood as a triggering irritation, which can show itself quite differently for individual students. With the help of the Tiny Articles, we were able to offer them a medium to make their irritation and questions of the divided world tutorial accessible after a phase between defense and integration. The progressive impulses of the lecture were able to stimulate the exploration phase in the model, in which the questions and feedback of fellow students in the tutorial played a crucial role. In the integration phase, students finally succeeded in formulating their own human science research question of personal interest to them. In the Tiny Articles exam, they finally described a rudimentary human science approach to answering their research question with reference to scientific publications. This was presented to the teachers and learners in the last phase in the lecture and could thus be transferred to the shared world.

Through this cyclical progression, students successively learned a process of reflective thinking by formulating their epistemological interests and subjecting them to scientific scrutiny. The individual stages in the thinking process could always be accompanied by Tiny Articles. Even beyond the events, students have now internalized a cycle of thinking and reflecting that can accompany them throughout their studies.

Figure 1.
A theoretical framework for Learning with Tiny Articles based on the Practical Inquiry Model (Garrison et al., 2001, p. 9).



3. LEARNING WITH TINY ARTICLES

For designing the virtual learning space, special attention was paid to balance between factual orientation (e.g., specialist knowledge, learning strategies), transferable skills (e.g., interdisciplinary teamwork, ethical thinking, scientific language skills) and individual aspects (e.g., own reflections). By involving student tutors as peers, both in tutorials and lectures, special attention was paid to aspects of social interaction. The organization team strived for an open-minded and approachable attitude. The lecture was conducted as a lecture series with varying presenters every week. Thematically, the focus was set by weekly key questions, which were addressed by guest speakers with different scientific backgrounds. The design of the lecture was to present a variety of learning and research methods. With this, the students experienced innovative presentation formats in addition to conventional teaching and learning methods. For example, panel discussions, interviews, storytelling or tandem talks were offered, in which guests contributed impulse presentations with complementary individual approaches.

After each lecture the students were invited to write short texts with their thoughts, intentions, challenges and questions. These texts are called Tiny Articles. A novel format of simplified scientific publications (e.g., a journal paper) was created. This idea was inspired by the mobile app Blinkist (Blinks Labs GmbH, 2023), which provides short summaries of key messages of books in a series of so-called blinks with 2-3 minutes reading time each. In each blink one key message is presented in a short text. We adapted the concept of a blink to a Tiny Article by limiting the length of the short text to up to 1000 characters, which corresponds to about 60-90 seconds reading time. Additionally, the Tiny Article was complemented by a title (with max. 100 characters), an optional figure (e.g., an image or a graph) and up to 5 citations (of other Tiny Articles, lectures or scientific publications).

The content of the Tiny Article was very individual. The following questions (among others) could be addressed: Which key messages can be noted for future academic activities? What was new or interesting? Which associations were observed? Which questions remained open?

The weekly Tiny Articles were published in a public whiteboard which could be read by all students and the presenters of the lectures. The use of digital collaborative writing tools (e.g., Padlet and Etherpad) has proven to be helpful to ensure transparency and participation. Questions of data protection, data security and the preservation of personal rights when using web-based tools were critically reflected. Students did not need to register or login to access padlet. Each student was creating a short name (with four letters) as an identifier of the person. The name of the real person presented by the short name was only known within the tutorial group of students and tutors.

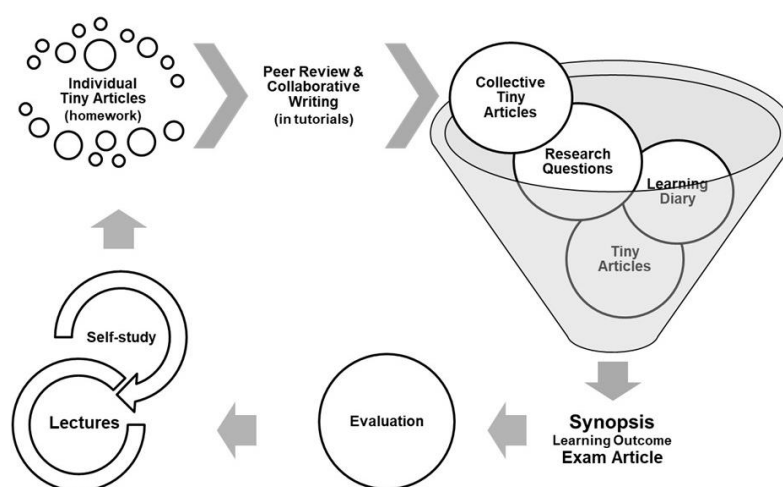
Students were divided into eight tutorial groups to discuss individual weekly Tiny Articles in a protected setting with their peers. In the upcoming tutorial the students were then asked to read and comment on selected Tiny Article of their peers. In this process, attention was paid to an open feedback culture as well as compliance with communication rules in the digital space following the concept of non-violent communication (Rosenberg & Chopra, 2015).

Based on the comments provided by the peers, the students were invited to revise their Tiny Article. Additionally, in each tutorial an Essence Tiny Article was created based on the most interesting insights of the individual weekly Tiny Articles. At the beginning of the next lecture, selected Essence Tiny Articles were presented to all students and made available to the speakers of the lecture as a learning result. This recurring writing and reflecting exercise promote the motivation for independent and cooperative reflection. At the same time,

an inclusive attitude towards heterogeneous and interdisciplinary teams should be stimulated by further developing the written Tiny Articles in an interdisciplinary and collaborative manner in the tutorial sessions.

At the end of the teaching program students were asked to write an additional Exam Tiny Article on a self-selected scientific question. They were asked to present their Exam Tiny Article in the final lecture in breakout sessions with 6-8 students. Based on the feedback they received after their presentation, all students were allowed to revise and submit the final Exam Tiny Article within two weeks.

Figure 2.
Flowchart describing the teaching concept "Learning with Tiny Articles".



4. FUTURE RESEARCH DIRECTIONS

For the future development of the teaching course "Learning and Working Strategies" we would like to focus more on the individual developmental process of the students and also document it retrospectively. We plan to further develop the peer review process in the tutorial, in which the students in small groups deal more intensively with selected Tiny Articles in the character of a collegial case processing. The typical roles in a scientific peer-review process of authors, editors, and reviewers can be alternated. A possible theoretical framework for a guided simulated writing conference in the tutorial is offered by the structural model of the topic-centered interaction. In addition to the Exam Tiny Article, it is further planned to submit a portfolio at the end of the semester that documents the developmental stages and can also serve as inspiration for the students in the further course of their studies.

Another aim is to ask the students to take responsibility for further developing and fine-tuning the process of learning with Tiny Articles. They can suggest new rules which are again communicated in the format of Tiny Articles to all tutorial leads. If the proposal is approved to fit the overall concept of the lecture, the students of the tutorial can vote and select and try out new rules. In order to make learning more effective a development of objective measures of learning outcomes is planned.

Learning and working with Tiny Articles is used in other courses in the Institute of Sport Science at Technical University Darmstadt. For instance, students in the biomechanics seminar are creating wiki modules about advanced research topics in the field. With the help of Tiny Article, they present the concept of the envisioned wiki module to students of the biomechanics lecture. These students are the potential future readers of the teaching wikis. By providing feedback on the Tiny Articles (in reflection Tiny Articles), the students of the seminar can fine-tune the design of their wiki projects to meet the needs and interests of students in the lecture. This is an example how Tiny Articles can be used to connect learning processes between different courses running in parallel at the university.

Currently, we started to transfer the concept of Tiny Articles in the design of scientific and cross-professional meetings like the Movement Academy at TU Darmstadt (<https://padlet.com/aseyfarth/MovA22>). All participants of the meeting (academic and non-academic professionals, patients, students, PhD researchers) are asked to write Tiny Articles on their reflections during the meeting. Again, the Tiny Articles are peer-reviewed by other attendees of the meeting and a revised version will then be published as a “micro-publication”. Publications with Tiny Articles are easy to use by a broader public compared to scientific publications which are much more challenging to create and to read.

5. CONCLUSION/DISCUSSION

The described concept of learning with Tiny Articles enables a protected environment for developing individual reflections and for collaborative learning. The result is a learner-centered learning space that practices scientific work in a new publishing way. The use of digital tools has a bridging function by enabling time- and location-independent and secure networking. By creating and sharing Tiny Articles about academic lectures, a collection of main ideas of all – called the common brain – is generated. This collection can be structured, annotated, modified, reviewed and discussed. Using interactive tools like digital pinboards or etherpads, students step out of their role as recipients and create their own learning materials. They can search for further information, modify it, and thus co-construct knowledge. By presenting opinions and attitudes in social software, the subjective perspective of learners is becoming more important (Jadin, 2007). Learning with Tiny Articles can thus lead to confrontation with different perspectives and viewpoints.

Comparable to connectivism-based learning systems (Siemens, 2005), an open and needs-based learning environment is created that allows interaction with learners and teachers. The joint construction of knowledge and ideas enables the discussion of opportunities for networked thinking, learning and working processes in diverse teams. With this, a conscious learning experience can be created and students were able to develop a creative and cooperative learning process based on Tiny Article and a structures review and communication process which was organized in the tutorials (peer-review) and lectures (presentation of Essence Tiny Article).

The teaching evaluation of the lecture shows that 81.3% of the students actively participated in over 80% of the sessions (feedback from n=75 students) and indicates the following insights:

- The collaboratively developed through digitally available Tiny Articles specifically encouraged independent and cooperative learning, reading, reflection and problem solving as well as oral and written exchange about forms of scientific communication.
- The technical requirements for this teaching concept are low and the potential for transferability to other courses is high.

- The goals of the introductory phase, to inform, motivate and prepare for research-oriented studies, could be achieved through a high and almost constant participation of the students in lectures and tutorials and a high willingness to write the Tiny Articles.
- Although the courses are demanding, the respondents did not state that they were overwhelmed and the majority stated that the course had stimulated their interest and that they were encouraged to work on their own/to think for themselves.
- The digital communication and cooperation options, the support and supportive feedback offers as well as the consideration of previous knowledge were rated as very good by the majority.
- It was emphasized that through the creation of and the exchange about the Tiny Articles, the content and topics were dealt with continuously and not selectively (in the examination phase), as was previously the case.
- The conception based on Tiny Articles contributes to the students' constant examination of scientific topics and to an independent, collaborative and result-oriented learning process.
- The opportunity for teachers to view and perceive results, learning progress and learning difficulties via the Tiny Articles during the semester enables student-oriented teaching and testing.

The use of Tiny Article was a new experience for both students and lecturers likewise. At the beginning a key challenge for many students was to know how to write concisely in scientific language. After writing a series of weekly Tiny Article they became more and more comfortable and trustful in their learning experience. By writing weekly Tiny Articles the students learned to formulate their reflections and insights as well as to share and complement their understandings in a virtual common brain contributing to a growing mindset of all participants (Hochanadel & Finamore, 2015). This collection of knowledge, ideas and reflections were also shared with the presenters of the lectures and opened up possibilities for networked learning and working in mixed teams.

In summary, Tiny Articles are an efficient and easy-to-use-tool that promote engagement and collaborative learning. By creating a common brain with rich interactions and an open access library with a review process, learning across disciplines and within society becomes more dynamic and different perspectives and upcoming ideas can be reflected.

REFERENCES

- Blinks Labs GmbH. (2023). *Blinkist* (Version 8.3.0) [Mobile app]. Apple Store. <https://apps.apple.com/de/app/blinkist-gro%C3%9Fe-ideen-in-15min/id568839295>
- Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical Thinking, cognitive presence, and computer conferencing in distance education. *American Journal of Distance Education, 15*(1), 7-23. <https://doi.org/10.1080/08923640109527071>
- Hochanadel, A., & Finamore, D. (2015). Fixed and growth mindset in education and how grit helps students persist in the face of adversity. *Journal of International Education Research, 11*(1), 47–50. <https://doi.org/10.19030/jier.v11i1.9099>
- Huber, L. (2004). Forschendes Lernen. 10 Thesen zum Verhältnis von Forschung und Lehre aus der Perspektive des Studiums [Research-based learning. 10 Theses on the Relationship between Research and Teaching from the Perspective of Studying]. *Die Hochschule: Journal für Wissenschaft und Bildung, 13*(2), 29-49). <https://doi.org/10.25656/01:16475>

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- Jadin, T. (2007). Social Software für kollaboratives Lernen [Social software for collaborative learning]. In B. Batinic, A. Koller & H. Sikora (Eds.), *E-Learning, digitale Medien und lebenslanges Lernen* [E-learning, digital media and lifelong learning] (pp. 23-35). Linz: Trauner Verlag.
- Jahn, D. (2019). Zur Förderung kritischen Denkens: Synthese der Ergebnisse einer Metastudie mit den Einsichten aus einem handlungstheoretischen Prozessmodell [To promote critical thinking: synthesizing the results of a meta-study with insights from an action theory process model]. *Die Hochschullehre*, 5, 905-930.
- Reimann, G., Sippel, S., & Spannagel, C. (2010). Peer Review für Forschen und Lernen. Funktionen, Formen, Entwicklungschancen und die Rolle der digitalen Medien [Peer review for research and learning. Functions, forms, opportunities for development, and the role of digital media]. In S. Mandel, M. Rutishauser & E. S. Schiedt (Eds.), *Digitale Medien für Lehre und Forschung. Medien in der Wissenschaft* [Digital media for teaching and research. Media in science] (pp. 218-229). New York; Munich; Berlin: Waxmann.
- Rosenberg, M. B., & Chopra, D. (2015). *Nonviolent Communication: A Language of Life*. Encinitas, CA: PuddleDancer Press.
- Siemens, G. (2005). Connectivism: A Learning Theory for the Digital Age. *International Journal of Instructional Technology and Distance Learning*, 2 (1), 3-10.
- Swan, K., Garrison, D. R., & Richardson, J. C. (2009). A Constructivist Approach to Online Learning: The Community of Inquiry Framework. In C. R. Payne (Ed.), *Information Technology and Constructivism in Higher Education: Progressive Learning Frameworks* (pp. 43-57). Vermont, USA: IGI Global.

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Chapter #11

DEVELOPING UNIVERSAL DESIGN FOR LEARNING WITHIN HIGHER AND FURTHER EDUCATION: THE BENEFITS OF EDUCATOR PEER TRIADS

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ABSTRACT

Universal Design for Learning (UDL) consists of a set of principles for curriculum development that aims to afford diverse learners equal opportunities to learn by providing more flexible and thus inclusive methods of teaching, learning and assessment. This paper is focused on the present authors' collective learnings as a 'triad', a peer learning group of university educators participating in the Digital Badge for Universal Design in Teaching and Learning, accredited by Ireland's National Forum for the Enhancement of Teaching and Learning. We place particular emphasis upon our triad's (peer learning group) experiences implementing a UDL re-design of teaching and assessment as part of the Digital Badge. Our reflective analysis explores in detail how each lecturer's teaching, learning and assessment practices evolved as a function of systematically incorporating various key practical elements of the UDL approach. Particular emphasis is placed upon describing how this UDL-based peer learning triad encouraged us as lecturers to adopt a more collaborative approach both with each other and with students.

Keywords: Universal Design for Learning (UDL), Equality Diversity and Inclusion (EDI), higher education, triads, peer learning, lifelong learning.

1. INTRODUCTION

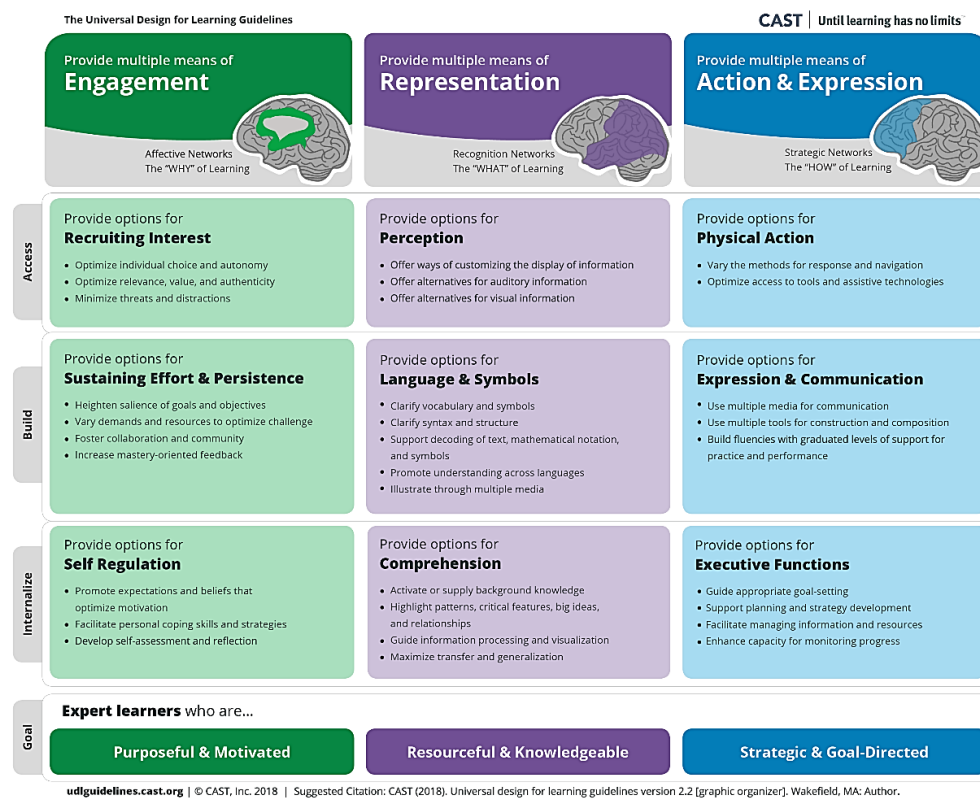
Providing an inclusive learning environment is inherently complex. Creating a culture of engagement and inclusion that works for all learners without accidentally marginalizing some in the process requires a systematic shift in thinking and practice, away from a 'one size fits all approach.' Universal Design for Learning (UDL) is a learner-centred framework that emphasises accessibility, collaboration, and community. This framework embraces diversity of motivations and learning preferences with practical guiding principles for curriculum development and delivery. UDL seeks to reduce learning barriers and seamlessly provide appropriate supports, thus enabling educators to develop courses where all students have an equal opportunity to learn, while also maintaining expectations of quality (Rogers-Shaw, Carr-Chellman, & Choi, 2018). There are three core UDL domains:

- **multiple means of engagement** in learning concerns the affective domain and suggests that there are a variety of methods to engage and motivate learners;
- **multiple means of representation** in learning concerns with how information is presented to learners, recognising that there is not one optimal means of representation;
- **multiple means of action and expression** in learning concerns the multiple potential means by which learners can demonstrate that they have learned.

(CAST, 2018)

In the increasingly diverse and evolving Further and Higher Education landscape, UDL provides an effective framework to improve the learning experience of all learners. To inform Irish educators about UDL, a training programme called the Digital Badge for Universal Design in Teaching and Learning was developed by the Association for Higher Education Access and Disability (AHEAD) in collaboration with University College Dublin’s department of Access & Lifelong Learning. This digital badge is accredited by Ireland’s National Forum for the Enhancement of Teaching and Learning (opencourses.ie, 2022). The stated goal of the Digital Badge is to provide existing third level educators with a solid introduction to the Universal Design for Learning Framework by supporting them to implement UDL principles within the participants’ current teaching activities (AHEAD, 2022). The programme requires approximately 25 hours’ work over 10 weeks, primarily structured around educator triads (peer learning groups) and the redesign of an activity in line with UDL principles.

Figure 1
The Universal Design for Learning Guidelines (CAST, 2018).



One of the most unique and fundamental components of the National Forum’s approach to peer learning as part of their Open Course digital badges is the utilisation of the ‘triad’ peer learning group. The triad aims to facilitate regular interactions and discussions among small groups of third level educators, ostensibly for the purpose of peer support and evaluation. Upon embarking on the digital badge, each participant is assigned to a group of

peers, a triad. This triad remains a fixed element throughout the process, and at the end of the course the triad members are tasked with formally verifying each other's engagement with the process.

Key elements of a triad include:

- the necessity of voluntarily participating in a process that is not associated with external performance management.
- the important learning that the observer is experiencing when they review the UDL implementation of their peers.
- the importance of routinely conducting the peer review process as a triad team that can act as not just participants but also both supportive peers and expert observers.

(Bolt & Atkinson, 2010, p.89)

Although triads are traditionally formed with three members, the current study incorporated a triad with five members. Numerous studies (Adams & Counard, 2004; Rajaguru, Narendran, & Rajesh, 2020; Schippers, 2014) have shown that "social loafing," or the tendency for individuals in a group to lose enthusiasm and effort as the number of members increases, can occur. Nonetheless, in the present case the extra members allowed the 'triad' to explore the opinions of a larger variety of people while also allowing for "nurturing valuable reciprocal learning and potentially transformative collaborative reflection." (National Forum, 2020). Without exception the present authors found that the triad format was incredibly useful for providing both moral support and constructive feedback as key benefits of this shared experience.

2. BACKGROUND

Technological University Dublin (TU Dublin) is a newly amalgamated university that is formally committed to building a culture of equality, inclusion, and respect for all. UDL is central to its aim of building a diverse learning community that is underpinned by the United Nations' Sustainability Development Goals (SDGs). This commitment is wide ranging with an inclusive approach not just to education, but also to the provision of accessible student services, online resources, and physical infrastructure. TU Dublin's Transform EDU project, sponsored by the Higher Education Authority, is strongly invested in implementing Universal Design within the University. Part of the remit of this project is concerned with learning resources and staff competencies in UDL (Transform EDU, 2021). TU Dublin has also embedded UDL in its Quality Framework, through School and Programme review processes (TU Dublin 2021a; TU Dublin, 2021b). The (Irish) Centre for Excellence in Universal Design (CEUD), and the (Irish) National Disability Authority (NDA), have both commended how TU Dublin has placed UDL at the heart of its quality assurance processes (CEUD, 2020) which mandate schools to be accountable for EDI performance and require schools to resource UDL practice appropriately.

Against this backdrop, the present authors engaged with the UDL Digital Badge as a self-selecting cohort that were already accustomed to engaging with continuing professional development that often included UDL principles incidentally. In committing to completing the UDL Digital Badge, we all shared a similar rationale for taking part, "I hope to discover new approaches to accessibility and inclusion in teaching and learning." Prior to engaging with this specific UDL badge each of us expressed a view that we already engaged with UDL processes in our existing practice on an informal and often unsystematic basis. As such, we felt that the UDL Digital Badge was a timely opportunity to enhance our teaching and the

assessment of student learning with UDL. This is notwithstanding Solano's (2020, p.7) observation that when dealing with transformative change many respondents typically answer with "We do that!" even though that may not be entirely the case. It may thus be the case that the UDL Digital is particularly beneficial to individuals, such as in the present case, who were already accustomed to self-reflection due to extensive prior engagement with complementary and related forms of continuous professional development. We have each been involved in teaching in higher education from between five to twenty years. Four of us are involved in the delivery of a Creative Digital Media undergraduate degree at TU Dublin, while the fifth of us teaches Psychology across undergraduate degrees in Social Care Work, Community Development and Youth Work, and Early Childhood Education and Care.

In principle, a key strength of formally engaging with UDL educator peer learning is that it exposes its participants to a complete and systematic understanding of UDL practice by incorporating its members' complementary perspectives with reflexivity. Brookfield (2017) argues for critical reflection of teaching practices as a method for interrogating assumptions held, checking their validity and accuracy, and reframe these where necessary. Given this, all participants felt that the Digital Badge provided an important opportunity to enhance their practice. The following three case studies present the key reflections of five triad peer group members about the evolving processes and outcomes of the learning re-design activity at the heart of the UDL Digital Badge.

3. CASE STUDIES

3.1. Case Study 1: Providing Multiple Means of Engagement

3.1.1. Approach

Creating high quality instructional materials and authentic assessments is important for learner success; though it is only meaningful if the learner is engaging with those materials. There are significant differences in how learners can be motivated to learn, and there is not one means of engagement that will be optimal for all learners in all contexts (CAST, 2018). Thus, the first goal of a UDL approach is to design multiple options for learners to engage: for example, with the content, with the mode of access/delivery, with the teacher, and with their peers.

This case study outlines the redesign of an assessment for "Professional Practice", a third-year module in the Creative Digital Media undergraduate programme. The learning outcomes for this module include requirements to describe and analyse working patterns, career opportunities and trends within the digital media industry, and identify and reflect on their own skills and career aspirations within the sector.

The original assignment brief required students to research and write a report on one of four sectors in the digital media industry. While this brief allowed students a certain limited degree of choice, it was felt that there was considerable potential for improvement regarding scope, personalisation, and metacognitive reflection, with the goal of enhancing students' interest in and personal critical analysis of potential career opportunities. The assignment was therefore reviewed through a UDL lens, with particular attention paid to providing multiple means of engagement (CAST, 2018). As shown in Figure 1, the UDL guidelines for engagement consist of three principles – providing options for recruiting interest, for sustaining effort and persistence, and for self-regulation. Within these guidelines, four checkpoints (CP) were identified as being of specific relevance:

- Optimise individual choice and autonomy (CP 7.1);
- Optimise relevance and authenticity (CP 7.2);
- Heighten salience of goals and objectives (CP 8.1); and
- Develop self-assessment and reflection (CP 9.3).

To optimise individual choice and autonomy (CP 7.1), the first step was to ask the students what interested them. A class survey revealed a wide diversity of professional interests, with 21 different career preferences represented. The assignment was then redesigned to encourage students to research any sector in the digital media industry that interested them (e.g., animation, sound design, branding, game design, AR/VR, or any other sector of their choice).

The redesigned brief also allowed students to submit their report in any appropriately portable format (e.g., written report, video, website, infographic, podcast, etc.). Offering such multiple means not only provided autonomy, it also enhanced the relevance and authenticity of the task (CP 7.2) as the topic could be aligned to individual professional interests. Similarly, students could determine their individual goals and objectives (CP 8.1) by researching a sector relevant to their own career potential. Finally, students were required to evaluate and reflect (CP 9.3) on how their own skills, experience and attributes matched the requirements for a career in their selected industry sector.

3.1.2. Results and Discussion

The outcomes of this UDL initiative were very positive. A post-submission feedback survey indicated that 100% of students welcomed the opportunity to respectively choose the topic and format of their report. Typical comments included:

"This helps me express myself the way I want to, the way that makes it actually fun to do! It's a joy to cover both topics and formats that I enjoy,"

"I personally think the freedom to choose the format and topic gives me more of a drive to deliver my best possible work for this assignment."

As illustrated in Figure 2, there was a wide variety of industry sectors represented in the reports. The choice of topic only partially correlates with the initial stated preferences, with a marked increase in the selection of two topics, UX/UI Design and Social Media Marketing. Students had only recently been introduced to these topics in their modules, and thus the increases probably reflect increased familiarity with those topics.

Figure 3 reveals another surprising result. Despite welcoming the fact that they had choice in assignment format, a majority of students still opted for the customary format of a written essay. Qualitative responses to the survey indicated that students felt time-poor at the end of the semester, and many opted for a familiar format, even though it was not their first preference.

These observations highlight the importance of providing support, guidance, exemplars, and time to practice when offering multiple means of engagement and expression, to allow learners to become confident and fully embrace wider opportunities.

Figure 2.
Career preferences (ranked in order of preference) as stated in three class surveys (n=84)
vs final choice of research topic (n=44).

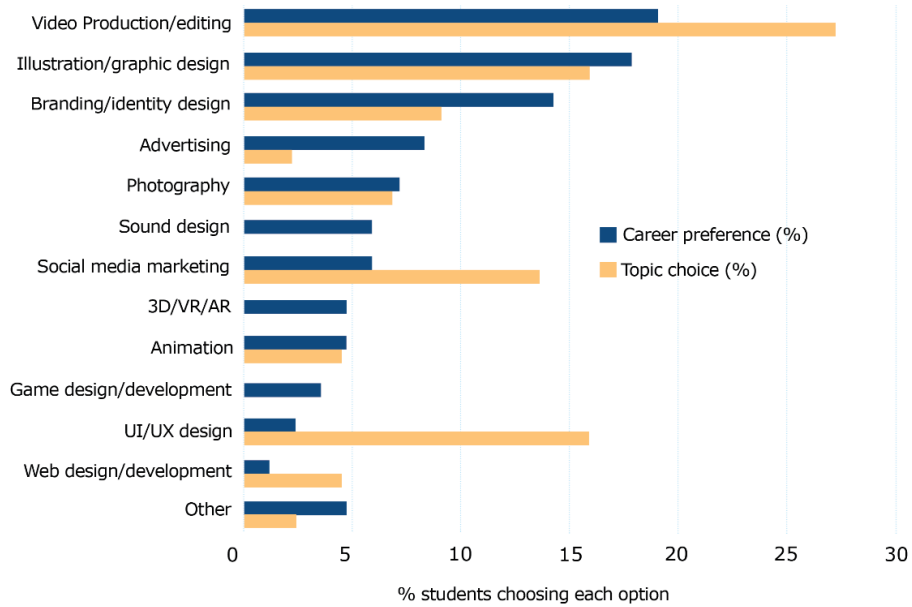
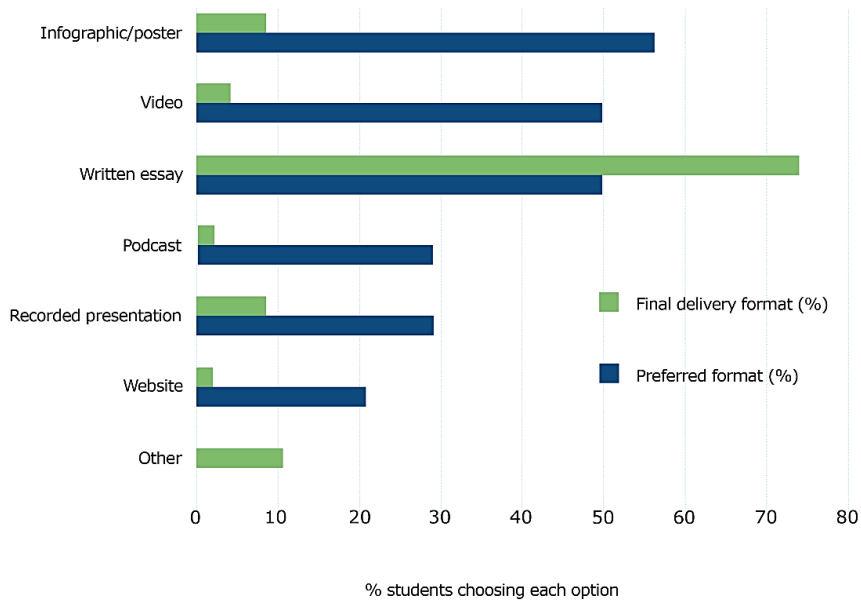


Figure 3.
Choice of delivery format in the redesigned assignment, vs format preferences of students
when they are not constrained by time or skills (n=44).



3.1.3. Impact of Peer Triad

One of the biggest challenges in redesigning an assignment in line with UDL guidelines is how to incorporate the multiple means of engagement and action/expression fairly and transparently, particularly in regard to defining equivalent specifications for different assessment types. Discussion with the peer triad helped to tease out these problems and identify useful tools and resources (e.g. O'Neill, 2011; Nottingham University, n.d.; Rice University Center for Teaching Excellence, n.d.). Similarly, peer discussion helped to unravel the potential reasons behind student choices in different contexts, and to brainstorm ideas for supporting and scaffolding unfamiliar assignments. Being part of a peer group has significant benefits when designing and applying teaching innovations; all members learn synergistically from the group's shared experiences and have greater confidence in applying such lessons to future implementations.

3.2. Case study 2: Providing Multiple Means of Representation

3.2.1. Approach

Sensory disabilities, cultural differences, and learning differences among students all contribute to the need to present information in several different formats. This second case study details a redesign process aimed at increasing means of representation within a first-year module, particularly in relation to guideline 1 of the UDL guidelines; 'Provide options for perception' (see Figure 1).

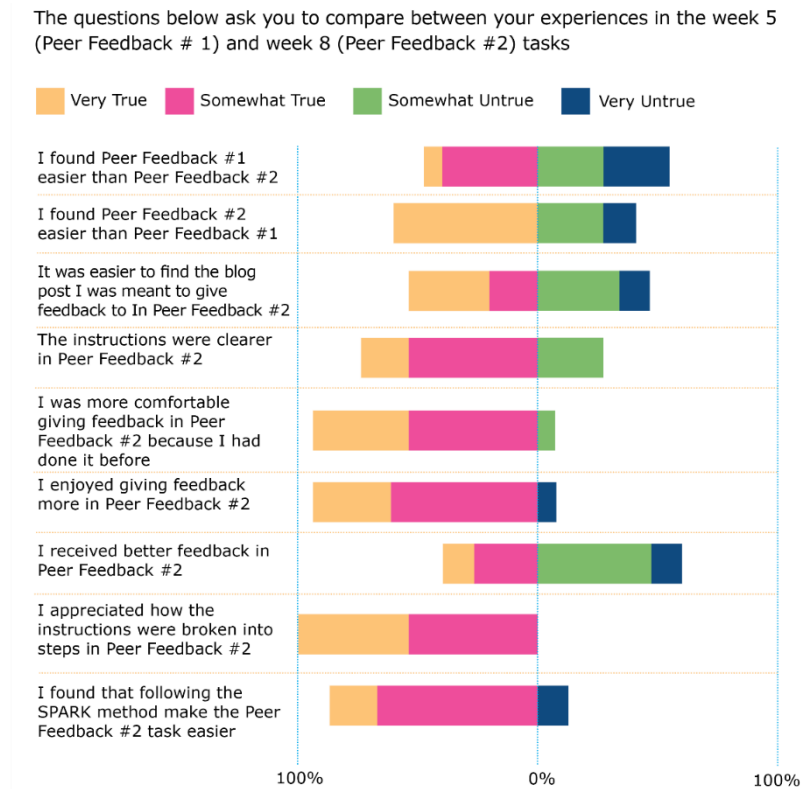
Prior to the redesign activity multiple options for perception were already designed into the relevant module. Class notes and materials were available in a customisable written form, audio versions of written notes were made available, and much of the course material was available in multiple formats. For this redesign activity the instructions that were given to students in relation to peer review were targeted for improvement. This activity provided a good basis for assessing the impact of UDL principles in the short-term as it was an activity that occurred more than once throughout the semester.

Learners participated in a peer feedback activity in week 5 and again in week 8 of the semester. While originally both feedback activities were identical in structure, this redesign reviewed the structure and formatting of the instructions for the second activity with a view to increasing clarity. In accordance with UDL Guideline 1 the following were implemented: break-down of instructions into step-by-step guidelines, increased use of headings and sub-headings, and increased use of font size and colour to communicate information and to separate and differentiate advice from instructions. Overall, the aim of this redesign was to provide a clear visual hierarchy of information which would help learners to navigate and engage more effectively with this activity's instructions.

3.2.2. Results and Discussion

Following completion, a short survey was issued to learners. Most learners (73%) perceived the instructions for the second task as clearer than the first. Indeed, almost all respondents (93%) enjoyed the second feedback task more than the first. However, most of those learners thought this was simply a practice effect, whereby they felt more familiar with the task on the second occasion having practiced it once before. Nonetheless, all respondents indicated that they appreciated the breaking down of instructions into steps, and most (86.7%) indicated that it made the task easier to engage with (see Figure 4).

Figure 4.
Learner responses – comparison of first and second feedback tasks (n=15).



In practical terms, a significant improvement was noted in the learner comprehension and completion of the activity on the second occasion. Following the first completion several learners submitted work that had missed one or more steps in the process as laid out in the task instructions. There was a notably higher level of completion (+10.2%) in the second feedback activity and there were less queries received relating to the second activity, and the tasks were more likely to have been carried out correctly and completely. While several variables, (stage in the semester, prior experience of the task) influenced the learner experience and feedback, this case study provides encouragement that providing additional options for perception increases activity completion and learner satisfaction.

3.2.3. Impact of Peer Triad

The main challenge faced in this redesign activity was in identifying something that could reasonably be adapted within the 10-week timeframe of the UDL Digital Badge. While there was certainly a temptation to redesign the whole module from the ground up this was not practical within the timescale available, nor was it appropriate within the scope of the UDL Digital Badge. Through discussions with the triad, the direction and scope of this redesign was appropriately scaled back and realigned. The peer group provided feedback on the redesign concept, the initial redesign at the pre-implementation stage, and gave input and feedback on the survey used to evaluate the results.

3.3 Case Study 3: Providing Multiple Means of Action and Expression

3.3.1. Approach

Multiple means of action and expression is considered the “How” of Learning. Invisible disabilities and other learning difficulties can have a significant impact on a student's mode of action and knowledge expression (Ross, 2019). Because learners differ, there is no one-size-fits-all approach to expressing themselves that will work for everyone. It is incumbent therefore on the educator to provide multiple means of expressing how they represent their knowledge and skills.

For this third and final case study the UDL principle “Multiple means of action and expression” was applied in the redesign of a final assessment brief for an undergraduate module in visual design that accounted for 40% of the overall grade of the module. There are three areas where multiple means of action and expression can be provided: physical action, expression and communication, and executive functioning (CAST, 2018). The latter two guidelines were implemented into the redesign of the assessment brief.

UDL-enhanced “Expression and Communication” was incorporated into the assessment brief in two ways. The first was by including activities that fostered the use of imagination to solve novel and relevant problems, or to make sense of complex ideas in creative ways that suited their mode of expression. The students were tasked with presenting their own interpretation of the broad problem that required solving. This ensured autonomy and freedom to express how their creativity and problem-solving skills related to their own interpretations of the problem solution. In other words, it promoted solving complex problems in a creative way that suited their mode of expression. The assessment brief was co-designed with the students to promote this autonomy within their own learning.

The second way that UDL-enhanced “Expression and Communication” was incorporated by providing students with options of presenting their knowledge in different formats; from the perspective of assessing knowledge transfer this was considered crucial for the effective evaluation of students who struggle with certain types of communication. Students could choose to present their assessment in a written report or by presenting their final output addressing the outcome and process via a recorded presentation.

3.3.2. Results and Discussion

Post assessment, 52 students completed a feedback survey on the redesign of the assessment brief. 50% strongly agreed, while 24% somewhat agreed they were more engaged with the assignment because of being allowed to choose the scope of their respective projects (see Figure 5). 61% strongly agreed that providing a choice of topics for the assignment gave them more scope for creativity, 54% strongly agreed that choice gave them freedom in a more creative way. As a result of co-designing the assessment brief with the students 51% reported that they had more ownership of their own learning (see Figure 6). 40% of the students indicated that having implicit milestones in the brief worked for them. 46% of students agreed that feedback at certain milestones engaged them to keep on track with their assignment.

Figure 5.
Learner responses – providing choice in assignments and the impact on engagement (n=52).

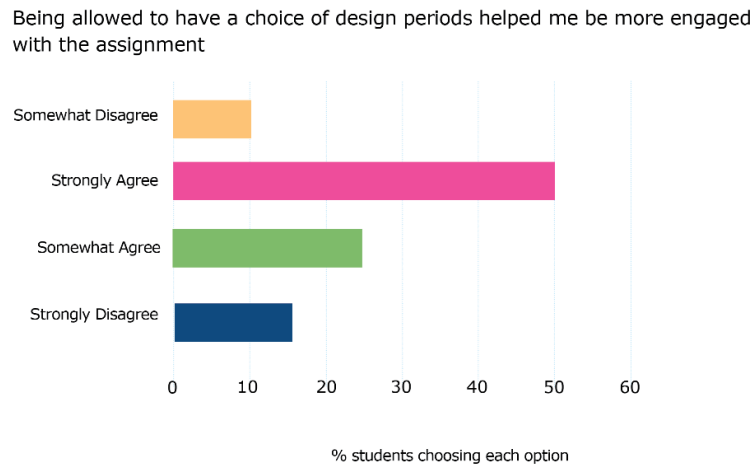
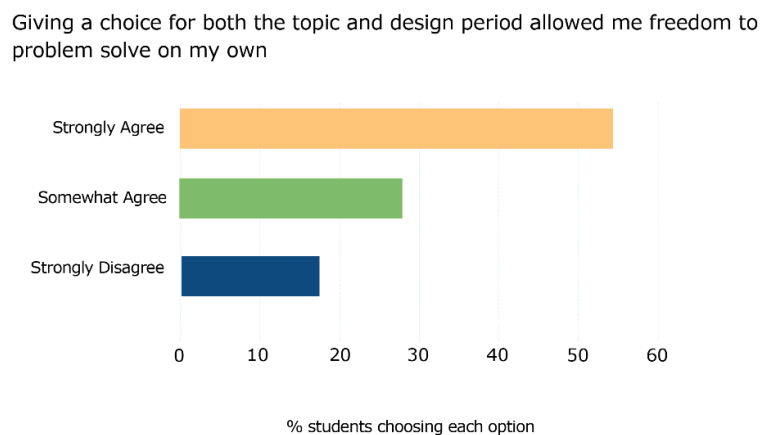


Figure 6.
Learner responses – providing choice and ownership of learning (n=52).



To complement the "Executive Function" guideline of assisting students in becoming expert learners, the assessment brief emphasised planning and building a time management strategy; this was accomplished by offering weekly goals and checklists to keep students on track. To ensure that the students could monitor their progress, feedback milestones were built into the assessment brief, feedback sessions enabled the student to move from various stages of their project. A self-assessment rubric was implemented so that students could grade their own progress giving them a sense of ownership of their own progress. Providing the student with weekly milestones supported and motivated them to regularly engage with their assignments, greatly facilitating incremental feedback and thus learning.

Reflecting on this redesign process, it was encouraging to see the positive learning experience reported by the students. Providing learners with options and flexibility in their

assessment increased engagement (see Figure 5) and gave the students a sense of authentic investment in their own learning. It is evident that implementing even minor changes in line with UDL principles provides a noticeably more inclusive experience for the learner.

3.3.3. Impact of Peer Triad

Working in a Triad was beneficial for so many reasons:

1. **Providing support:** Having a weekly meeting provided us with both academic and emotional support, while also professionally validating each other's work against the UDL Digital Badge's key milestones. Being in a triad group also gave each member a sense of commitment to work together toward our common goal of completing each component of the UDL Digital Badge. This shared purpose, and our groups' existing familiarity with reflective practice fostered a sense of trust within the triad that served as its bedrock.
2. **Sharing of knowledge:** during weekly meetings, each member of the triad had the freedom to adventurously share ideas about UDL in a supportive environment. We all benefitted from the diverse skills and experience that each group member had, it also provided each of us with the opportunity to network with new colleagues from new disciplines.
3. **Openness:** Being able to tease out problems/challenges and ideas in a supportive and trusting environment encouraged all five triad members to non-defensively and indeed collaboratively re-design their respective modules. This collaborative process was a valuable learning experience for all five peers, and it underscored the importance of the socially inclusive agenda at the heart of the UDL approach. Collaborative reflection on new ideas not only gave the group the confidence to incorporate UDL principles into their teaching practices, it also served as the basis for modelling similar collaborative learning processes with and among their students.

3.4. Peer Learning Triads

"I have learnt so much from working with my peers; we shared resources, supported one another, brainstormed ideas, teased out problems and became a strong unit for working on new ideas of how to implement UDL into our teaching and learning practice."

One of the most unique components of National Forum Digital Badges is the introduction of the 'triad' format. Several benefits of peer triads for academics have been noted by Grainger, Bridgstock, Houston, and Drew (2015), including positive benefits for pedagogy and increased teaching confidence. The triad format aims to facilitate regular interactions and discussions among small groups of peers, providing both support and evaluation. This format is applied across all National Forum Digital Badges, as they consider it an accessible approach that encourages participation and allows for rich discussion and knowledge-sharing, while also being rigorous enough to maintain the badges' credibility (Donnelly & Maguire, 2020). Upon embarking on the badge, each participant is assigned to a group of peers. This triad remains a fixed element throughout the process, and at the end of the course the triad members provide an affirmation of the participation of each member.

In our case, the triad had five members. Each group member came to the process with some interest and understanding of UDL, and through weekly discussion, debate, and sharing of experiences we have each developed a more complete understanding, and structured and robust approach. We met weekly over the course of the badge and this format has provided many invaluable insights into how accessibility can be embedded into teaching practices and approaches. The synergy between our individual ongoing reflections, combined with deeper

engagement and discussion with learners, and those reflections co-constructed with triad partners has enabled each of us to identify areas that can be improved by further refinement. The combination of these modes of reflection certainly amounted to more than the sum of its parts and the triad has provided an invaluable space for members to triangulate combined knowledge and resources, engage in group problem solving, and develop innovative solutions to pedagogical challenges.

Teaching staff within the institute are all very busy, and there is often limited flexibility available for many staff in terms of their teaching schedule. If we are to give everyone the best chance of participating in and completing an important piece of CPD such as the UDL badge, then it is imperative that participation is not subject to the ability to attend regular meetings at a predetermined time and place. The peer triad model facilitates flexibility in this. Triads, constructed of small groups of colleagues, can consider the individual circumstances of their group members and plan to meet at a time of their choosing.

Even so, we recommend that each triad consider implementing a weekly schedule if one can be found that works. For us, weekly peer meetings with colleagues provided impetus and drive, and have encouraged open discussion, bringing fresh perspectives, and providing instrumental feedback on our UDL ideas and activity redesigns. Weekly discussion has allowed us to develop a common vocabulary and understanding of the UDL Framework, and the collegial format has provided a dedicated space and time to explore the UDL principles and consider how these can be best applied to both teaching and learning activities to create a more inclusive learning experience for our diverse cohorts of learners. This process of examining where UDL improvements can be embedded into each member's teaching practices allows us to continue to implement UDL elements in our teaching and learning practices in small but significant ways. We also suggest that there is significant benefit to continuing with regular meetings even beyond the parameters of the UDL Digital Badge. Our triad continues to meet regularly throughout the subsequent teaching year to discuss UDL concepts and approaches that can help to make the modules we deliver even more accessible in the future.

4. CONCLUSION/DISCUSSION

Throughout the digital badge a "plus one" approach was advocated, asking participants to focus on one small area of their course design and delivery and make changes to improve the learner experience. The case studies discussed above indicate that it is possible to implement small, incremental changes over a short period of time, and these can be built on to foster further improvements. The current findings, while tentative, are very positive overall, indicating that even small changes that are informed by a UDL perspective can improve learner experience, engagement, and output. The incremental nature of the UDL plus one approach means that each module design and delivery can continue to be improved on an ongoing basis, where small incremental efforts can over time result in substantial changes for learners.

The peer support provided as part of the UDL Digital Badge has given the present authors a renewed commitment to further developing a UDL culture within TU Dublin, both in research and practice. Our experiences as a peer learning group have usefully paralleled the challenges faced by our learners. In deliberately and systematically incorporating UDL principles into our teaching practice on an ongoing basis, we thus strive to enable our students in turn to reflect upon, support and learn from each other's diverse approaches to learning and understanding.

REFERENCES

- Adams, A., & Counard, J. (2004). The Effect of Group Size on Social Facilitation and Social Loafing as Measured in Productivity. *Modern Psychological Studies*, 10(1), 20–26.
- AHEAD (2022). *CPD - the Digital Badge for Universal Design in Teaching & Learning*. Retrieved September 9, 2022, from <https://www.ahead.ie/udl-digitalbadge>
- Bolt, S., & Atkinson, D. (2010). Voluntary peer review of face-to-face teaching in higher education. In M. Devlin, J. Nagy & A. Lichtenberg (Eds.), *Research and Development in Higher Education: Reshaping Higher Education*, 33 (pp. 83–92). Melbourne, Australia: Deakin University.
- Brookfield, S. D. (2017). *Becoming a critically reflective teacher* (2nd ed.). San Francisco, CA: Jossey-Bass. (Original work published 1995).
- CAST (2018). *Universal Design for Learning Guidelines version 2.2*. Retrieved October 12, 2022, from <http://udlguidelines.cast.org>
- Centre for Excellence in Universal Design (CEUD) (2020). *Universal design at TU Dublin recognised by CEUD centre for excellence in universal design* [Blog Post]. Retrieved from <https://universaldesign.ie/news-events/news/universal-design-at-tu-dublin-recognised-by-ceud.html>
- Donnelly, R., & Maguire, T. (2020). Building digital capacity for higher education teachers: Recognising professional development through a national peer triad digital badge ecosystem. *European Journal of Open, Distance and E-Learning*, 23(2), 1-19. <https://doi.org/10.2478/eurodl-2020-0007>
- Grainger, P., Bridgstock, M., Houston, T., & Drew, S. (2015). Working in triads: A case study of a peer review process. *Journal of University Teaching & Learning Practice*, 12(1), 19–44. <https://doi.org/10.53761/1.12.1.3>
- National Forum (2020). *Introduction to peer triads in a PD open course*. Retrieved September 23, 2022 from <https://hub.teachingandlearning.ie/wp-content/uploads/2021/06/NF-2020-Introduction-to-Peer-Triads-For-Participants.pdf>
- Nottingham University Digital Transformations Hub. (n.d.) *Video essays*. Nottingham University. Retrieved from <https://www.nottingham.ac.uk/artsdigitalhub/documents/teaching-resources/video-essays.pdf>
- O’Neill, G. (Ed.). (2011). *A practitioner’s guide to choice of assessment methods within a module: Case studies from University College Dublin*. Dublin, Ireland: UCD Teaching and Learning. Retrieved from https://www.ucd.ie/teaching/t4media/choice_of_assessment.pdf
- Opencourses.ie (2022). *The digital badge in universal design in teaching and learning*. Retrieved September 9, 2022, from <https://opencourses.ie/opencourse/universal-design-in-teaching-and-learning/>
- Rajaguru, R., Narendran, R., & Rajesh, G. (2020). Social loafing in group-based learning: Student-created and instructor-created group perspectives. *Education + Training*, 62(4), 483–501. <https://doi.org/10.1108/et-01-2019-0018>
- Rice University Center for Teaching Excellence. (n.d.). *Course workload estimator*. Retrieved from <https://cte.rice.edu/workload>
- Rogers-Shaw, C., Carr-Chellman, D. J., & Choi, J. (2018). Universal design for learning: Guidelines for accessible online instruction. *Adult Learning*, 29(1), 20–31. <https://doi.org/10.1177/1045159517735530>
- Ross, S. R. (2019). Supporting your neurodiverse student population with the Universal Design for Learning (UDL) framework. *2019 IEEE Frontiers in Education Conference (FIE)*, 1–5. <https://doi.org/10.1109/fie43999.2019.9028693>
- Schippers, M. C. (2014). Social Loafing Tendencies and Team Performance: The Compensating Effect of Agreeableness and Conscientiousness. *Academy of Management Learning & Education*, 13(1), 62–81. <https://doi.org/10.5465/amle.2012.0191>

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- Solano, A. (2020). *Why colleges struggle to implement priorities and what to do about it*. Retrieved October 12, 2022, from https://s3.amazonaws.com/kajabi-storefronts-production/sites/84681/themes/2357781/downloads/r64kHN9SgaTI2YUjMRzq_Dr._AI_Guide.pdf
- Transform EDU. (2021). *WS 4.2 Universal design for learning*. Retrieved October 13, 2022, from <https://transformedu.ie/wp4/ws-4-2-ud-for-learning/>
- TU Dublin. (2021a). *Principles of an education model for TU Dublin*. Retrieved April 17, 2023, from <https://www.tudublin.ie/media/intranet/education-model/documents/UEM-10-Guiding-Principles.pdf>
- TU Dublin. (2021b). *Strategic intent*. Retrieved from <https://www.tudublin.ie/explore/about-the-university/strategicintent/>

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Chapter # 12

THE STUDENT'S ACADEMIC ASPIRATIONS, PREDISPOSITIONS AND EDUCATIONAL SUPPORT

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ABSTRACT

This chapter presents the results of empirical research aiming to classify the students of the research group by their subjective view of their study ambitions and assumptions and analyse the relationship between them. Teachers' and schools' incentives to guide students towards technological thinking and deepen the school's interest in the field of study were examined as elements of academic support. The students' views on both of these variables were related to the perception of their educational aspirations. Academic aspiration expresses the anticipated level of performance or position the students wish to achieve. Study predispositions are a set of knowledge, competencies, cognitive abilities, talents, study ambitions and motivations. The research sample consists of 907 technical secondary school students in the Czech Republic. Descriptive data showed, that more than half of the respondents believe they have suitable prerequisites for studying and aspire to the status of a good student. Only 3% lack these prerequisites and have no ambition to be good students. Students with higher aspirations more frequently believe that they have sufficient prerequisites for studying and perceive school support to deepen their interest in the field. However, educational aspirations are separate from students' opinions about the teacher's efforts to develop technical thinking.

Keywords: academic aspiration, academic predispositions, interest in the study, educational support, technical thinking,

1. INTRODUCTION

The chapter deals with identifying the subjectively perceived level of study aspirations and study prerequisites of the technical secondary school population and determining the value of the intersection of both variables and the statistical relevance of this relationship. The relationships between students' academic aspirations, the teacher's supportive procedures to develop their technical thinking, and the school's supportive activities deepening the students' interest in the field of study are assessed. The investigated constructs are defined in the following text, their importance for educational practice is emphasised, and relevant research findings are presented if found. Empirical research on a more extensive research group makes it possible to consider results as valuable information about the self-reflection of selected psychosocial states of secondary school students, their relationships and their perception of the educational institution's supportive activities. They can thus be helpful for educational theory and practice.

2. EDUCATIONAL ASPIRATIONS

Educational aspiration reflects the educational goals an individual sets for themselves. It is essential as it encourages and energises the individual to achieve them (Fraser & Garg,

2011). However, in the professional community, there is no single and universally accepted definition or joint agreement regarding the term (Quaglia & Cobb, 1996). Oxford Dictionary defines aspiration as the "hope or ambition of achieving something" (Stevenson, 2010a). Educational aspiration thus refers to one's hope or ambition of achieving something in education. Sometimes, the meaning of aspiration and its synonym expectation, defined as a "strong belief that something will happen or be the case" (Stevenson, 2010b), may be used interchangeably (Hong, 2022). We understand an individual's current state, characterising mainly their talent, previous education, will or sufficient motivation to achieve a specific educational goal, usually formulated by obtaining a certain degree and field of education.

Children's abilities and talents play an essential role in developing their aspirations. Research indicates that children's aspirations are raised when doing well academically. For example, children's ability at age seven was related to their aspirations at age 11, and ability at age 11 was related to aspirations at age 16. At 11 and 16, children's aspirations were also positively related to their test scores. (Bond & Saunders, 1999, cited in Gutman & Akerman, 2008). These findings suggest that aspirations and the ability to influence each other throughout the school years, therefore establishing causality between these two influences, is difficult (Gutman & Akerman, 2008). Educational aspiration is a term that can be researched and explained using psychological, pedagogical and sociological theories. From a psychological point of view, it is part of the performance motivation construct we need to achieve. Students' achievement motivation is an essential prerequisite for their engagement, overcoming study difficulties and, ultimately, completing their studies. The motivation to achieve goals leads individuals to pursue work they perceive to be valuable and prompts them to compete with others (Covington, 2000). This drive may come from an internal or external source. Achievement motivation is intrinsic when interest or enjoyment sparks it in the task. It is organic to the person, not a product of external pressure. Achievement motivation can be instead extrinsic when it comes from outside the person. Common sources of extrinsic motivation among students are rewards like good marks or praise from parents and teachers (OECD, 2017).

From a pedagogical point of view, educational aspirations are seen as a characteristic of the learner, which can or needs to be cultivated educationally. Quaglia and Cobb (1996, p. 131) believe that "Assuming that students' aspirations can be impacted in some way, and assuming that the best way to go about that is to do so indirectly via changes in whole group aspirations, there are enormous implications for schools (e.g., create an environment which fosters aspirations)". Professionals and volunteers who work closely with young people also have an essential role in helping them to develop and realise their aspirations. Evidence suggests that while increasing aspirations is worthwhile, a national approach will be vital in helping all young people achieve their potential and meet challenging targets (Gutman & Akerman, 2008).

Gutman and Akerman (2008) state, "numerous studies have found that aspirations are significant predictors of young people's educational and occupational attainment. However, there is less evidence concerning the causal nature of these associations in terms of whether aspirations predict later achievement, controlling for other individual and family characteristics. The authors add that "the influence of aspirations on outcomes may also vary according to the young people's characteristics. For certain groups, including females, economically disadvantaged young people and those from ethnic minorities, high aspirations may not necessarily predict higher educational and/or occupational achievement" (p. 15). While data on educational aspirations is comparatively easily accessible, there is no common agreement on measuring the concept. Most commonly, survey participants are asked to choose between different educational alternatives in

response to questions of the following form to collect information on their idealistic and realistic aspirations, for example, "What is the highest level of education you would like to get?" (Trebbels, 2015). Although there is a growing interest in researching study aspirations, more attention is paid to their racial, gender or socio-economic factors (Behjoo, 2013; Hong, 2022) or their relationship to educational outcomes (Gutman & Akerman, 2008). Aspiration is the variable that acquires values based on the subjective perception of one's study, learning or career desires and/or ideas. In our research, we asked respondents to choose the answer to the question, "Do you want to be successful at secondary school?" From the following options: a) definitely yes, b) rather yes, c) I do not know, d) rather not, and e) certainly not.

3. STUDY PREDISPOSITIONS

Study predispositions (preconditions, prerequisites) are a set of knowledge, (key or transversal) competencies, (cognitive) abilities, talents, study ambitions and study motivations. The breadth of understanding of this concept depends primarily on why we deal with them and for what purpose we define them. That is usually the case in admission procedures at a secondary school or university, requiring transparent operationalisation into an effective tool for measuring them.

For many decades, the SAT (Scholastic Aptitude Test) has been one of the world's most widely used tools for selecting suitable university candidates. The test consists of three parts: reading, math, and writing, or ACT (American College Testing), used by up to 78% of American schools. Predictive validity, as an essential feature of these tests, expresses their ability to predict future success. Research shows that entrance tests and final exams or secondary school grades have their justification in university admission procedures. For all these predictors, we find studies confirming their ability to predict university achievement or successful completion of studies. Indeed, the combination of these predictors predicts significantly better than the predictors alone. (Bartáková, Chvál, & Martinková, 2018). Since 2015, a uniform entrance examination has been introduced in the Czech Republic for all secondary school study programs ending with a school-leaving examination. It consists of a test in the mother tongue and mathematics, and its minimum weight in the admission procedure is 40%. It is criticised, among other things, because it does not work with the cut score. Our research examined study prerequisites in the form of their subjective reflection by interviewing secondary school students using a simple and understandable question "Do you think that you have the prerequisites for the chosen field of study?" Students chose one of the offered variants: a) definitely yes, b) rather yes, c) I don't know, d) rather no, and e) definitely no.

4. TECHNICAL THINKING AS PART OF TECHNICAL LITERACY

Technical thinking is a part of technical literacy that emphasises critical thinking. Plischke and Kropáč (2010, p. 222) claim that "critical thinking results in decisions and their defence while respecting the arguments of others." Critical thinking develops critical reading, which Wallace and Wray (2011, p. 7) characterise as "a skill in assessing the extent to which authors have provided adequate justification for their claims." Technical thinking helps to understand the everyday life of Society 4.0, influenced by digitisation, automation, and robotisation in the 21st century. "The assumption of understanding is an a priori component of every speech act or information transfer (Štochl, 2005, p. 142). Acquaintance with processes and the assimilation of currently relevant information linked to technical literacy

includes technical education within the framework of general education as well as narrowly specialised training aimed at preparing experts with a focus on the performance of technical professions of all qualification levels. The goal of technical education, in general, is the achievement and development of an individual's technical literacy. Trexima (2015, pp. 7-8) defined "technical literacy as the ability of a human individual to understand technical processes and the ability to use, assess and determine the right technologies and approaches." Technical literacy is described in the Standards (2020) within eight characteristics of cross-cutting competencies and their application transfer of possible use in eight industries (sectors). The Standards for Technology and Engineering Literacy (STEL) can be seen as an inspiring strategy to innovate technical education curricula at all school levels. The standards for technical and engineering literacy (STEL) consist of 1. Nature and Characteristics of Technology and Engineering, 2. Core Concepts of Technology and Engineering, 3. Integration of Knowledge, Technology, and Practices, 4. Impacts of Technology, 5. Influence of Society on Technological Development, 6. History of Technology, 7. Design in Technology and Engineering Education, 8. Applying, Maintaining and Assessing Technological Products and Systems. Practices of STEL consist of eight areas: 1. Systems Thinking, 2. Creativity, 3. Making and Doing, 4. Critical Thinking, 5. Optimism, 6. Collaboration, 7. Communication, 8. Attention to Ethics. The aspect of context through the lens of STEL is also important here, categorising it into eight parts: 1. Computation, Automation, Artificial Intelligence, and Robotics, 2. Material Conversion and Processing, 3. Transportation and Logistics, 4. Energy and Power, 5. Information and Communication, 6. The Built Environment, 7. Medical and Health-Related Technologies, 8. Agricultural and Biological Technologies (Švrčinová, Vicherková, Chmura, & Malach, 2022, p. 25). In the 20s of the 21st century, the educational concept in the Czech Republic underwent a revision of key curricular documents, primarily in the direction of strengthening digital (technical) literacy, namely in the curriculum of basic education (RVP ZV) and secondary education. Research by Křížková (2008, p. 134) devoted to the level of individual components of creative thinking showed that "Society requires social skills, independent thinking and creative thinking, and the school should fulfil these requirements."

5. EDUCATIONAL SUPPORT

The fundamental principle of the Educational Support Policy is a holistic approach to the individual needs of each child. The aim is to ensure that the support given is planned and provided in the best interest of each child. The policy avoids categorising or labelling the child by calling them SEN pupil or SWALS pupil but by recognising that every child may need support at some time throughout their schooling and the support should be tailor-made to the needs of the child" (Schola Europaea, 2018, p. 6). This policy is also evident in the current strategy of the educational policy of the Czech Republic (MŠMT, 2020), e.g. in the formulation of two strategic goals: a) to focus education more on the acquisition of competencies needed for an active civic, professional and personal life and b) to reduce inequalities in access to quality education and enable the full development of the potential of children, pupils and students. Secondary technical schools, schooling 80% of the young population in the Czech Republic, have the duty to "Strengthen career counselling, cooperation with employers, departments and other partners" by systematically working on the career development of each student and strengthening their professional identity and connection with the field of education, thereby early graduation and "travelling between disciplines" would be avoided (p. 35). Therefore, the role of career counselling in schools

must change. Furthermore, the skills of educators to support students in completing their studies and transiting to the labour market must also be improved.

These changes first require transformations in the school culture - an intangible manifestation inside the organisation which mirrors itself primarily in the process and organisation of teaching, the relationships between teachers and students, and the relationship of teachers to their profession and their work (Eger & Beran, 2021). These relationships of teachers will tend to be adopted by their students. Rydlo and Tesárek (2021) consider the acquisition of new competencies or the development of existing ones, which generally leads to a shift in the upbringing and education of each student, as the main goals of the professional development of teaching staff. Professionally well-disposed teachers, belonging to the professional social type in the sense of Holland's theory, should co-create a supportive, supportive environment that has the potential to fulfil Holland's hypothesis that "people with more information about work environments make better career choices than people with less information." (Kohoutek, 2009, p.17). Based on research advice, Mainhard, Brekelmans and Wubbels (2011) summarise that the supportive behaviour of the teacher, whom students perceive as warm and caring, is essential for creating a compelling context for learning. Using appropriate and non-offensive humour, encouraging positive student behaviour, providing emotional and academic support to students and undertaking activities students consider entertaining support a positive classroom social climate and constitute a motivational factor for students. Although the effects of supportive behaviour they found were not substantial, they showed that supportive behaviour pays off immediately and is an investment for the near future as well. Chen (2005) found that in a set of secondary school students, they perceived parental support and teacher support were directly related to academic achievement. However, perceived teacher support made the most total (direct and indirect) contribution to student achievement. Perceived peer support had the slightest, nevertheless significant, indirect relationship to academic achievement.

6. RESEARCH METHODOLOGY

6.1. Research objectives

The objective of the empirical research was to find out the following:

1. division of students into groups according to the subjectively perceived level of their own educational aspirations;
2. division of students into groups according to the subjectively perceived level of their own study prerequisites;
3. division of students into groups based on both of these criteria;
4. students' opinions on the existence of support for their technical thinking divided according to their subjectively perceived level of study aspirations;
5. students' opinions on the school's influence on deepening their professional interest, divided according to their subjectively perceived level of study aspirations;
6. the significance of the relationships between the subjectively perceived level of one's own study aspirations and between the subjectively perceived level of students' own study prerequisites
7. the significance of the relationships between students' opinions on the existence of support for their technical thinking and the subjectively perceived level of their study aspirations
8. the importance of relationships between students' opinions on the existence of support from the school of their professional interest and the subjectively perceived level of their educational aspirations.

6.2. Data collection

The research was carried out within the TAČR project at the Faculty of Education of the University of Ostrava. The data were collected using an author's questionnaire containing 29 items (20 closed and nine open or semi-open). Four items and their results are presented in this chapter. Data collection was carried out from September 2020 to February 2021 on a deliberately selected research sample of 907 respondents (students of 6 technical secondary schools) in the Moravian-Silesian Region of the Czech Republic. Most of the research group consisted of boys (884, i.e., 97.46%), and only 21 (2.32%) respondents were girls. Three-quarters (630, i.e., 69.40%) of respondents studied a four-year engineering field completed with a school-leaving examination, and only a third of 266 (29.33%) respondents studied another field of study (non-engineering).

7. RESULTS

A positive finding is a significant predominance of students (81.48%) who have ambitions (answers *definitely yes* and *rather yes*) to be successful. A negligible share of 6.78% of students does not have these ambitions (answers *rather no* and *definitely no*). In absolute terms, there are 61 students who, for some reason (perhaps they do not study at the school of their choice), do not intend to aspire to the term "successful student". A particular explanation for this number may be that the secondary school students understood the term in the pursuit of good grades, which may not be of significant value to them at present. Thus, a negative opinion does not necessarily mean this group of students resign to professional knowledge and skills acquisition. More than a tenth of the respondents were unable or unwilling to assess their study ambitions (Table 1).

Table 1.
Student expression of aspiration to be a successful student.

Quantities	Student answers Q34				
	Definitely yes	Rather yes	I don't know	Rather no	Definitely no
Absolute quantities	405	334	101	47	14
Relative quantity	44.65%	36.82%	11.14%	5.18%	1.54%
Cumulated absolute frequencies	739		101	61	
Cumulated relative frequencies	81.48%		11.14%	6.73%	

However, the result of student evaluations of one's preconditions for studying a selected field at a secondary school turned out to be somewhat surprising because only 60.20% of students subjectively perceive that they have (answers *definitely yes* and *rather yes*) these preconditions. About one in six students (15.77%) believe they do not have the prerequisites to study (answers *certainly no* and *rather no*). Almost a quarter of students chose the answer "I don't know". It might be reasonable to analyse these answers in terms of the year of study (Table 2).

Table 2.
Student perception of preconditions for the selected field of study.

Quantities	Student answers Q7				
	Definitely yes	Rather yes	I don't know	Rather no	Definitely no
Absolute quantities	151	395	215	104	39
Relative quantity	16.65%	43.55%	23.70%	11.47%	4.30%
Cumulated absolute frequencies	546		215	143	
Cumulated relative frequencies	60.20%		23.70%	15.77%	

Table 3.
Distribution of students according to the subjectively evaluated level of preconditions for study and the expressed degree of ambition to be a successful student.

	Question Q34 - I have aspirations to be a good student	Question Q34 - I have no aspirations to be a good student	Question Q34 - I do not know if I have aspirations to be a good student
Question Q7 - I have the preconditions to study	473 students (52.15%)	26 students (2.87%)	46 students (5.07%)
Question Q7 - I have no preconditions to study	94 students (10.36%)	20 students (2.21%)	27 students (2.98%)
Question Q7 - I don't know if I have the preconditions to study	169 students (18.63%)	15 students (1.65%)	28 students (3.09%)

Table 3 shows the values for the intersection of the two investigated constructs. Due to the high frequency of "don't know" responses, the initially intended four-field table is processed with nine fields to use all the data obtained. For the first time, it is interesting to note that 52.15% of students believe that they have the prerequisites to study and, simultaneously, want to be good students. Of those students who believe they have the prerequisites to study, up to 86.7% aspire to be good students. In the whole group, 10.36% of students believe they do not have the prerequisites to study and, simultaneously, have ambitions to be good students. But the ambition to be a good student also has 66.66% of all those who think they do not have the prerequisites to study. Only a tiny proportion of all students (2.87%) have no ambition to be good students, even though they think they have the prerequisites to study. 20 (2.21%) students in the research group believe they do not have the prerequisites to study and do not have the ambition to be good students. Twenty-eight students who could not assess their characteristics level deserve attention and targeted educational intervention.

Hypothesis H1 expressed the main finding presented in Table 3 in the following wording: "Students who, in their opinion, have the prerequisites to study a selected (technical) field more often declare their aspirations to be a good student than students lacking (not) these preconditions. Therefore, the values given in Table 4 allow this hypothesis H1 to be accepted.

Table 4.

H1: Statistical significance of the distribution of students according to the subjectively evaluated level of preconditions for study and the expressed degree of aspiration to be a successful student

Pearson's chi-square = 32,720221 degree of freedom = 4 significance p= 0,0136285E-4				
Question 7	question Q34 - I have aspirations to be a good student	question Q34 - I have no aspirations to be a good student	Q34 - I do not know if I have aspirations to be a good student	Line totals
I have the preconditions to study	473(446,682)	26(37,021)	46(61,297)	545
I have no preconditions to study	94(115,563)	20(9,578)	27(15,859)	141
I don't know if I have the preconditions to study	169(173,755)	15(14,401)	28(23,844)	212
Column totals	736	61	101	898

It was thus proved that there is a statistically significant difference in declaring ambitions to be a good student among students with different self-assessments of their preconditions to study the field. Hypothesis H1 was confirmed.

Table 5.

The division of students according to their subjective evaluation of their teacher's guidance towards thinking about a technological problem and the expressed degree of aspiration to be a successful student.

	Question Q34 - I have aspirations to be a good student	Question Q34 - I have no aspirations to be a good student	Question Q34 - I do not know if I have aspirations to be a good student
Question Q27 - teacher guides us towards thinking about a technological problem	568 students (62.62%)	41 students (4.20%)	73 students (8.05%)
Question Q27 - teacher does not guide us towards thinking about a technological problem	159 students (17.53%)	19 students (2.09%)	28 students (3.09%)

Table 5 shows the values for the intersection of the two investigated constructs. 62.63% of students said that they are encouraged and guided by their teacher towards thinking about a technical problem, and they have ambitions to be good students. However, only 4.52% of students think that although they are encouraged and guided by their teacher towards thinking about a technical problem, they do not have ambitions to become good students. Attention should be paid to the fact that 17.53% of students have ambitions to become good students; however, they do not think that they are encouraged and guided by their teacher during their technical training classes towards thinking about a technical problem and using critical thinking skills. 8.05% of students who are guided by their teachers towards thinking about a technical problem cannot express and evaluate whether they have ambitions to become good students or not, which can be a result of several factors, i. e., low confidence when it comes to their own learning potential, and/or student's insufficient skills to assess a specific problem.

The hypothesis H2 expressed the main finding presented in Table 5 in the following wording: "Students, who have stated that their technical training teachers guide them towards thinking about a technical problem said that they have aspirations to be a good student more frequently than students who stated that their technical training teachers do not guide them towards thinking about a technical problem."

However, values in Table 6 do not allow us to accept hypothesis H2.

Table 6.

H2: Statistical importance of the students' distribution according to their subjective evaluation of their teacher's guidance towards thinking about a technical problem and the expressed extent of aspiration to be a successful student.

Pearson's chi-square = 3.4033974 degree of freedom = 2 significance p= 0.1167936				
Question 27	Question 34 - I have aspirations to be a good student	Question 34 – I have no aspirations to be a good student	Question 34 – I do not know if I have aspirations to be a good student	Line totals
teacher guides them towards thinking about a technical problem	568 (558,35)	41 (46,08)	73 (77,57)	682
teacher does not guide them towards thinking about a technical problem	159 (168,65)	19 (13,92)	28 (23,43)	206
Column totals	727	60	101	888

It has not been proven that both questions have a statistically significant relationship. (Whether their teachers guide them towards thinking about a technological problem and their aspiration to be a good student).

Table 7.

Division of students according to their subjective evaluation of the school's incentives to create a deeper interest in the field of study and expressed extent of aspiration to be a successful student.

	Question Q34 - I have aspirations to be a good student	Question Q34 – I have no aspirations to be a good student	Question Q34 – I do not know if I have aspirations to be a good student
Question Q32 - school deepens the student's interest in the field of study	417 students (45.98%)	15 students (1.64%)	30 students (3.31%)
Question Q32 - school does not deepen the student's interest in the field of study	313 students (34.51%)	46 students (5.07%)	67 students (7.39%)

Table 7 shows the values for the intersection of the two investigated constructs. Almost half of the respondents (45.98%) think that their school deepens their interest in their field of study, and they also state that they aspire to become successful secondary school students. On the other hand, quite a high number of respondents (34.51% of students) think their school does not deepen their interest in the field of study. However, they still state that they aspire to become successful secondary school students. On the contrary, only 5.07% of students believe that their school does not deepen their interest in the field of study, and they also do not have aspirations to become successful secondary school students. It is worth mentioning that 7.39% of students think that school does not deepen their interest in the field of study, and they are also unable to decide whether they have aspirations to become successful secondary school students. Sixty-seven students could not assess their own characteristics.

The hypothesis H3 expressed the main finding presented in Table 7 in the following wording:

"Students who have stated that the school deepens their interest in the field of the study said that they have aspirations to become a good student more frequently than students who stated that the school does not deepen their interest in the field of study."

Therefore, the values given in Table 8 allow this hypothesis H3 to be accepted.

Table 8

H3: Statistical importance of the students' distribution according to their subjective evaluation of the school's incentives to create a deeper interest in the field of study and expressed degree of ambition to be a successful student.

Pearson's chi-square = 34,294306 degree of freedom = 2 significance p= 0,0396709 E-8				
Question 32	Question 34 - I have aspirations to be a good student	Question 34 – I have no aspirations to be a good student	Question 34 – I do not know if I have aspirations to be a good student	Line totals
school deepens student's interest in the field of study	417 (379,80)	15 (31,74)	30 (50,47)	462
school does not deepen student's interest in the field of study	313 (350,20)	46 (29,26)	67 (46,53)	426
Column totals	730	61	97	888

It has been proven that there is a statistically significant relationship between both questions (whether their teachers guide them towards thinking about a technological problem and their ambition to be a good student). Hypothesis H3 was proven.

8. DISCUSSION AND CONCLUSIONS

It was found that 81.48% of the respondents admitted the aspirations to be successful. Our finding is very close to the findings of Khattab (2015), who found a high level of aspiration in 83% of them in a set of more than 14,000 students. Although Abdelrazek (2015) found a moderately strong dependence between the level of aspiration and motivation ($r= 0.32$), he does not provide data on the distribution of the studied group of students according to their level of aspiration. 60.2% of students perceive that they are predisposed to study the field. A similar figure was not found for other populations, so it is impossible to assess whether this proportion of students is common or exceptional in the group we examined.

More than half of students (52.15%) also state that they are ambitious to study successfully and consider that they have the appropriate study predispositions. No other results are available for this defined pair. However, it can be predicted that this group of students will achieve good academic results (Abdelrazek, 2015). The difference in declaring ambitions to be a good student among students with different self-esteem preconditions for studying the field failed to prove statistical significance.

Almost half of all respondents (45.98%) think that school deepens their interest in the field of study, and they also state that they have ambitions to be successful secondary school students. On the other hand, 34.51% of students think that school does not deepen their interest in the field of study, and yet they say that they have ambitions to be successful secondary school students. Interestingly, more than half (62.63% of students) answered that they think their teachers guide them towards thinking about technical problems, and they have ambitions to be good students. Only 30 respondents could not evaluate whether they have ambitions to become successful secondary technical school students. Enhancing interest

in the field and supporting technical thinking as two supportive strategies have considerable potential to influence study engagement and study results. A limitation of this study is that this relationship was not investigated and therefore remains a topic for further research.

Research findings in the form of quantification of the share of students with a higher level of educational aspiration and with a greater degree of certainty that they have the prerequisites for studying or students with a simultaneous combination of both subjectively perceived characteristics are usable in educational practice as tools for incentives, increasing self-confidence and self-regulation. Furthermore, finding the relative number of students expressing themselves positively regarding the use of the teachers and school's researched supportive activities can be an objective argument for preparing professional (self) education.

REFERENCES

- Abdelrazek, O.H.G. (2015). Level of Aspiration, Critical Thinking and Future Anxiety as Predictors for the Motivation to Learn among a Sample of Students of Najran University. *International Journal of Education and Research*, 4(2), 61-70.
- Bartáková, I., Chvál, M., & Martinková, P. (2018). Predikční validita zkoušek zakončujících středoškolské vzdělávání a přijímacích testů na vysoké školy. [Predictive validity of high school graduation exams and university entrance tests.]. *Pedagogika*, 68(1), 66–85. <https://doi.org/10.14712/23362189.2017.1016>
- Behjoo, B. M. (2013). The educational aspirations of ELT students for higher education. *Procedia-Social and Behavioral Sciences*, 70, 1062–1069. <https://doi.org/10.1016/j.sbspro.2013.01.159>
- Bond, R., & Saunders, P. (1999). Routes of success: influences on the occupational attainment of young British males. *British Journal of Sociology*, 50, 217–249. <https://doi.org/10.1111/j.1468-4446.1999.00217.x>
- Covington, M.V. (2000). Goal theory, motivation, and school achievement: An integrative review. *Annual Review of Psychology*, 51(1), 171-200. <https://doi.org/10.1146/annurev.psych.51.1.171>
- Eger, L., & Beran, V. (2021). Analýza-Kultura školy podporující maximální rozvoj každého žáka. [Analysis-School culture supporting the maximum development of each student.]. Praha: MŠMT.
- Fraser, M., & Garg, R. (2011). Educational Aspirations. In R.J.R. Levesque (Eds.) *Encyclopedia of Adolescence*. New York: Springer. https://doi.org/10.1007/978-1-4419-1695-2_147
- Gutman, L. M., & Akerman, R. (2008). *Determinants of aspirations*. London: Centre for Research on the Wider Benefits of Learning, Institute of Education University of London.
- Hong, Y. (2022). *The Educational Hopes and Ambitions of Left-Behind Children in Rural China. An Ethnographic Case Study*. Abingdon, Oxon, New York: Routledge.
- Chen, J. J. (2005). Relation of Academic Support from Parents, Teachers, and Peers to Hong Kong Adolescents' Academic Achievement: The Mediating Role of Academic Engagement. *Genetic, Social, and General Psychology Monographs*, 131(2), 77-127. <https://doi.org/10.3200/MONO.131.2.77-127>
- Khatab, N. (2015). Students' aspirations, expectations and school achievement: what really matters? *British Educational Research Journal*, 41(5), 731-748. <https://doi.org/10.1002/berj.3171>
- Kohoutek, R. (2009). *Historie a současnost kariérového poradenství na základních a středních školách České republiky*. [History and present of career counselling in primary and secondary schools of the Czech Republic.]. *Škola a zdraví*, 21, 53-72.
- Křížkovská, I. (2008). Výzkum úrovně jednotlivých složek tvořivého myšlení. [Research on the level of individual components of creative thinking.]. *Trends in Education*, 1(1), 132-135.
- Mainhard, T.M., Brekelmans, M., & Wubbels, T. (2011). Coercive and supportive teacher behaviour: Within- and across-lesson associations with the classroom social climate. *Learning and Instruction*, 21, 345-354. <https://doi.org/10.1016/j.learninstruc.2010.03.003>
- MŠMT (2020). *Strategie vzdělávací politiky České republiky do roku 2030+*. [Education policy strategy of the Czech Republic until 2030+]. Praha: MŠMT. Retrieved September 22, 2021 from <https://www.msmt.cz/vzdelavani/skolstvi-v-cr/strategie-2030>

- OECD (2017). *PISA 2015 Results (Volume III): Students' well-being*. Paris: OECD Publishing. Retrieved May 21, 2022 from <https://www.oecd.org/pisa/PISA-2015-Results-Students-Well-being-Volume-III-Overview.pdf>
- Plischke, J., & Kropáč, J. (2010). Kritické myšlení a možnosti jeho rozvíjení v technických předmětech na ZŠ. [Critical Thinking and Possibilities of its Development in Technical Subjects at Elementary Schools.] *Trends in Education*, 3(1), 222-225.
- Quaglia, R. J., & Cobb, C. D. (1996). Toward a Theory of Student Aspirations. *Journal of Research in Rural Education*, 12(3), 127-132.
- Rydlo, J., & Tesárek, L. (Eds.) (2021). *Manuál profesního rozvoje pedagogických pracovníků*. [Manual of professional development of teaching staff.]. Praha: MŠMT.
- Schola Europaea. (2018) *Evaluation Report on the Implementation of the Educational Support Policy in the European Schools*. Ref.: 2018-09-D-53-en-4. Retrieved October 17, 2022 from <https://www.eursc.eu/Documents/2018-09-D-53-en-4.pdf>
- Stevenson, V. (ed.) (2010a). *Oxford Dictionary of English* (3 ed). Retrieved October 18, 2022 from <https://www.oxfordreference.com/search?q=aspiration&searchBtn=Search&isQuickSearch=true>
- Stevenson, V. (ed.) (2010b). *Oxford Dictionary of English* (3 ed). Retrieved October 18, 2022 from <https://www.oxfordreference.com/search?q=expectation&searchBtn=Search&isQuickSearch=true>
- Švrčinová, V., Vicherková, D., Chmura, M., & Malach, J. (2022). Vzdělávání ve strojírenských oborech a jeho optimalizace pro potřeby trhu práce. [Education in engineering fields and its optimisation for the needs of the labour market.]. Brno: Paido.
- Štochl, M. (2005). *Teorie literární komunikace: úvod do studia literatury*. [Theory of literary communication: an introduction to the study of literature.]. Praha: Akropolis.
- Trebbels, M. (2015). *The transition at the end of compulsory full-time education Educational and future career aspirations of native and migrant students*. Wiesbaden: Springer VS.
- Trexima (2015). Definice technického vzdělávání. [Definition of technical education.]. Praha: Technologická agentura České republiky.
- Wallace, M., & Wray, A. (2011). *Critical reading and writing for postgraduates*. London: SAGE Publications.

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Chapter # 13

OPINION SURVEY OF TEACHERS OF DYSLEXIC SCHOOLCHILDREN REGARDING LEARNING SKILLS

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ABSTRACT

The aim of this study was to characterize the opinion of teachers of students with dyslexia in a specific questionnaire on learning skills. 74 teachers of Brazilian schoolchildren with dyslexia participated, aged from 9 years to 10 years and 11 months from the 3rd to the 5th year of Elementary School I. The teachers answered the Learning Skills Questionnaire, composed of items: attention skills; visual processing skills; auditory processing skills; logical-mathematical reasoning skills; motor skills; behavioral skills. The questionnaire was filled out by teachers, with responses scored on a scale from 0 to 4 points (Likert Scale). Data for this study were collected from March 2019 to March 2020, before the start of the COVID-19 pandemic in Brazil. The results were analyzed statistically indicating that teachers answered "rarely" and "sometimes" for all categories, except for category behavioral, which most answers were "never". There was also an indication of "I don't know" for all categories, suggesting that teachers' lack of knowledge regarding behaviors aspects of dyslexic's schoolchildren. The results allowed us to conclude that teachers still need of information about how schoolchildren with dyslexia learn to read, since the results "rarely" and "sometimes" were presented in all categories of academic learning.

Keywords: dyslexia, learning, educational measurement.

1. INTRODUCTION

Dyslexia is described as a difficulty in learning to read and affects 5-12% of schoolchildren (Norton, Beach, & Gabrieli, 2015). Research has reported that reading is a complex task, requiring the integration of multiple visual, linguistic, cognitive and attentional processes (Ziegler et al., 2008). Due to this diversity of manifestations, it is necessary to use procedures, such as questionnaires, in order to verify teachers' opinions on the potential academic markers for this population. The inability to read and understand, present in students with dyslexia, is one of the greatest obstacles to learning, leading to serious educational, social and emotional consequences (Fletcher, 2009).

The study was designed due to the diversity of the findings in the literature about conceptions of dyslexia by elementary school teachers. Although the use of questionnaires is usual in clinical practice, in the educational context, there are still few Brazilian studies about the opinion of teachers about the educational performance of students with dyslexia.

In this way, this study presented as a research question how students with dyslexia are seen by their teachers, and it also makes possible to observe the knowledge of teachers about this condition.

2. BACKGROUND

Dyslexia is defined as a specific learning disorder with impairment in reading, which can range from problems in word reading accuracy, reading speed, or reading fluency and comprehension (American Psychiatric Association, APA, 2014). Regarding the cause of dyslexia, there are different theories that justify reading difficulties by relating them to failures in phonological, visual and cognitive processes (Reid, 2016), expanding the possibility of characterizing this population, with several theories suggesting possible causes of dyslexia. According to Reid (2016), developmental dyslexia is characterized by differences in individual processing, often characterized by difficulties presented at the beginning of literacy, compromising the acquisition of reading, handwriting, and spelling.

However, studies have pointed to a much broader and more heterogeneous profile. Among the manifestations, studies indicated the presence of phonological deficit (Vellutino, Fletcher, Snowling, & Scanlon., 2004), temporal auditory processing (Tallal, 1980), and speech perception (Mody, Studdert-Kennedy, & Brady, 1997). In addition, there are also studies that refer failures in sensorimotor tasks (Bucci, Brémond-Gignac, & Kapoula, 2008), motor coordination and balance (Fawcett & Nicolson, 1999).

In this way, students with dyslexia may present a diversity of manifestations depending on its subtypes, which may be phonological, visual or mixed (Facoetti et al., 2003; Galaburda & Cestnick, 2003; Ramus et al., 2003), but regardless these subtypes there are changes in the mechanism of conversion of letters in their phonemic representations, resulting in slow reading fluency and changes in orthographic and calligraphic writing, reading comprehension and text production.

Thus, these difficulties impair decoding (letter-sound association); fluency (ability to read words and texts automatically); and comprehension (proficient reader) (American Academy of Pediatrics, 2009).

Consequently, the investigation of learning skills from the perspective of their teachers can collaborate in the identification of educational behaviors among dyslexic students, which in turn can help in the design of clinical and educational interventions, as well as guide the elaboration of orientation and training programs for the teachers of these students.

Despite the consensus in the international related literature (Wadlington & Wadlington, 2005; Snowling & Hulme, 2013; Washburn, Binks-Cantrell, Joshi, Martin-Chang, & Arrow, 2016) that the role of the teacher does not include diagnosing dyslexia, there is the idea that teachers need to have a minimum understanding of what dyslexia is and its manifestations, since the specific knowledge of what difficulties students with dyslexia present can help in the development of specific educational strategies that can minimize the impact of these changes on academic learning.

However, playing a key role in dyslexic students' educational path, teachers' attitudes, conceptions and knowledge about this diagnosis can contribute to early identification, effective teaching planning and referral to interdisciplinary diagnosis when these students do not respond to specific interventions in the teaching of reading and writing (Wadlington & Wadlington, 2005; Snowling & Hulme, 2013; Washburn et al., 2016). We emphasize that, in Brazil, the interdisciplinary diagnostic service, for the most part, is composed of speech Language Pathologist, Neurologists and Psychologists, with the rare participation of teachers.

Nevertheless, the role of the teacher is extremely important, especially with regard to the understanding of school difficulties, but going beyond, when we think of their work with students with dyslexia in the school context. According to Rohde, Barbosa, Tramontina, & Polanczyk (2000), interventions in the school environment are very important and, in this

sense, teachers should be guided and have knowledge about the special needs of these students to plan effective teaching strategies.

Knowledge about dyslexia, its manifestations and specific interventions are essential to ensure that these students have an adequate academic and socio-emotional development, and this can certainly be a facilitator of the academic learning process.

Stefanini and Cruz (2006) posited that it is important that teachers have a deeper knowledge about the causes of the students' learning problems and, even more, reflect especially on those that depend specifically on them, as teachers.

A study of Pereira, Siqueira and Alves (2011) aimed to investigate the practical-theoretical knowledge about developmental dyslexia of educators from public and private networks showed that most of them had knowledge about dyslexia, which allowed them to correctly identify the concept, its main characteristics, and its causes, thereby revealing that despite having formative knowledge about developmental dyslexia, the interviewed educators often sought to improve, through diverse sources of information. For the authors, these results reinforced the need for continuity of guidance programs in schools, incentives for the continuing education of teachers.

Likewise, in order to investigate the conceptions of elementary school teachers about school difficulties, learning disorders and dyslexia, Gonçalves and Crenitte (2014) conducted a study with 31 elementary school teachers from a city in the interior of the state of São Paulo. The results showed, in general, that the participating teachers demonstrated difficulties with defining the disorders, assigning their causes, and scoring their manifestations. When teachers were separated by type of school, public or private, and according to prior knowledge on the subject, no statistically significant difference was observed in most responses, which allowed the authors to conclude that the teachers in this study had a lack in their conceptual repertoire regarding school difficulties, learning disorders and dyslexia, and therefore needed guidance in relation to effective work with these students.

From the results of the studies presented above, it is possible to observe that there is a divergence of findings when it comes to the teacher's knowledge about dyslexia and its manifestations and this can be explained by the fact that training courses on this topic are not mandatory, since dyslexia is not configured within Brazil's National Special Education Policy (NSEP) agenda.

According to the NSEP's Perspective of Inclusive Education (Brazil, 2008), students with diagnoses of intellectual disability and/or autism spectrum disorder are part of the group that make up the conditions of Special Educational Needs, hence served by special education, but this group excludes students with dyslexia and students with attention deficit hyperactivity disorder (ADHD).

This is a point of reflection about Brazilian education. According to Lombardi et al., (2016) Inclusive Education has not occurred satisfactorily in Brazil because only a target audience is being contemplated with the resources defined by the Ministry of Education and Culture (MEC). The authors also pointed out that the citation in the MEC document of some clinical conditions such as dyslexia and Attention-Deficit/Hyperactivity Disorder (ADHD) is not clear, leaving scope for different interpretations (Lombardi & Mendes, 2013).

Buzetti, Giaconi, Del Bianco, & Capellini (2021) also stated that because students with dyslexia and ADHD present persistent learning barriers throughout their academic life, actions by the school team are necessary in order to share strategies that aim to facilitate their transition process through academic life and minimize the difficulties that occur during this teaching-learning process. These aspects reinforce the need for teachers to understand dyslexia

3. OBJECTIVE

To characterize the opinions of teachers of dyslexic schoolchildren, using a specific questionnaire on learning skills.

4. METHODS

This study was approved by the Research Ethics Committee at São Paulo State University “Júlio de Mesquita Filho” (UNESP), Marília, São Paulo, Brazil, under protocol nº 957.998.

A total of 74 teachers of schoolchildren with an interdisciplinary diagnosis of dyslexia participated in this study. The students were of both sexes, aged 9 years to 10 years and 11 months and from the 3rd to 5th year of Elementary School I.

As the teachers are not part of the diagnostic team, they were invited to answer a questionnaire, which aims to characterize the academic performance of students with learning complaints, from the teachers' point of view. For ethical reasons, teachers had their personal information kept confidential.

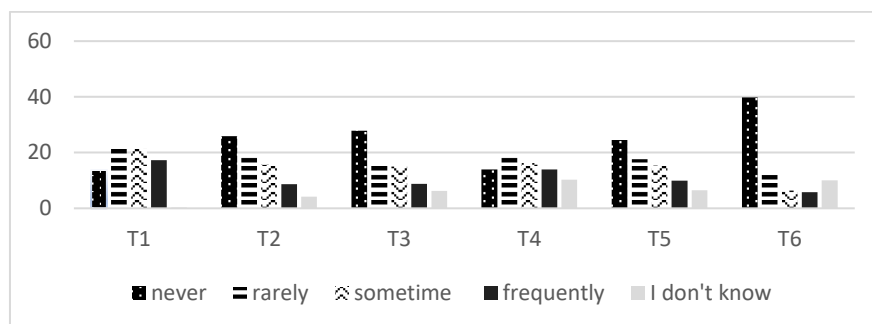
The teachers answered the Learning Skills Questionnaire (Capellini, Giaconi, & Germano, 2016), comprising six items: 1) attention skills (e.g., difficulty maintaining attention while performing school activities); 2) visual processing skills (e.g., difficulty copying drawings, shapes, and letters from a blackboard or book); 3) auditory processing skills (e.g., speech developmental delay); 4) logical-mathematical reasoning skills (e.g., difficulty in doing mathematical calculations); 5) motor skills (e.g., difficulty in fine or gross motor skills); and 6) behavioral skills (e.g., presence of agitated behavior in the classroom and at home). The questionnaire was completed by the teachers, without influence from the researcher, and the answers were marked on a scale of 0 to 4 points (Likert Scale), according to the possible responses of the instrument, namely “I don’t know”, “never”, “rarely”, “sometimes”, and “frequently”.

Data for this study were collected from March 2019 to March 2020 and therefore prior to Covid-19 pandemic in Brazil.

5. RESULTS

The results were statistically analyzed using the Statistical Package for Social Sciences, version 22.0. The significance level was set at 5%. Graph 1 indicates the mean of the distribution of the teachers' opinion in relation to each category, with the application of the Chi-Square test, all with statistically significant results (Graph 1).

Graph 1.
Distribution of frequencies of teachers' opinions for each category of the Questionnaire.
Chi-Square Test ($p < 0.05$).



According to the categories of questionnaire responses, it was possible to observe in Graph 1 that teachers responded “rarely” and “sometimes” for all categories, except for category 6 (behavioral), where most responses were “never”.

That is, teachers responded that they rarely or sometimes noticed that students with dyslexia had difficulties in attention skills, visual processing skills, auditory processing skill, logical-mathematical reasoning skills and motor skills.

There was also an indication of “I don't know” for all categories, suggesting that the skills present and investigated in the questionnaire are unknown to the teachers as a measure for analysis of their dyslexic students’ behavior.

6. DISCUSSION

A study (Dilnot, Hamilton, Maughan, & Snowling, 2017) carried out with parents and teachers indicated that the teachers' responses proved to be a strong predictor for the identification of difficulties in academic performance, since it demonstrated complaints regarding visual, auditory processing, logical-mathematical reasoning had a greater impact than other skills within the educational context. Our findings revealed that auditory and visual processing impairments were related to dyslexic schoolchildren (Snowling, Gooch, McArthur, & Hulme, 2018; Carroll, Mundy, & Cunningham, 2014).

Furthermore, a study (Verhulst, Koot, & Van der Ende, 1994) showed that speech, language, auditory and visual processing skills are closely associated with literacy, and dyslexics tend to present deficits in these areas since early childhood education, with a greater impact in the first years of literacy.

Among the findings of this study are dyslexic children’s failures in auditory and visual processing skills identified by teachers, which can be the cause of these schoolchildren's reading problems (Verhulst et al., 1994; Snowling et al., 2018; Capellini et al., 2016).

In addition, the literature (Carroll et al., 2014) describes that speech, language, auditory and visual processing skills are closely associated with literacy and that dyslexic children tend to present deficits in each of these areas since the preschool years, with a greater impact on the first years of literacy.

The results of this study show that the learning skills investigated in the questionnaire are not unknown by teachers, but there is no specific training for them about the observation of these skills in the context of the academic learning of dyslexic students. As posited by

Wadlington and Wadlington (2005) and Washburn et al. (2016), teachers' specific knowledge about what are the difficulties of dyslexic students is necessary so that the latter can be assisted in their development of reading and writing.

For a real inclusion of students with dyslexia, it is necessary to train teachers to understand the manifestations of dyslexia in the context of learning to read and write. Only in this way will it be possible to minimize the distortions that occur in the conception of dyslexia by teachers, as well as choose effective interventional strategies for teaching-learning, as proposed by Rohde et al. (2000).

The fact that students with dyslexia are not included as the target audience of Inclusive Education in Brazil, as reported in studies (Buzetti et al., 2021; Lombardi & Mendes, 2013; Lombardi et al., 2016), compromises the development of specialized training actions for basic education teachers. Consequently, teachers are not aware of early signs, manifestations, and educational and social behaviors of this population, which can be applied to the learning skills involved in the teaching-learning process, as presented in the results of this study.

However, it is necessary to highlight that the learning difficulties of the population of dyslexic schoolchildren is not indifferent to teachers. There are many doubts and anxieties on their part in relation to their performance with this specific learning disorder, as highlighted by Costa et al. (2013) and Lara, Tanamachi, and Lopes (2006). What is lacking is specific training or capacity-building to plan efficient educational strategies for the full development of reading and writing in the classroom, which was also highlighted by Pereira et al. (2011), and Gonçalves and Crenitte (2014).

7. FUTURE RESEARCH DIRECTIONS

As future implications, the results of this study indicate the need to propose training courses for teachers, with the aim that they better understand the performance of students with dyslexia and, thus, propose specific educational interventions in the classroom.

8. CONCLUSION

The results of this study allowed us to conclude that elementary school teachers of dyslexic students need clarification about the real difficulties presented by this population regarding learning skills, which was shown by the constant presence of the answers "rarely" and "sometimes" in all categories of academic learning skills.

It is important to highlight that these findings suggest a lack of support from Brazilian educational public policies guiding teachers to identify difficulties in learning skills.

Only by means of training and capacity-building courses with specific guidance about the characteristics and manifestations of dyslexic students in the classroom will it be possible to guarantee a better quality of educational life for these students.

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REFERENCES

- American Academy of Pediatrics. (2009). Joint statement-learning disabilities, dyslexia, and vision. *Pediatrics*, *124*(2), 837-44. <https://doi.org/10.1542/peds.2009-1445>
- American Psychiatric Association. (2014). Diagnostic and statistical manual of mental disorders (DSM-5®). American Psychiatric Pub.
- Brazil (2008). National Policy on Special Education from the perspective of Inclusive Education. (2008). Brasília: MEC/SEESP, 2008. Decree No. 6571, of September 17, 2008
- Bucci, M. P., Brémond-Gignac, D., & Kapoula, Z. (2008). Latency of saccades and vergence eye movements in dyslexic children. *Experimental Brain Research*, *188*(1), 1-12. <https://doi.org/10.1007/s00221-008-1345-5>
- Buzetti, M.C., Giaconi, C., Del Bianco, N., & Capellini, S.A. (2021). *Inclusion of students with neurodevelopmental disorders in the Brazilian reality*. In Mathylde, A.S.; Capovilla, F.C., Jalmiris, R.O.R.S., & Neves, L.M. (Org.). Paths of Learning and Inclusion: weaving multiple knowledges (v. 3, p. 157-163) Belo Horizonte: MG: ed Artesã.
- Capellini, S. A., Giaconi, C., & Germano, G. D. (2016). Parents and teachers opinion about learning skills: Comparison between Brazilian and Italian dyslexic's students. *Dyslexia: Perspectives, Challenges and Treatment Options*, 91-98. NovaPublisher.
- Carroll, J. M., Mundy, I. R., & Cunningham, A. J. (2014). The roles of family history of dyslexia, language, speech production and phonological processing in predicting literacy progress. *Developmental science*, *17*(5), 727-742. <https://doi.org/10.1111/desc.12153>
- Costa, J. P. F., Júnior, A. B. T., dos Santos, H. M. P., Mateus, Y., de Albuquerque, L., Nascimento, B. B. T., & Silva, G. E. D. S. M. (2013). Level of knowledge of teachers from public and private schools about dyslexia. *XII Journey of Teaching, Research and Extension - JEPEX 2013 - UFRPE*: Recife, December 9 to 13, 2013.
- Dilnot, J., Hamilton, L., Maughan, B., & Snowling, M. J. (2017). Child and environmental risk factors predicting readiness for learning in children at high risk of dyslexia. *Development and psychopathology*, *29*(1), 235-244. <https://doi.org/10.1017/S0954579416000134>
- Facoetti, A., Lorusso, M. L., Paganoni, P., Cattaneo, C., Galli, R., Umilta, C., & Mascetti, G. G. (2003). Auditory and visual automatic attention deficits in developmental dyslexia. *Cognitive brain research*, *16*(2), 185-191. [https://doi.org/10.1016/S0926-6410\(02\)00270-7](https://doi.org/10.1016/S0926-6410(02)00270-7)
- Fawcett, A. J., & Nicolson, R. I. (1999). Performance of dyslexic children on cerebellar and cognitive tests. *Journal of motor behavior*, *31*(1), 68-78. <https://doi.org/10.1080/00222899909601892>
- Fletcher, J. M. (2009). Dyslexia: The evolution of a scientific concept. *Journal of the International Neuropsychological Society*, *15*(4), 501-508. <https://doi.org/10.1017/S1355617709090900>
- Galaburda, A. M., & Cestnick, L. (2003). Dislexia del desarrollo. *Revista de neurología*, *36*(1), 3-9. <https://doi.org/10.33588/rn.36S1.2003068>
- Gonçalves, T.S., & Crenitte, P.A.P. (2014). Conceptions of elementary school teachers about learning disorders. *Revista CEFAC*, *16*, 817-829. <https://doi.org/10.1590/1982-0216201427312>
- Lara, A.F.L., Tanamachi, E.R., & Lopes Jr., J. (2006). Development and learning conceptions regarding teacher's work. *Psicologia em Estudo*, *11*, 473-482. <http://dx.doi.org/10.1590/S1413-73722006000300003>
- Lombardi, A. B., & Mendes, A.O. (2013). *The child and the school: health promotion and the approach to school difficulties*. In Leão, E. et al. (Ed.), *Ambulatory Pediatrics* (5. ed., pp. 253-268). Belo Horizonte: Coopmed.
- Lombardi, A. B., Oliveira, A. E. F., de Souza, B. E., de Lima, B. L. G., Barbosa, C. T., Silva, D. R., Montoro, M. A., & Darwich Filho, R. Z. (2016). The inconsistencies in the legislation on specialized educational assistance: an observation that demands interdisciplinary and intersectoral attention of the education and health. *Polêm!ca*, *16*(4), 001-013. <https://doi.org/10.12957/polemica.2016.26430>
- Mody, M., Studdert-Kennedy, M., & Brady, S. (1997). Speech perception deficits in poor readers: Auditory processing or phonological coding? *Journal of experimental child psychology*, *64*(2), 199-231. <https://doi.org/10.1006/jecp.1996.2343>

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- Norton, E. S., Beach, S. D., & Gabrieli, J. D. (2015). Neurobiology of dyslexia. *Current opinion in neurobiology*, 30, 73-78. <https://doi.org/10.1016/j.conb.2014.09.007>
- Pereira, L. V., Siqueira, C. M., & Alves, L. M. (2011). Investigative study on the knowledge of dyslexia in educators from public and private schools in the cities of Belo Horizonte and Nova Lima. *Revista Tecer*, 4(6), 26-40
- Ramus, F., Rosen, S., Dakin, S. C., Day, B. L., Castellote, J. M., White, S., & Frith, U. (2003). Theories of developmental dyslexia: insights from a multiple case study of dyslexic adults. *Brain*, 126(4), 841-865. <https://doi.org/10.1093/brain/awg07>
- Reid, G. (2016). *Dyslexia: A practitioner's handbook*. (4th ed.) Hoboken, NJ, USA: John Wiley & Sons.
- Rohde, L. A., Barbosa, G., Tramontina, S., & Polanczyk, G. (2000). Attention deficit/hyperactivity disorder. *Brazilian Journal of Psychiatry*, 22, 07-11. <https://doi.org/10.1590/S1516-44462000000600003>
- Snowling, M. J., Gooch, D., McArthur, G., & Hulme, C. (2018). Language skills, but not frequency discrimination, predict reading skills in children at risk of dyslexia. *Psychological science*, 29(8), 1270-1282. <https://doi.org/10.1177/0956797618763090>
- Snowling, M.J., & Hulme, C. (2013). *A ciência da leitura*. Porto Alegre: Penso Editora.
- Stefanini, M.C., & Cruz, S.A. B. (2006). Learning Difficulties and their causes: the look of the teacher from 1st to 4th grades of Elementary School. *Educação*, 29(1).
- Tallal, P. (1980). Auditory temporal perception, phonics, and reading disabilities in children. *Brain and language*, 9(2), 182-198. [https://doi.org/10.1016/0093-934x\(80\)90139-x](https://doi.org/10.1016/0093-934x(80)90139-x)
- Vellutino, F. R., Fletcher, J. M., Snowling, M. J., & Scanlon, D. M. (2004). Specific reading disability (dyslexia): What have we learned in the past four decades? *Journal of child psychology and psychiatry*, 45(1), 2-40. <https://doi.org/10.1046/j.0021-9630.2003.00305.x>
- Verhulst, F. C., Koot, H. M., & Van der Ende, J. (1994). Differential predictive value of parents' and teachers' reports of children's problem behaviors: A longitudinal study. *Journal of abnormal child psychology*, 22(5), 531-546. <https://doi.org/10.1007/BF02168936>
- Washburn, E. K., Binks-Cantrell, E. S., Joshi, R., Martin-Chang, S., & Arrow, A. (2016). Preservice teacher knowledge of basic language constructs in Canada, England, New Zealand, and the USA. *Annals of dyslexia*, 66(1), 7-26. <https://doi.org/10.1007/s11881-015-0115-x>
- Wadlington, E. M., & Wadlington, P. L. (2005). What educators really believe about dyslexia. *Reading Improvement*, 42(1), 16-33.
- Ziegler, J. C., Castel, C., Pech-Georgel, C., George, F., Alario, F. X., & Perry, C. (2008). Developmental dyslexia and the dual route model of reading: Simulating individual differences and subtypes. *Cognition*, 107(1), 151-178. <https://doi.org/10.1016/j.cognition.2007.09.004>

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Chapter # 14

THE APPLICATION OF KNOWLEDGE MANAGEMENT IN THE TEACHING OF TRANSLATION IN UNIVERSITIES

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ABSTRACT

With the development of information technology, the universities are faced with an increasing need to integrate the knowledge management in their translation teaching, to form students' integral translation abilities and better the teaching efficiency. This research first makes a literature review on the knowledge management and the translation teaching. Then, we discuss the traditional translation teaching in universities and formulates the teaching model of knowledge management for translators', which includes the curriculum design, the search, identification and acquisition of information, the organization of information and the creation of personal knowledge bank, as well as the application of knowledge bank in the practical translation tasks.

Keywords: knowledge management, translation teaching, competence formation, workshop teaching.

1. INTRODUCTION

In the era of big data, the rich Internet platforms provide large amounts of information for the translators; meanwhile, due to the information resources of the sea, the overall body of the knowledge tremendous, so the knowledge management in translation is indispensable. The formation of translators in universities is also beginning to show new features with the fast development of technology and information. The texts to be translated contain large amounts of rapid-changing information. Moreover, the content is of wide range of coverage, and is more professional, more complex and more difficult to translate. Thus, the universities should explore new ways, like integrating knowledge management (KM) in translation teaching, to broaden the knowledge, form students' ability to use computer assisted tools and make them informed of up-to-date information.

2. KNOWLEDGE MANAGEMENT AND TRANSLATION TEACHING: A BRIEF LITERATURE REVIEW

Knowledge is the key resource of the information age. The term "knowledge management" is used to describe everything from the application of new technology to the broader endeavor of harnessing the intellectual capital of an organization. (Sallis & Gary, 2012) KM has gained popularity in both the business and education arenas, and advances in information technology have served to assist in developing and implementing KM strategies.

Making a distinction between two different but important types of knowledge is crucial to KM, and to using knowledge effectively in the organizational context. The two types of knowledge are generally known as explicit and tacit knowledge. (Serban & Luan, 2002) Explicit knowledge is documented information that can facilitate action. This type of

knowledge is easy to articulate, write down, and share. Because explicit knowledge is the knowledge that can be most easily articulated and transmitted, it is sometimes called codified or declarative knowledge, with translation related examples including language and grammar rules, terminologies, reference material, legal requirements, contact and industry information, and documented information on the subject matter. Tacit knowledge is know-how and learning embedded within the minds of the people in an organization. It involves perceptions, insights, experiences, and craftsmanship. Tacit knowledge is personally and socially embedded. Translation related examples here include being able to grasp the context of the target communication situations, understanding meanings behind source text utterances and being able to make intuitive decisions in text production. (Risku, 2013)

Thus, based on the basic concepts of KM and our objective of integrating KM in the formation of translators' competence, referring to the definition formulated by Davenport, DeLong, and Beers (1998) and Galbreath (2000), we define "Knowledge management" as following: knowledge management combines the processes and application of technological tools to digitize and store, and make universally available, via electronic networks, the ongoing creation and transference of knowledge and wisdom. The knowledge to be managed includes both explicit, documented knowledge, and tacit, subjective knowledge.

Ditlevsen & Kastberg (2009) first introduced the personal knowledge management in translation teaching, and later formulated six rudimentary phases of the knowledge management approach, which are identify, acquire, evaluate, organize, apply, optimize the knowledge. Niu and Wang (2013), based on Dalkier's comprehensive knowledge cycle management model, taking translation technology majors of British universities as an example, analyzes the guiding significance and actual effects of the KM in translation teaching in teaching-research compound institutions. Chen (2018) uses the knowledge management competency model to rank the hierarchy of professional translator's competences according to their importance, and revises the translator's translation terminology competence model, to provide suggestions for terminology teaching and the translator's self-evaluation. Mu, Tian and Yang (2018) formulates the Knowledge Management Model for Online Translation Learning, discussing especially the Tag-Word-Based Network of Knowledge Management Model. Zhao (2019) proposes the personal knowledge management (PKM) teaching method combining the personal KM theory with the translation technology in the Internet age. Zhao also gives the specific implementation steps of PKM in the cultivation of patent translation talents.

Based on the former studies, our research intends to combine the PKM theory of Ditlevsen and Kastberg (2009) and Kastberg (2009) with the perspective of the translation teaching of teachers and integrates the new technologies, in order to discuss the application and integration of KM in the translation teaching in universities.

3. TRANSLATION TEACHING IN UNIVERSITIES

In China, the translation teaching for university students has three major objectives: present the nature, the form, the basic concepts and the cognitive process of the translation; cultivate the ability of bilingual thinking and master the basic techniques and strategies of translating; realize the dual responsibility of technical training and better the Chinese language and foreign language level.

Nowadays, with the development of the internet technology and the information age, our time is entering the era of knowledge economy from the era of industrial economy. The fundamental reason for the development of education informatization is that education must adapt to the changes in the production mode and lifestyle of the whole society. In this

context, the translation teaching in the universities is beginning to show new features. Firstly, the text contains large amounts of rapidly changing information. We are now in a world which is fast-changing, thus the translation materials also contain information that concerns new technology, up-to-date news, new forms of economy and new relations of collaboration. All these information need a scientific form of knowledge management and a wide range of domain of knowledge for translators. Moreover, the content is of wide range of coverage, and is more professional, more complicated and more difficult to translate. It's common that nowadays translators receive translation tasks like professional academic reports, formal political discourses or political documents, documents or contracts in areas such as chemical industry, construction, artificial intelligence, etc. These also require that the translators' domain the information search skills, computer assisted tools and skilled techniques of sentence reconstruction, in order to complete the translation tasks. Thus, the universities should explore new ways in their translation teaching in order to broaden the knowledge, form students' ability to use computer assisted tools and make them informed of up-to-date information.

This context also requires that universities help to form more professional and integral translators' competencies, in regarding of which, our research follows the translation competence model of PACTE (2003). PACTE starts from the concept of translation as a communicative activity directed towards achieving aims that involves making decisions and solving problems, and requires expert knowledge, like any other activity with these characteristics. According to PACTE, translation competence consists of the ability to carry out the transfer process from the comprehension of the source text to the re-expression of the target text, taking into account the purpose of the translation and the characteristics of the target text readers. It is made up of five sub-competencies:

- **The bilingual sub-competence.** In other words, the translators should have the ability to communicate between the source language and the target language. This sub-competence is made up of pragmatic, socio-linguistic, textual, grammatical and lexical knowledge in the two languages.
- **Extra-linguistic sub-competence.** Predominantly declarative knowledge, both implicit and explicit, concern the world in general and special areas. It includes: (1) bicultural knowledge (about the source and target cultures); (2) encyclopaedic knowledge (about the world in general); (3) subject knowledge (in special areas).
- **Knowledge about translation sub-competence.** Predominantly declarative knowledge, both implicit and explicit, about what translation is and what are the aspects of the profession. It includes: (1) knowledge about how translation functions: types of translation units, processes required, methods and procedures used (strategies and techniques), and types of problems; (2) knowledge related to professional translation practice: knowledge of the work market (different types of briefs, clients and audiences, etc.).
- **Instrumental sub-competence.** Predominantly procedural knowledge related to the use of documentation sources and information and communication technologies applied to translation: dictionaries of all kinds, encyclopedia, grammars, style books, parallel texts, electronic corpora, searchers, etc.
- **Strategic sub-competence.** Procedural knowledge to guarantee the efficiency of the translation process and solve the problems encountered. This is an essential sub-competence that affects all the others and causes inter-relations amongst them because it controls the translation process. Its functions are: (1) to plan the process and carry out the translation project (choice of the most adequate method); (2) to evaluate the process and the partial results obtained in relation to the final purpose; (3) to activate

the different sub-competencies and compensate for deficiencies in them; (4) to identify translation problems and apply procedures to solve them.

The PACTE translation competence model shows the competences that need to be formed for university students of translation specialty. As we can see from the content above, translators frequently need to be able to translate in a wide range of domains, of large quantity of information and need to be capable of using different instruments and know about the subject matter, therefore, the KM can play an important role in the formation of translators' competence and in the elevation of translating efficiency. In the next section, we will discuss how to form translators' competence based on KM.

4. APPLICATION OF KNOWLEDGE MANAGEMENT IN TRANSLATION TEACHING IN UNIVERSITIES

The KM perspective for translation teaching and learning is different from the traditional form of teaching in many ways. In the traditional form of teaching, the focus is on the teaching material and content, the teacher is the knowledge source while the students only receive the knowledge from the teachers, the curriculum design centers on the process of teaching and students learn from the technology. Meanwhile, with the integration of KM, the teaching focuses on the students and the teachers serve as mentors; the curriculum design focuses on the learning environment and the students learn with the technology as a tool. In the translation teaching with the integration of KM, teachers not only need to help students to use information technology to obtain information with efficiency, but also train them to learn how to quickly systematize this information to solve practical translation problems. Moreover, it is important to mention that PKM is not taught as a separate and/or additional course but as an integrated part of the translation teaching and exercises.

4.1. Curriculum design

The constructivism emphasizes on the design of the teaching environment instead of on the design of teaching process. So, the very first step to implement the integration of KM in translation teaching is to design an environment favorable for the students' research, learning, and capability development. Based on the theory of Chen (2007), we think that the curriculum design includes the design of the learning environment, the assignment, the resources and the instruments.

Table 1.
Curriculum design of translation teaching based on knowledge management.

DESIGN ELEMENTS	CONTENT
assignment design	translation project as translation assignment
environment design	the knowledge supply based on the environment and its acquisition
resources design	the teaching strategies, the knowledge repositories
instrument design	instrument of computer assisted translation, instrument of knowledge management and evaluation, instrument of acquisition of information and instrument of cooperation

In the curriculum design, we use the "workshop" mode. The translation teaching is based on translation projects with the purpose to motivate the students' ability of creation, research and cooperation. The environment design means creating the knowledge supply

based on the environment and its acquisition. The resource design is to offer the students the translation cases, the necessary tool and information bank in order to acquire knowledge and solve problems. The instrument design is to teach students to use computer assisted translation platforms and other software, the information search engines, the concept map etc., to realize the personal knowledge management.

Let's take an example of the translation teaching of the theme "information technology". To determine the teaching process, the teacher needs to design, first of all, a translation task about this theme. So, the teacher finds the technical reports presented on "The 10th China Information Technology Expo" and gives it to the students, asking them to form groups and translate the report from Chinese to Spanish, with the aim of forming the students to translate and cooperate as professional translators. The students firstly assign different tasks within the group, search the background information, create the terminology list, uniform the expression style, and choose the computer assisted translation platform. Then they follow the professional translation process of pre-translation, translation, first revision, second revision, edition, and quality check. During this process, the students need to use the knowledge management techniques that we will discuss in detail in the following sections. The practice is also accompanied with the direction and communication with the teacher, who serve as a guide or a consultant, rather than a narrator who dictates knowledge in the traditional classroom.

4.2. Search, identification and acquisition of information

The search, identification and acquisition of information consist of the first three phases formulated by Kastberg (2009). When teachers give the students an assignment of translation, they need to guide them to acknowledge, recognize and identify the personal information deficit with respect to the assignment at hand, which includes the terminology, the subject matter, the deficiency in the use of translation strategies, etc. Students can use a series of instruments to search and acquire the information they need: search engines like Google, Baidu, Yahoo; database like Scopus, Google scholar, Springer, CNKI; online dictionaries like Dictionary by Merriam-Webster, Collins Online Dictionary for English, and Xinhua Dictionary for Chinese; online open courses such as MOOC, Coursera, edX; online encyclopedias such as large Encyclopedia Britannica, Bing Encyclopedia, Interactive Encyclopedia, Wikipedia; community question and answer sites, such as Zhihu¹, Yahoo Knowledge, Quora, Stack Overflow, etc.

Teachers should offer all these resources to the students, teach them the instructions and, most important of all, guide them to evaluate and select the information carriers which are relevant to them, in order to accomplish the assignment as a professional translator.

4.3. Organization of the knowledge and the creation of personal knowledge bank

With the information identified and collected, the students need to organize the knowledge, and to enrich their personal knowledge bank. In these phases, the students are also faced with difficult tasks such as how to organize the large amounts of knowledge which are not familiar to them, how to select the appropriate solution of the target language when the new acquired knowledge are still fragmented, and how to form an efficient knowledge management procedure in order to accomplish the text revision task after the translation. To solve these problems, a series of instruments are necessary. Risku, Dickinson, and Pircher

¹Official website: <https://www.zhihu.com/signin?next=%2F>

(2010) identify different KM tools and instruments for these forms of knowledge in a translation context. The management of explicit knowledge is supported by various instruments and methods, like glossaries, translation memories, style guides, newsletters, handbooks, websites, knowledge portals, topic maps, customer relationship management tools, and project management tools. The non-codifiable, tacit aspects of translation are supported by personal experience of different communication situations, such as mailing lists, online communities, translator associations, courses and collaboration tools, but also by taking part in mentoring and storytelling projects.

The teachers need to guide the students to select the appropriate instrument to solve the translation problems and form their competence at the same time. The personal space of online dictionaries and terminology application such as SDL Trados and memoQ can register the new words and terminology of the students, which is an effective way to enrich the vocabulary of the translators and better their bilingual competence. The concept map and knowledge repositories can help the students to manage different subject matter, open their horizon and form their extralinguistic competence. The translation project management tools offer the students a space for group cooperation and problem-solving practices, to form their strategic sub-competence. KM applications such as OneNote or MarginNote can help the students to record and analyze the information of translation theory and techniques, which form their know-about competence.

4.4. Application of personal knowledge bank in the practical translation task

With the personal knowledge bank created, the students are now formed with the knowledge base, and what is required now is to internalize the knowledge bank into personal domain and use it in the translation task. Thus, this phase is more practical and needs the students to unleash and integrate their capability of knowledge domain, computer skills, and translation techniques.

For example, in the translation of the annual report of SINOPEC (China Petrochemical Corporation), the students can actively use their personal knowledge bank to search the annual report of SINOPEC or other petrochemical companies, as well as the terminology bank of petrochemical industry to assist the translation. Moreover, they can also choose the appropriate translation tool and form the translation group according to the characteristics and the needs of this translation material. In this way, the students can applicate and optimize their knowledge with the assistance of the KM technology and method.

5. CONCLUSION

In the information age, the integration of KM in translation teaching is necessary to help the students form translator competence and meet the increasing demand of the market for translators. In the present research, we exposed the basic concepts of KM as well as the application of KM in the translation teaching. We also discussed how to form translators' competence based on knowledge management from the teaching perspective and the learning perspective, namely, the curriculum design, the search, identification and acquisition of information, the organization of the knowledge and the creation of the personal knowledge bank, as well as the application of the knowledge bank in the practical translation tasks. In this process, the teachers should play the role of guide, while the students are the main participants of learning. The application of KM in the translation teaching has the following advantages. To begin with, it offers an integral perspective to form translators' ability, not only paying attention to the linguistic and translation abilities of the translators, but also focuses on their computer and technology ability and teamwork ability. Secondly, the

integration of knowledge management in the translation teaching also gives more autonomy to the students in their learning and working, making it possible that the translation learning is not only the acquisition of knowledge, but also a process of forming personal knowledge bank, learning to cooperate with others, and do the work actively and creatively. Thirdly, the integration of knowledge management in translation teaching is also useful in forming professional translators who satisfy the complicated need of the market in the information age.

REFERENCES

- Chen, J. (2007). 基于知识管理的教学设计 [The curriculum design based on the knowledge management]. *Distance Education in China*, (11), 38-41.
- Chen, L. (2018). 知识管理视域下译者术语能力研究 [Research on Translator's Terminology Competence from the Perspective of Knowledge Management]. *China Terminology*, 20(4), 14-18.
- Davenport, T.H., DeLong, D.W., & Beers, M.C. (1998). Successful knowledge management projects. *Sloan Management Review*, 39(2), 43-57.
- Ditlevsen, M. & Kastberg, P. (2009). Personal knowledge management. Knowledge mapping techniques in the training of LSP translators. *inTRAlinea Special Issue: Specialised Translation I*. Retrieved from <https://www.intraline.org/specials/article/1731>
- Galbreath, J. (2000). Knowledge management technology in education: An overview. *Educational Technology*, 40(5), 28-33.
- Kastberg, P. (2009). Personal knowledge management in the training of non-literary translators. *The Journal of Specialised Translation*, (11), 88-101. Retrieved from http://www.jostrans.org/issue11/art_kastberg.php
- Mu, Y., Tian, L., & Yang, W. (2018). Towards a Knowledge Management Model for Online Translation Learning. In Hao, T., Chen, W., Xie, H., Nadee, W., Lau, R. (Eds.), *Emerging Technologies for Education. SETE 2018. Lecture Notes in Computer Science* (Vol. 11284, pp. 198–207). Springer, Cham. https://doi.org/10.1007/978-3-030-03580-8_21
- Niu, J., & Wang, O. (2013). 基于知识管理模型的英国科技翻译与翻译技术专业分析 [A study of MSc in UK from perspective of integrated knowledge management cycle]. *Journal of Shaoguan University Natural Science*, 34(6), 108-112.
- PACTE (2003). Building a Translation Competence Model. In Alves, F. (Ed.). *Triangulating Translation: Perspectives in Process Oriented Research*. Amsterdam: John Benjamins Publishing. <https://doi.org/10.1075/btl.45.06pac>
- Risku, H. (2013). Knowledge management and translation. In Gambier, Y. & Doorslaer, L. (Eds.), *Handbook of translation studies* (pp. 92-97). Amsterdam/Philadelphia: John Benjamins Publishing.
- Risku, H., Dickinson, A., & Pircher, R. (2010). Knowledge in Translation Studies and translation practice: Intellectual capital in modern society. In Gile, D., Hansen, G., & Kocijancic-Pokorn, N. (Eds.). *Why Translation Studies Matters* (pp. 83–96). Amsterdam: John Benjamins Publishing.
- Sallis, E., & Gary, J. (2012). *Knowledge management in education*. Routledge. New York.
- Serban, A. M., & Luan, J. (2002). Overview of knowledge management. *New Directions for Institutional Research*, 113, 5–16. <https://doi.org/10.1002/ir.34>
- Zhao, Z. (2019). 译者个人知识管理(PKM)在专利翻译教学中的应用——基于大数据信息搜索与管理的教学设计 [Application of translator's personal knowledge management (PKM) in patent translation teaching: Instructional design based on big data information search and management]. *Technology Enhanced Foreign Language Education*. (189), 69-75.

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Chapter # 15

SCHOOLCHILDREN'S PERFORMANCE ON COGNITIVE-LINGUISTIC SKILLS DURING THE CONTEXT OF A PANDEMIC

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ABSTRACT

Aim: to characterize the performance of cognitive-linguistic skills of schoolchildren in early literacy during the pandemic. Twenty-two Brazilian schoolchildren participated in this preliminary study, distributed in GI, composed by ten schoolchildren for 1st grade and GII, composed by twelve schoolchildren for 2nd grade, submitted to the application of the Cognitive-Linguistic Skills Assessment Protocol. Results: schoolchildren from GI and GII showed average performance for writing the name, sequential alphabet recognition, and visual memory of shape. The GI presented a refusal response for the subtests of word, nonword and, picture dictation, word repetition and visual sequential memory of shapes and poor performance for alphabet recognition in random order and average performance for alphabet recognition in sequence. GII showed lower performance for the subtests of word, nonword and, picture dictation and superior performance for alphabet recognition in random order, alphabet in sequence and visual sequential memory of shapes. Discussion: the appropriation of the letter-sound relationship mechanism raises questions, since it evidenced the difficulty of all schoolchildren in cognitive-linguistic skills necessary for the full development of reading and writing. Conclusion: schoolchildren in the 1st and 2nd grade showed lower performance in cognitive-linguistic skills important for learning reading and writing.

Keywords: literacy, pandemic, learning, child development.

1. INTRODUCTION

COVID-19 spread rapidly around the world in 2020 and generated the unprecedented situation where 90% of the student population was being isolated worldwide (Arruda, 2020). In this pandemic scenario, social isolation was initiated as a measure of prevention and attenuation of the virus. Among these measures, in addition to the closing of many educational institutions, the suspension of in-person classes and remote teaching were implemented (Camacho, Joaquim, Menezes, & Sant'Anna, 2020).

Regarding remote learning, it was implemented on an emergency basis, that is, the schoolchildren would only return to the face-to-face format once the health crisis had been resolved or controlled, thus providing schoolchildren with temporary access to educational content in a way that minimizes effects of social isolation on their education and learning (Joye, Moreira, & Rocha, 2020).

Therefore, the aim of this study was to characterize the performance of cognitive-linguistic skills of schoolchildren in the initial stage of literacy during the pandemic.

2. BACKGROUND

The covid-19 pandemic made even more evident the discrepancies between the different realities experienced by young students, insofar as access to virtual classes with the use of more advanced digital tools and teachers trained for this practice were not equal or homogeneous in the public and private education systems (Joye, Moreira, & Rocha, 2020; Camacho, Joaquim, Menezes, & Sant'Anna, 2020; Nascimento, Ramos, Melo & Castioni, 2020).

Many were the challenges faced by the need for the realization of emergency remote teaching (Batista & Martins, 2021). Brought issues related to the limitations in the teaching process, in view of the new configurations in the family environment facing the study at home. They also elucidated how complex and difficult it was to contemplate the school curriculum during face-to-face classes and adjust such content to the family environment.

The repercussions of the pandemic on the academic learning of Brazilian schoolchildren are still inestimable, according to (Stolf et al., 2021; Santana, Capellini & Germano, 2022). Thus, professionals working in the field of education must be aware of the overlapping of learning difficulties in reading and writing, due to the lack of instructional teaching of the alphabetic basis of the Brazilian Portuguese writing system, added to the difficulties in the teaching-learning relationship imposed by the pandemic. Such aspects may imply in failures in the identification of possible diagnoses of learning problems, as well as in the understanding of normality parameters for the acquisition and development of reading and writing.

Hence, more than an educational problem, the blocking of access to school reconfigured the education system, society and, consequently, the performance of education speech language therapy and clinical their therapy clinic.

Based on the above, this study aimed to investigate whether the period of remote access education established during the pandemic compromised the development of cognitive-linguistic skills necessary for the full literacy of schoolchildren in the early literacy phase.

3. OBJECTIVE

To characterize the performance of cognitive-linguistic skills of schoolchildren in early literacy phases during the pandemic

4. METHODS

This study was approved by the Research Ethics Committee at Faculty of Philosophy and Sciences of the São Paulo State University – FFC/ UNESP, Marília, São Paulo, Brazil, under number 4.862.668.

The sample of the study was composed of 48 schoolchildren of both sexes, ranging in age from 6 to 7 years and 11 months, from the 1st and 2nd year of elementary school, with complaints about learning problems and referred by municipal public schools in the region of Marília-SP.

From the analysis of the performance of the schoolchildren it was verified that 26 could not read and write, so the number of participants was redefined to 22 schoolchildren, of both sexes, in the age group of 6 years to 7 years and 11 months of the 1st and 2nd year of elementary school, divided into two groups:

- Group I (GI): composed of 10 schoolchildren from the 1st year of Elementary School, 50% male and 50% female and;

Schoolchildren's performance on cognitive-linguistic skills during the context of a pandemic

- Group II (GII): composed of 12 schoolchildren from the 2nd year of Elementary School, 83.3% male and 16.7% female.

All schoolchildren were submitted to application of the collective and individual version of the Cognitive-Linguistic Skills Assessment Protocol for schoolchildren in the early phase of literacy (Silva & Capellini, 2019), consisting of the following tests: writing of the name, writing of the alphabet in sequence, copying of shapes, dictation of words and pseudowords or non-words, dictation of figures, dictation of numbers, recognition of the alphabet in sequence, recognition of the alphabet in random order, reading of words, reading of non-words, rhyme, alliteration, syllabic segmentation, discrimination of sounds, repetition of words, repetition of non-words, repetition of numbers in reverse order, fast automatic naming of figures, fast automatic naming of digits, visual memory of shapes.

The procedure of this study was applied in person and followed the Unesp guidelines to reorganize activities during the pandemic. Data analysis was performed using the Statistical Package for Social Sciences, version 25.0. The results were statistically analyzed at a significance level of 5% (0.05).

5. RESULTS

Table 1 shows there was a statistically significant difference between the study groups with the application of the Likelihood-Ratio Test.

In Table 1, it was possible to verify that the schoolchildren from GI and GII showed average performance for writing their name and writing the alphabet in sequence.

Table 1.
Frequency distribution of the performance classifications of schoolchildren from groups GI and GII in the Cognitive-Linguistic Skills Assessment Protocol. Likelihood-Ratio Test (p<0.05).

Subtests	Classification	G1		GII		p Value
		Freq.	%	Freq.	%	
WN	Refusal	0	0.00	0	0.00	0.036*
	Inferior	4	40.00	1	8.30	
	Average	6	60.00	6	50.00	
	Superior	0	0.00	5	41.70	
CS	Refusal	0	0.00	0	0.00	0.015*
	Inferior	4	40.00	0	0.00	
	Average	6	60.00	12	100.00	
	Superior	0	0.00	0	0.00	
WD	Refusal	7	70.00	2	16.70	0.027*
	Inferior	3	30.00	7	58.30	
	Average	0	0.00	3	25.00	
	Superior	0	0.00	0	0.00	
NWD	Refusal	7	70.00	2	16.70	0.036*
	Inferior	3	30.00	9	75.00	
	Average	0	0.00	1	8.30	
	Superior	0	0.00	0	0.00	
FD	Refusal	8	80.00	2	16.70	0.023*
	Inferior	2	20.00	6	50.00	
	Average	0	0.00	2	16.70	
	Superior	0	0.00	2	16.70	
RAS	Refusal	2	20.00	0	0.00	0.002*
	Inferior	3	30.00	0	0.00	
	Average	4	40.00	1	8.30	
	Superior	1	10.00	11	91.70	
RARO	Refusal	2	20.00	0	0.00	0.006*
	Inferior	4	40.00	0	0.00	
	Average	3	30.00	3	25.00	

RW	Superior	1	10.00	9	75.00	0.030*
	Refusal	5	50.00	0	0.00	
	Inferior	1	10.00	1	8.30	
	Average	3	30.00	5	41.70	
VMS	Superior	1	10.00	6	50.00	0.031*
	Refusal	5	50.00	0	0.00	
	Inferior	2	20.00	2	16.70	
	Average	2	20.00	5	41.70	
	Superior	1	10.00	5	41.70	

Caption: WN: writing name, CS: copy shapes, WD: word dictation, NWD: nonword dictation, ND: figure dictation, RAS: recognition of the alphabet in sequence, RARO: recognition of the alphabet in random order, RW: repeating words, VMS: visual memory for shapes.

Table 1 allows verifying that both GI and GII students presented average performance for writing the name and writing the alphabet in sequence. GI presented a refusal response for the subtests of word dictation, pseudowords dictation and figure dictation, word repetition and visual sequential memory of shapes, in addition to inferior performance for alphabet recognition in random order and average performance for alphabet recognition in sequence.

GII presented inferior performance for the subtests of word dictation, pseudowords dictation, and figure dictation, in addition to superior performance for alphabet recognition in random order, alphabet in sequence and visual sequential memory of shapes.

6. DISCUSSION

The process of reading and writing development process was already questionable before the pandemic occurred and widely debated before the pandemic due to the fact that current literacy methodologies in Brazil do not focus on the explicit teaching of the alphabetic and orthographic principle of the Portuguese Language (Pacheco & Hubmer, 2021). Now, in a virtual education system, issues related to the appropriation of knowledge of the letter-sound relationship mechanism bring questions and discussions, since, among the results of this study, it was possible to observe the difficulty of both 1st and 2nd graders with the cognitive-linguistic skills necessary for the full development of reading and writing in an alphabetic writing system such as Brazilian Portuguese.

Around the world, the pandemic has caused substantial changes in the most varied domains and the education sector was no exception. The current unprecedented situation has required a rapid transition from face-to-face teaching-learning to virtual education, now giving rise to a hybrid model.

The beginning of literacy, a phase in which the schoolchildren in this study found themselves, is an important period for the acquisition of cognitive-linguistic skills, considered predictors for the learning of reading and writing (Cunha & Capellini, 2010; Silva & Capellini, 2019; Santos & Capellini, 2020). Furthermore, any delays resulting from an inadequacy in the teaching of alphabetic and orthographic principle, that is, in teaching the letter-sound conversion mechanism, can trigger difficulties in the reading and writing of words.

In this study, we found that among the schoolchildren in the GI group there was a refusal response for the tasks of dictation and repetition of words and visual sequential memory of shapes and poor performance for alphabet recognition in random order. On the other hand, the schoolchildren from GII presented lower performance in the dictation tasks, showing that knowledge of the sequence of the letters of the alphabet for the two groups was not a guarantee of acquisition for the application of the alphabetic and orthographic principle at the time of writing.

When receiving schoolchildren with complaints of learning problems today, professionals in the clinical field, such as speech therapists and, educational speech language

pathologist should extend their considerations about complaints from their parents or teachers to include the context of exposure to teaching-learning situations and the consequences of its deprivation.

Thus, the repercussions on the academic learning of Brazilian schoolchildren are still invaluable because the problems of academic learning in the country are not recent, dating back to pre-Covid 19 times. Overlapping between reading-and-writing difficulties can have varied, distinct and perhaps incomparable repercussions.

The present study found that whereas among the students of the GI group there was a refusal response for the tasks of dictation and repetition of words and visual sequential memory of shape, as well as an inferior performance in the recognition of the alphabet in random order, GII students presented an inferior performance in the dictation tasks, evidencing that, for both groups, knowing the knowledge of the sequence of the alphabet letters, alone, did not ensure acquisition for applying the alphabetic and orthographic principle at the time of writing.

The results of this study indicate that health professionals, including speech therapists, should be prepared to establish an interface between health and education during the performance of their diagnostic and interventional clinical reasoning.

This is because, according to UNESCO, the natural decline in learning could expand for more than a decade without new public policies to invest in educational improvements (UNESCO, 2020). In other words, immediate improvement in distance learning is not enough thinking and rethinking public policies that represent the planning of recovery strategies for academic learning (Queiroz & Paula, 2021) have never been more urgent.

Furthermore, the alphabetizing teacher's lack of knowledge about the instructional teaching of the alphabetic and orthographic principles, allied with the lack of professionals such as educational speech therapists at school causes the teaching-learning relationship of schoolchildren in the initial phase of literacy to be at risk, since the lack of qualified and trained educators in the educational field, from the early identification of reading and writing problems in the classroom, can contribute to an educational planning which does not develop the strategies necessary for the acquisition and development of coding and decoding mechanisms of the writing system of the Portuguese language (Stolf et al., 2021, Santana, Capellini & Germano, 2022).

The data from this study remind us of the need to think, as clinical and educational speech therapists, that there is still much to be done for these schoolchildren. A literature review carried out by the authors (Almeida & Júnior, 2021) found 15 scientific articles in 2020 addressing the impacts of the pandemic on schoolchildren and observed a frequency of psychological and eating disorders and negative emotions in 40% of the articles, anxiety in 33%, depression in 26%; irritability, sedentary lifestyle and sleep disturbance was cited in 20% of the articles, stress and post-traumatic stress disorder in 6% of the articles.

The data collected in the aforementioned study are alarming because referrals to the speech therapy clinic will be carried out by the school and, if educational speech therapists are not able to conduct these referrals in a proper manner, most of these children will probably be misdiagnosed. However, it should also be considered that four of the articles in this study reported that the social and educational isolation suffered by the child population made it vulnerable to the occurrence of symptoms of lack of social contact, lack of need for social communication, inattention and hyperactivity besides anxiety, irritability, obsession, hostility and impulsivity, which can compromise memory formation for learning.

Based on the data found in the present study, we conclude this article by highlighting the need for clinical and/or educational speech therapists to act as guardians of the acquisition and development of school learning, assisting in the planning of specific actions to promote normal development and the detection of deviant processes of the teaching-learning process,

thus conquering an important space together with teachers and the educational staff. This space can be a forum for dialogue not only about the relevance of cognitive-linguistic skills for the development of academic learning, but also about child development milestones and predictors for literacy, so important to ensure the success of reading and writing of these students in the initial phase of literacy and so disregarded or not prioritized during the remote teaching-learning process during the COVID-19 pandemic.

7. FUTURE RESEARCH DIRECTIONS

Future studies need to be carried out with a larger sample, aiming to verify the impact of the pandemic on the development of reading and writing learning in the initial phase of literacy.

8. CONCLUSION

Schoolchildren in the initial phase of literacy in the 1st and 2nd years had lower performances in important cognitive-linguistic skills that are essential for the development and learning of reading and writing, with 1st year students also presenting a refusal response in several of those skills. They did not know how to perform the tasks requested probably because they were not literate enough and did not know how to use the cognitive-linguistic skills necessary to trigger the analysis and synthesis processes necessary for the formation of words for both reading and writing.

REFERENCES

- Almeida, I.M.G, & Júnior, A.A.S. (2021). The biopsychosocial impacts suffered by the child population during the COVID-19 pandemic. *Research, Society and Development*, 10(2), 1-10. <http://dx.doi.org/10.33448/rsd-v10i2.12286>
- Arruda, E.P. (2020). Educação Remota Emergencial: elementos para políticas públicas na educação brasileira em tempos de Covid-19 [EMERGENCY REMOTE EDUCATION: elements for public policies in Brazilian education in times of Covid-19]. *Em Rede - Revista de Educação à Distância*, 7(1), 257-275. <http://doi.org/10.53628/emrede.v7.1.621>
- Batista, F.A., & Martins, K.S.B.S. (2021). Pandemia e estudantes em casa: Currículo escolar e novas formas de aprendizagem dos estudantes no contexto de Parintins, AM [Pandemic and students at home: school curriculum and new forms of student learning in the context of Parintins, AM]. *Conjecturas*, 21(3), 142-168. <http://doi.org/10.53660/CONJ-101-120>
- Cunha, V.L.O., & Capellini, S.A. (2010). Análise psicolinguística e cognitivo-linguística das provas de habilidades metalinguísticas e leitura realizadas em escolares de 2^a a 5^a série [Psycholinguistic and cognitive-linguistic analysis of the metalinguistic skills and reading proofs in students from 2nd to 5th grades of elementary education]. *Revista Cefac*, 12(5), 772-783. <http://doi.org/10.1590/S1516-18462010005000017>
- Joye, C.R., Moreira, M.M., & Rocha, S.S.D. (2020). Distance Education or Emergency Remote Educational Activity: in search of the missing link of school education in times of COVID-19. *Research, Society and Development*, 9(7), 1-29. <http://doi.org/10.33448/rsd-v9i7.4299>
- Nascimento P.M, Ramos D.L, Melo A.A.S, & Castioni R. (2020). Acesso Domiciliar à Internet e Ensino Remoto Durante a Pandemia [Home Internet Access and Remote Learning during the Pandemic]. *Revista Multidisciplinar do Nordeste Mineiro*, 1(1), 1-14.
- Pacheco L.P, & Hubner L.C. (2021). Como o distanciamento social em tempos de pandemia desafia os estágios iniciais da aprendizagem da leitura em crianças [How social distancing in times of pandemic challenges the early stages of learning to read in children]. *Signo*, 46(85), 58-69. <https://doi.org/10.17058/signo.v46i85.15672>

- Queiroz M., Sousa F.G.A., & Paula G.Q. (2021). Educação e Pandemia: impactos na aprendizagem de alunos em alfabetização [Education and the Pandemic: impacts on student learning in literacy]. *Ensino em Perspectivas* 2(4), 1-9.
- Santana, M.G., Capellini, S.A., & Germano, G.D. (2022). Predictive reading skills in schoolchildren in the early years of literacy in times of pandemic. *Revista Ibero-Americana de Estudos em Educação*, 17(4), 2513-2525. <https://doi.org/10.21723/riaee.v17i4.16233>
- Santos, B., & Capellini, S.A. (2020). Programa de remediação com a nomeação rápida e leitura para escolares com dislexia: elaboração e significância clínica [Remediation program with rapid naming and reading for students with dyslexia: elaboration and clinical significance]. *CoDAS*, 32(3), 1-6. <http://doi.org/10.1590/2317-1782/20202018127>
- Silva, C., & Capellini, S.A. (2019). Indicadores cognitivo-linguístico em escolares com transtorno fonológico de risco para a dislexia [Cognitive-linguistic indicators in students with phonological disorder at risk for dyslexia]. *Distúrbios da Comunicação*, 31(3), 428-436. <http://doi.org/10.23925/2176-2724.2019v31i3p428-436>
- Silva C., & Capellini, S.A. (2019). Cognitive-linguistic skills assessment protocol for students in the initial literacy phase (1st ed.) Ribeirão Preto, SP: Booktoy.
- Stolf, M. T., Santos, N. L. D., D'Angelo, I., Del Bianco, N., Giacconi, C., & Capellini, S. A. (2021). Performance of early literacy students in cognitive-linguistic skills. *J Hum Growth Dev*. 31(3), 484-490. <https://doi.org/10.36311/jhgd.v31.12668>
- UNESCO. (2020, April 23). UNESCO's Futures of Education Commission calls for advance planning against rising inequalities following COVID-19. Paris: UNESCO. Retrieved from <https://www.unesco.org/pt/articles/comissao-futuros-da-educacao-da-unesco-apela-ao-planejamento-antecipado-contra-o-aumento-das>

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Chapter # 16

DESIGNING A CURRICULUM FOR SUPPORTING THE TRANSITION TO ADULT LIFE OF YOUNG INDIVIDUALS WITH INTELLECTUAL DISABILITIES

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ABSTRACT

Individuals with intellectual disabilities (ID) are faced with significant barriers relating to the transition to adult life and employment. The proposed chapter's purpose consists of presenting the results emerged by the project of research E-IDEAS (Empowerment of youth with Intellectual Disabilities through Educational and training curricula for Acquiring employment Skills). In particular, the curriculum developed for supporting the acquisition of independent living and employment skills and the consequent transition to adult life of young persons with ID. Starting from a systematic analysis of literature on the topic, the chapter highlights the elements emerged that were used to develop the curriculum. Besides the search findings that led to curriculum elaboration, it includes the description of the methodology adopted, learning contents, as well as teaching strategies and tools utilized. Lastly, the results achieved by participants who attended the curriculum are presented, its assessment discussed, and future research directions defined.

Keywords: curriculum, transition programs, independent living skills, employment skills, youths, intellectual disability.

1. INTRODUCTION

This chapter presents a specific curriculum for supporting the transition to adult life of young persons with intellectual Disabilities (ID). It intends to highlight the learning contents and teaching strategies adopted during the implementation of the intervention, developed in the framework of the research project E-IDEAS (founded by the charity RESPECT and the Programme Marie-Curie Actions) and carried out at National University of Ireland Galway, School of Psychology.

From the initial search analysis conducted before the design of the curriculum emerged that to date teaching and learning programs addressed to individuals with ID have focused almost exclusively on childhood and early interventions. The adolescents and young persons with ID are an under-studied population (Lai, Elliott, & Ouellette-Kuntz, 2016) and, even if in recent years some studies have been conducted on methodologies that prepare for adult life and favour social inclusion, little research has been conducted on detailed curricula for the acquisition of independent living or employment skills (McGlinchey, McCallion, Burke, Carroll, & McCarron, 2013; Gilson & Carter, 2016; Poppen, Lindstrom, Unruh, Khurana, & Bullis, 2017). In fact, the current situation is often characterized by special or mainstream schools with an outdated focus on caring for the individual, rather than promoting specific paths aimed to prepare individuals for an active and productive role in society (World Health Organisation, 2011).

In paragraph 1 the author summarizes the results of the research that analysed existing curricula, learning paths and transition programs from school to adult life addressed to youths

with ID. In paragraph 2 is presented the curriculum developed in the framework of E-IDEAS, its contents, structure, and features. Paragraph 3 reports the main finding of the intervention and some implication for practices. Lastly, paragraph 4 includes conclusions and limitations. The information reported in this chapter intend to be useful for designing and developing curricula to facilitate the transition from school to adult life of youths with ID, proving interesting elements to inspire care givers, educators and teachers that wish to enhance the acquisition of independent living and employment skills.

2. BACKGROUND

This chapter intends to highlight the importance of promoting better acquisition of independent living and employment skills and outcomes achievement for youth with ID. Employment is a crucial aspect of adult life (Wehman et al., 2014) and a primary aspiration for every individual. Being employed involves integrating into a social network, contributing to society, making choices and decisions. Employment promotes social status, self-esteem, financial independence, independent living, physical and psychological health, cognitive functioning, greater participation, and emancipation (Alevriadou & Lang, 2011). In fact, studies indicate that long-term quality of life correlates with successful employment (Joshi, Bouck, & Maeda, 2012). Moreover, the UN Convention on the Rights of Persons with Disabilities (UN, 2006), Article 27 recognizes the right of persons with disabilities to work on an equal basis with others.

There is a need to develop specific strategies and methods for transferring skills for adult life to youth with ID, also taking advantage of supports as information and assistive technology (ICT-AT) with educational and employment purposes (Wehmeyer et al., 2006). Successful independent life and employment satisfaction contribute to improving the general quality of life (Fleming, Fairweather, & Leahy, 2013). However, it is harder for persons with ID to gain and maintain autonomy or a meaningful job, as they are often affected by challenging factors such as low expectations, limited experience with social interactions, lack of social communication skills, inappropriate behaviours, and other factors (Smiley et al., 2007).

2.1. Initial search findings that led to curriculum elaboration

The aim of the initial search was to identify what curricula were empirically designed in the last decade for supporting the transition to adult life in order to define what elements were useful for design a successful learning program for acquiring independent living and employment skills. The method used to collect information was based on the systematic search of publications investigating transition programs from school to adult life and employment addressed to youths with ID. It was carried out using the PRISMA method (Evans, 2002; Cronin, Ryan, & Coughlan, 2008; Moher, Liberati, Tetzlaff, & Altman, 2009) and conducted to review the literature covering the period 2008 (from the entry into force of the UNCRPD) to 2020. This search focused on different databases (PsycINFO, CINHALL, Social & Behavior Science and ERIC). In addition, manual searches were conducted on specific journals (European Journal of Special Needs Education, Disability & Society, Journal of Intellectual and Developmental Disability and Equality, and Diversity and Inclusion: An International Journal) to identify suitable studies currently in press and not yet indexed in the databases considered.

The review process has identified 9979 records, then a titles review considering one or more keyword related to most important subjects for research (transition programs, employability skills, special education, students with disability and youths) led to 151 results. Abstracts review followed based on the inclusion criteria (see Appendix A), and 46 articles

were identified and subjected to full-text analysis. Forty-four were excluded after the quality assessment. Following the manual search, one record was included in the final sample, resulting in a total of three programs included in studies being selected. These presented an original empirical research design and outline a functional curriculum for acquiring employment and independent living skills including information and data on the achievement of more independence and paid jobs. The programs are:

1. Job coaching program¹.
2. Project SEARCH program².
3. Transition Service Program (TrP) at Montgomery County Public Schools³.

The programs reported have some common themes: use of a person-centred approach based on person's needs, provision of internships within community or in real life employment settings, and support of job coach during the internship. Also, the collaboration between educational environments, adult services and employers emerged as a successful factor for realizing experiences that help to acquire self-esteem, self-advocacy, and independence (Pascall & Hendey, 2004), besides the knowledge and competences to gain competitive employment. Other common features are the age of participants (18-21) and the use of intensive instruction for acquiring social, communication, and job skills.

In addition, the search identified 13 interventions for supporting the transition from school to adult life and work addressed to young adults with ID (reported in Appendix B). The evidence emerged through the analysis of the curricula, programs and projects identified and aimed to allow the acquisition of independent living and employment skills concerned mainly four aspects:

1. Curriculum with contents facilitating the acquisition of self-determination skills as independent living and job-related skills.
2. Chance to have real life work experiences through individualized internship.
3. Support provided by job coaches and technological solutions.
4. Transition programs anchored in community-based rather than school-based settings.

Another important aspect emerged through the analysis of literature searched and projects analysed is that youths with ID who participated in specific interventions for supporting the transition from school to adult life have better long-term employment outcomes than those who did not attend any transition program or specific intervention (Clodagh & Gleeson, 2017; Fleming et al., 2013; OECD, 2011; Green, Cleary, & Cannella-Malone, 2017).

Also, the search allowed to determinate, on the basis of literature analysed, what skills are important to transfer for improving the chances to have an independent life and a paid job.

The skills needed for an effective transition to adult life are social communication and employment skills for performing the everyday and work-related tasks (OECD, 2011; Santos & Costa, 2016).

As studies showed, deficits in such skills and professionalism represent a significant barrier for obtaining independence and maintaining a job, especially for individuals with ID (Bremer & Smith, 2004; Matson, Dempsey, & Fodstad, 2009; Kearney & Healy, 2011). In fact, the difficulties in understanding social rules in the workplace, the communicative

¹Website not available

²Additional readings on research outcomes of Project SEARCH are available at: <https://www.projectsearch.us/outcomes-research/>

³Additional readings on research outcomes of Transition Service Program at Montgomery County Public Schools are available at: <https://www.montgomeryschoolsmd.org/departments/sharedaccountability/>

intent of others or being unable to understand facial expressions and tones of voice or the inability to seek help when needed and handling job feedback, often result in barriers (O'Reilly et al., 2004; Matson, Terlonge, González, & Rivet, 2006; Nota, Ferrari, Soresi, & Wehmeyer, 2007; Lemaire & Mallik, 2008). Further lack of personal hygiene and inability to understand emotions of others can impact the overall employment experience, as the majority of workplaces require understanding and adherence to social norms. For these reasons the skills for health and well-being were included in the curriculum, as functional to have positive relations with others.

3. THE CURRICULUM

3.1. The methodology adopted

The methodology adopted for the development of the curriculum was based on task analysis and chaining. It is based on the Applied Behavior Analysis, and it is used to break complex tasks into a sequence of smaller steps or actions (Steege, Mace, Perry, & Longenecker, 2007). The understanding of all steps involved for a particular task can assist in identifying any steps that may need extra instruction, and this helps to learn the task in a logical progression. Also, a person-centred approach was used for designing the teaching activities and employment tasks. This curriculum was designed to be functional, that means a type of curriculum focused on teaching learners the necessary skills to function in adult life (Bouck & Joshi, 2012) and promote the self-determination. For example, it included functional math and reading skills for preparing a young person with ID for actively participating in the community, because studies show (Guy, 2006) adult literacy education is an important bridge to adult life and employment⁴.

3.2. Contents and structure

The curriculum was divided in two phases with different learning activities, delivered concurrently and representing a unique learning program: the Employment preparation phase and the Individualized work-placement phase.

The Employment preparation phase was developed using a “top/down” driven approach, as it was based on previous research and projects outcomes. While the Individualized work-placement was organized adopting a “bottom/up” driven approach that consists of analysing the work placement context, identifying employment needs, organizing focus groups, and collecting feedback from all the stakeholders involved (Beyer, Kaehne, Grey, Sheppard, & Meek, 2008; Cheong & Yahya, 2013; Kaehne & Beyer, 2014).

The curriculum was developed starting from the identification of skills that are significant to overcome barriers for obtaining a more independent life and maintaining an employment. These have been further analysed and organised in four categories of didactic units:

1. Basic skills
2. Social skills
3. Independent living skills
4. Employment skills

Each unit included specific learning contents and teaching activities as detailed in table 1 and 2. Concerning the second part of the curriculum, the Individualized work-placements phase, it took place within the community, because individuals who learn in authentic and integrated environments are more likely to acquire competences for community living,

⁴Retrieved from: <http://unesdoc.unesco.org/images/0014/001462/146281e.pdf>

mobility, social and other skills for adulthood (Rogan, Updike, Chesterfield, & Savage, 2014). This aspect fostered a direct involvement of local employment providers (a hair dress shop, a cafeteria, a restaurant, a supermarket, and a youth organisation), necessary to validate employment outcomes and promote effective social inclusion (Lysaght, Cobigo, & Hamilton, 2012).

The job-related tasks were defined and performed with the support of job coaches that guaranteed an effective realization of the internship. Examples of activities performed were folding the towels for the barbers, pricing different products using the pricing gun, cleaning counters, tables, and chairs, emptying and filling the dishwasher, recycling, organising the drawers. Many of these activities were previously introduced and explained to participants through the educational platform AVAIL®⁵ and this helped to understand the different steps required to successfully perform the tasks.

Table 1.
Learning contents of the curriculum.

Didactic Unit	Learning content
1. Basic skills	<p>1.1 Health and Wellness:</p> <ul style="list-style-type: none"> • Care of their own • Follow correct nutritious diet • Follow a healthy lifestyle, stress management • Linking good physical and mental health with personal achievement
	<p>1.2 ICT-AT*:</p> <ul style="list-style-type: none"> • Basic knowledge of ICT • Turn on and off a computer, smartphone, or tablet • Access and manage Apps for supporting learning and work activities • Use technology to locate basic information • Online safety • Basic knowledge of AT • Use of AVAIL platform
	<p>1.3 Money Management:</p> <ul style="list-style-type: none"> • Counting and sorting of money • Knowledge of basic financial information • Identification of methods of withdrawing and deposit funds
2. Social skills	<p>2.1 Communication Skills:</p> <ul style="list-style-type: none"> • Use of verbal, nonverbal, written and electronic communication skills • Use of appropriate conversational skills with peers and adults • Identity, express and understanding feelings of oneself and others • Follow and give information • Presentation skills
	<p>2.2 Adult related Social Skills:</p> <ul style="list-style-type: none"> • Getting an adult attention • Responding to requests from parents, teachers, employers • Working independently
	<p>2.3 Self-related Skills:</p> <ul style="list-style-type: none"> • Using self-control • Feeling good about her/his-self • Resolve problems with others

⁵Available at: <https://www.availsupport.ie/>

3. Independent living skills	<p>3.1. Navigation in the community:</p> <ul style="list-style-type: none">• Knowledge of the transportation system• Knowledge of the main signals• Knowledge on how to orientate in the community• Ability to move and travel independently <p>3.2 Time management:</p> <ul style="list-style-type: none">• Knowledge and understanding of time• Being organized• Ability to plan, prioritize work and setting clear goals• Dealing with unexpected events <p>3.3 Professionalism:</p> <ul style="list-style-type: none">• Knowledge of appropriate interview etiquette• Ability to keep track of appointment and be on time• Demonstrate appropriate conversational skills with co-workers and customers• Maintaining an appropriate appearance <p>3.4 Advocacy skills:</p> <ul style="list-style-type: none">• Identify barriers and difficulties in the community• Understand Advocacy and Self Advocacy• Reflect on what it means to be a person with a disability in Ireland• Identify resources and support within local community
4. Employment skills	<hr/> <p>4.1 Team Building:</p> <ul style="list-style-type: none">• Ability to communicate personal needs• Team-building practice• Solve conflicts within a team• Complete assigned tasks, establish procedures, respect a timeline <p>4.2. Job Searching:</p> <ul style="list-style-type: none">• Develop a personal resume and cover letter• Identify interests, abilities, personal priorities and family responsibilities affecting carrier choice• Identify employment opportunities related to personal employment goal• Identify various sources to use in finding job opportunities <p>4.3. Safety at work:</p> <ul style="list-style-type: none">• Knowledge of the workplace• Identify safe working practices• Knowledge of personal safety practices

*ICT-AT: Information Communication Technology and Assistive Technology

3.3. Teaching activities

The teaching activities provided during the Employment preparation phase took place in two locations: at the National University of Ireland Galway (NUIG) and at the Ability West St. Joseph training centre, a local disability service provider, for a total of 4 months (96 hours). The activities were delivered by one researcher supported by two undergraduate students from the School of Psychology of NUIG and one staff member from the disability service provider.

The activities carried out during the individualized work-placement phase took place in five different job placements (2 hours for 2 days per week for 3 months) with the support of five job coaches provided by a local organization (EmployAbility Galway) involved in the

intervention, and the support of the assistive technology AVAIL®. Participants were trained to use this education platform through tablets during the classroom activities at the training centre and during their work-placement with the support of job coaches. The specific teaching strategies used during the curriculum delivery are reported in table 2.

*Table 2.
Teaching strategies used.*

Teaching strategy	Purpose
Individual reflections	Stimulate by questions and answers for examining participants personal experiences, beliefs and needs.
Group discussions	Provide the opportunity to share perceptions, feelings, and experiences.
Group activities	Guide participants to understand, practice and solve problems.
Role-play	Provide a friendly setting to practice skills needed.
Team-working	Focus on strengthening participants oral communication skills, sense of collaboration, problem solving aptitude, conflict resolution and to make decision.
Practical cases and exercises	Complete ad-hoc exercises based on specific real-life situations or imagined scenarios.
Slides, photos, and videos	Provide simple information to support participants' learning and understanding.
Non-structured interviews	Collect participants feedback about their work placement experiences.

3.4. Materials and tools utilized

The materials and tools utilized during the curriculum delivery (Employment preparation and the Individualized work-placement) were selected on the basis of participants' need to have as many sources of information as possible to stimulate their interest and attention.

These include simple and intuitive tools, like paper maps and Power Point presentations developed using an Easy-to-Read style, as well as technological devices consisting of assistive technologies as tablets and education platform. In particular, the education platform AVAIL® was adopted because it utilises key strategies, task analysis, chaining, prompt-fading and positive reinforcement (Jacobson, 2000). Basically, the prompts used were composed by instructions and demonstrations of job-related tasks to increase the likelihood that individuals will make the right response. For example, the audio/video modelling was used to show to participants how to clean tables, to use a dishwasher, to introduce oneself and other tasks addressed to skills acquisition (Davies, Stock, & Wehmeyer, 2002). In table 3 are reported the means utilized during learning activities.

Table 3.
Materials and tools.

Materials and tools	Purpose
Power point presentations	Help participants to stay focused on each argument presented during sessions and provided a visive support to better understand the content delivered. These were developed using an Easy-to-Read style.
Photos/images	Text alternatives for identifying learning contents and for helping participants to improve the accessibility of topic presented.
Videos	Add details or make focus on the arguments presented in order to support learning process.
Worksheets	Elaborate exercises and practical cases.
Maps and timetables	Support participants to orientate in the community as well as for familiarizing with travelling resources.
Tablets	Enhance engagement in learning as well as increase participants independence.
AVAIL® platform	Adoption of a specific assistive technology used through Tablets. It is an educational platform that utilizes the principles of Applied Behaviour Analysis (ABA), Audio/Video modelling and other prompting for helping individuals to acquire skills that are critical to their success and to live independently.

3.5. Findings

3.5.1. Participants' achievements

Five participants ranging in age from 19 to 22 years were recruited from a vocational training centre in Galway. One participant was diagnosed ID and four with Down Syndrome and a co-occurring mild to moderate ID. Participants' scores relating to diagnoses were obtained from their case files. All participants had been enrolled in special education services throughout their lives. Participation in the research was voluntary and informed written assent was also obtained from participant's parents. Pseudonyms were assigned to all participants to preserve anonymity and confidentiality. To be part of the research, participants had to meet the following inclusion criteria:

- 18 years or older.
- A diagnosis of ID.
- Mild to moderate disability.
- Can provide informed consent.
- Live in the community.

Exclusion criteria were a cognitive impairment that would affect reliable participation or capacity to give informed consent or to use materials (e.g., the assistive technology, tablets, worksheets, etc.) or to actively participate during lessons.

A 3-month follow-up probes conducted after the completion of the curriculum provided information about participants, and additional work experiences were carried out by some of them. Following completion of the curriculum, F. was successful in gaining employment in a restaurant four days per week. Mt. obtained a paid job at a supermarket and for M. the work-placement period was extended for two additional months. The other two participants (K. and G.) were appointed for job interviews at a cafeteria and a restaurant. All participants also demonstrated to have reached more autonomy and independence in the execution of everyday tasks and activities.

3.5.2. Curriculum assessment

To assess the efficacy of the curriculum to transfer social, communication, independent living and employment skills, an inductive approach was taken (Braun & Clarke, 2006) to analyse qualitatively the data collected through two different measuring tools: the San Martín Scale (Verdugo, Gómez, Arias, Navas, & Schalock, 2014) and Vineland-II Adaptive Behavior Scales – 2nd edition (Sparrow, Cicchetti, & Balla, 2005). The first tool was used to evaluate the variation in the quality of life of participants, the second to measure the acquisition of independent living skills before and after the participation in the curriculum.

Changes in scores obtained from pre- and post-intervention were analysed. Also, the effect of intervention was interpreted using observations and informal interviews with the job-coaches that supported participants. The small number of participants has not allowed a significative statistical or quantitative analysis of data collected, but all participants were evaluated using pre- and post-testing in order to provide a social validity of intervention.

Moreover, outcomes were evaluated using questionnaires administered directly to participants, families, and care givers. The scales used allowed the collection of data to assess the improvement of participants' quality of life and acquisition of skills⁶.

Across all curriculum areas (units), including social, communication, independent living and employment skills, participants demonstrated they acquired these skills correctly following the implementation of teaching activities. This improvement occurred when the intervention was implemented and the individualized work placements started, suggesting that the curriculum was responsible for the improvements in job related tasks performed by participants. Results show that young persons who attended the curriculum have higher scores at post-test. The San Martín and Vineland-II scales, which were the primary outcome measures of the study, showed an increase in the achievement of independent living and employment skills.

The domains where they have most improved were communication, daily living skills and socialisation. In addition, job coaches and care givers reported that social, communication, independent living and employment skills improved following the curriculum, demonstrating a significant progress in overall social competencies. These included peer and adults-related social skills and independent living skills, which have led to more appropriate social behaviors in employment settings and improved personal competence in managing daily activities. Based on job coaches feedback collected through reports and interviews, the main employment skills acquired by participants consisted of communication and interaction skills with colleagues, timekeeping, cleanliness, and independence.

After completion of the curriculum a measure of social validity was undertaken by the researchers with each participant through a questionnaire to rate the participant's satisfaction with transition program. Another social validity questionnaire was sent out to families for assessing parent's satisfaction with the intervention and the progress they felt their son/daughter made in social, communication, independent living, and employment skills.

4. FUTURE RESEARCH DIRECTIONS

Future research could explore the effects of the intervention on larger group samples. Research could explore the use of group designs, as the small sample size included in this

⁶For a complete reporting and discussion about the scores obtained by participants see the publication: Traina, I., Mannion, A., & Leader, G. (2022). Transition Program from School to Employment in Youths with Intellectual Disability: Evaluation of the Irish Pilot Study E-IDEAS. *Developmental Neurorehabilitation*, 25(2), 87-100.

research might reflect an issue. Further study could examine the effects of this program in other countries, as the topography of skills useful to obtain more independence, maintain a job and respect social norms can vary across cultures and locations. What is needed is to carefully examine and replicate features of the curriculum that builds capacities for transition to adult life. While this research utilized a methodical approach to evaluate empirically the efficacy of curricula and transition program, potential sources of bias exist. These are due to the lack of specific tools for measuring the acquisition of skills by persons with ID as well as for analysing specific achievements. The lack of testing for generalization within the workplace environment to ascertain true social fit is another limitation.

5. CONCLUSION

Although there are some promising studies and methods for training youths with ID designed to facilitate the transition from school to adult life, currently, there are no standard programs and limited research on effectiveness. Research generally addresses a limited subset of skills, and none have been validated for general acceptance. Starting from this evidence, this research provided an important foundation for future study in this area. Since there is not much empirical research focusing on transition programs, including the availability of curricula showing evidence of the achievements in many aspects of adult life, especially the employment. This research delivered useful elements to replicate, adapt or re-design program grounded on evidence-based research and real work experiences, such as the person-centred approach or the methodology adopted for the development of activities based on task analysis. These have shown to be successful in helping participants to understand and perform activities, allowing to learn the task in a logical progression.

Also, the learning activities included in the curriculum were provided concurrently with the individualized internship, allowing participants to immediately put into practice what learned. Finally, the use of assistive technology AVAIL® and support of job coaches have helped participants to actively perform job-related tasks.

To conclude, the research has analysed the literature on this topic to determinate what implications and successful elements consider to design, implement, and evaluate the curriculum, as tool to be used by care givers, educators, and teachers to enable the adoption of transition pathways that simultaneously provides an employment preparation and individualized work-placement which can successfully support the acquisition of skills for inclusion.

REFERENCES

- Alevriadou A. & Lang L., (2011). *Active Citizenship and Context of Special Education*. CiCe Central Coordination Unit Guidelines. Institute for Policy Studies in Education London Metropolitan University. Retrieved August 6, 2022 from <http://www.cicea.eu/docs/GUIDELINES/general/guidelines-12.pdf>
- Beyer, S., Kaehne, A., Grey, J., Sheppard, K., & Meek, A. (2008). *What works? Good practice in transition to employment for young people with learning disabilities*. Cardiff: Welsh Centre for Learning Disabilities.
- Bouck, E. C., & Joshi, G. (2012). Functional curriculum and students with mild intellectual disability: Exploring postschool outcomes through the NLTS2. *Education and Training in Autism and Developmental Disabilities, 47*(2), 139-153.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>

- Bremer, C. D., & Smith, J. (2004). Teaching social skills. *Information Brief*, 3(5), 1-5.
- Cheong, L. S., & Yahya, S. Z. S. (2013). Effective Transitional Plan from Secondary Education to Employment for Individuals with Learning Disabilities: A Case Study. *Journal of Education and Learning*, 2(1), 104-117. <https://doi.org/10.5539/jel.v2n1p104>
- Clodagh, N., & Gleeson, C. I. (2017). The transition to employment: the perspectives of students and graduates with disabilities. *Scandinavian Journal of Disability Research*, 19(3), 230-244. <https://doi.org/10.1080/15017419.2016.1240102>
- Cronin, P., Ryan, F., & Coughlan, M. (2008). Undertaking a literature review: a step-by-step approach. *British Journal of Nursing*, 17(1), 38-43. <https://doi.org/10.12968/bjon.2008.17.1.28059>
- Davies, D. K., Stock, S. E., & Wehmeyer, M. L. (2002). Enhancing independent task performance for individuals with mental retardation through use of a handheld self-directed visual and audio prompting system. *Education and Training in Mental Retardation and Developmental Disabilities*, 37(2), 209-218.
- Evans, D. (2002). Systematic reviews of interpretive research: interpretive data synthesis of processed data. *The Australian Journal of Advanced Nursing*, 20(2).
- Fleming A., Fairweather, J., & Leahy, M. J. (2013). Quality of life as a potential rehabilitation service outcome: The relationship between employment, quality of life, and other life areas. *Rehabilitation Counseling Bulletin*, 57(1), 9-22. <https://doi.org/10.1177/0034355213485992>
- Gilson, C. B., & Carter, E. W. (2016). Promoting social interactions and job independence for college students with autism or intellectual disability: A pilot study. *Journal of Autism and Developmental Disorders*, 46(11), 3583-3596. <https://doi.org/10.1007/s10803-016-2894-2>
- Green, J. C., Cleary, D. S., & Cannella-Malone, H. I. (2017). A model for enhancing employment outcomes through postsecondary education. *Journal of Vocational Rehabilitation*, 46(3), 287-291. <https://doi.org/10.3233/JVR-170863>
- Guy, T. (2006). *The adult literacy education system in the United States*. Paper commissioned for the EFA Global Monitoring Report. Retrieved August 22, 2022 from <https://unesdoc.unesco.org/ark:/48223/pf0000146281>
- Kaehne, A., & Beyer, S. (2014). Person-centred reviews as a mechanism for planning the post-school transition of young people with intellectual disability. *Journal of Intellectual Disability Research*, 58(7), 603-613. <https://doi.org/10.1111/jir.12058>
- Kearney, D. S., & Healy, O. (2011). Investigating the relationship between challenging behavior, co-morbid psychopathology and social skills in adults with moderate to severe intellectual disabilities in Ireland. *Research in Developmental Disabilities*, 32(5), 1556-1563. <https://doi.org/10.1016/j.ridd.2011.01.053>
- Jacobson, J. W. (2000). Converting to a behavior analysis format for autism services: Decision-making for educational administrators, principals, and consultants. *The Behavior Analyst Today*, 1(3), 6-16.
- Joshi, G., Bouck, E., & Maeda, Y. (2012). Exploring employment preparation and post-school outcomes for students with mild intellectual disability. *Career Development and Transition for Exceptional Individuals*, 35(2), 97-107. <https://doi.org/10.1177/0885728811433822>
- Lai, R., Elliott, D., & Ouellette-Kuntz, H. (2016). Attitudes of Research Ethics Committee Members Toward Individuals with Intellectual Disabilities: The Need for More Research. *Journal of Policy and Practice in Intellectual Disabilities*, 3(2), 114-118. <https://doi.org/10.1111/j.1741-1130.2006.00062.x>
- Lemaire, G. S., & Mallik, K. (2008). Barriers to supported employment for persons with developmental disabilities. *Archives of Psychiatric Nursing*, 22(3), 147-155. <https://doi.org/10.1016/j.apnu.2007.06.014>
- Lysaght, R., Cobigo, V., & Hamilton, K. (2012). Inclusion as a focus of employment-related research in intellectual disability from 2000 to 2010: a scoping review. *Disability and Rehabilitation*, 34(16), 1139-1350. <https://doi.org/10.3109/09638288.2011.644023>
- Matson, J. L., Terlonge, C., González, M. L., & Rivet, T. (2006). An evaluation of social and adaptive skills in adults with bipolar disorder and severe/profound intellectual disability. *Research in developmental disabilities*, 27(6), 681-687. <https://doi.org/10.1016/j.ridd.2005.10.001>

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- Matson, J. L., Dempsey, T., & Fodstad, J. C. (2009). The effect of autism spectrum disorders on adaptive independent living skills in adults with severe intellectual disability. *Research in developmental disabilities, 30*(6), 1203-1211. <https://doi.org/10.1016/j.ridd.2009.04.001>
- McGlinchey, E., McCallion, P., Burke, E., Carroll, R., & McCarron, M. (2013). Exploring the Issue of Employment for Adults with an Intellectual Disability in Ireland. *Journal of Applied Research in Intellectual Disabilities, 26*(4), 335-343. <https://doi.org/10.1111/jar.12046>
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med, 6*(6), e1000097. <https://doi.org/10.1371/journal.pmed.1000097>
- Nota, L., Ferrari, L., Soresi, S., & Wehmeyer, M. (2007). Self-determination, social abilities and the quality of life of people with intellectual disability. *Journal of Intellectual Disability Research, 51*(11), 850-865. <https://doi.org/10.1111/j.1365-2788.2006.00939.x>
- OECD (2011). *Inclusion of Students with Disabilities in Tertiary Education and Employment*. Retrieved June 3, 2022 from http://www.oecd-ilibrary.org/education/inclusion-of-students-with-disabilities-in-tertiary-education-and-employment_9789264097650-en.
- O'Reilly, M. F., Lancioni, G. E., Sigafoos, J., O'Donoghue, D., Lacey, C., & Edrisinha, C. (2004). Teaching social skills to adults with intellectual disabilities: a comparison of external control and problem-solving interventions. *Research in developmental disabilities, 25*(5), 399-412. <https://doi.org/10.1016/j.ridd.2003.07.003>
- Pascall, G., & Hendey, N. (2004). Disability and transition to adulthood: The politics of parenting. *Critical Social Policy, 24*(2), 165-186. <https://doi.org/10.1177/0261018304041949>
- Poppen, M., Lindstrom, L., Unruh, D., Khurana, A., & Bullis, M. (2017). Preparing youth with disabilities for employment: An analysis of vocational rehabilitation case services data. *Journal of Vocational Rehabilitation, 46*(2), 209-224. <https://doi.org/10.3233/JVR-160857>
- Rogan, P., Updike, J., Chesterfield, G., & Savage, S. (2014). The SITE program at IUPUI: A post-secondary program for individuals with intellectual disabilities. *Journal of Vocational Rehabilitation, 40*(2), 109-116. <https://doi.org/10.3233/JVR-140673>
- Santos, P. J. D. L., & Costa, R. S. (2016). Workers with disabilities in sheltered employment centres: a training needs analysis. *International Journal of Inclusive Education, 20*(7), 756-769. <https://doi.org/10.1080/13603116.2015.1111446>
- Smiley E., Cooper S. A. Finlayson J. Jackson A., Allan L., Matry D., McGrother C., McConnache A., & Morrison J., (2007) Incidence and predictors of mental ill-health in adults with intellectual disabilities. Prospective study. In *The British Journal of Psychiatry, 191*(4) 313-319. <https://doi.org/10.1192/bjp.bp.106.031104>
- Sparrow, S. S., Cicchetti, D., & Balla, D. A. (2005). *Vineland Adaptive Behavior Scales, Second Edition (Vineland-II)* [Database record]. APA PsycTests. <https://doi.org/10.1037/t15164-000>
- Steege, M. W., Mace, F. C., Perry, L., & Longenecker, H. (2007). Applied behavior analysis: Beyond discrete trial teaching. *Psychology in the Schools, 44*(1), 91-99. <https://doi.org/10.1002/pits.20208>
- U.N. (2006). *Convention on the Rights of Persons with Disability*, G.A. Res. 61/106, Dec. 13. Retrieved July 11, 2022 from <https://www.un.org/development/desa/disabilities/resources/general-assembly/convention-on-the-rights-of-persons-with-disabilities-ares61106.html>
- Verdugo, M. A., Gómez, L. E., Arias, B., Navas, P., & Schalock, R. L. (2014). Measuring quality of life in people with intellectual and multiple disabilities: Validation of the San Martín scale. *Research in developmental disabilities, 35*(1), 75-86. <https://doi.org/10.1016/j.ridd.2013.10.025>
- Wehman, P., Schall, C., Carr, S., Targett, P., West, M., & Cifu, G. (2014). Transition from school to adulthood for youth with autism spectrum disorder: What we know and what we need to know. *Journal of Disability Policy Studies, 25*(1), 30-40. <https://doi.org/10.1177/1044207313518071>
- Wehmeyer, M. L., Palmer, S. B., Smith, S. J., Parent, W. D., Daniel K., & Stock, S. (2006). Technology use by people with intellectual and developmental disabilities to support employment activities: A single-subject design meta analysis. *Journal of Vocational Rehabilitation, 24*(2), 81-86.
- World Health Organisation (2011). *World Report on Disability*. Geneva: Author. Retrieved March 9, 2022 from <https://apps.who.int/iris/handle/10665/44575>

Appendix A. Search inclusion criteria

Age	Studies have to be transition programs for youths with ID (16-22 years old)
Diagnosis	Diagnosis has to refer to moderate and mild ID
Detailed curricula	Studies of transition programs have to include detailed curricula for facilitating the acquisition of self-determination skills or internship experiences realized in employment settings
Outcomes	Studies have to report production of tools, methodologies, guidebooks or manual
Original empirical research design	Studies have to outline qualitative, quantitative, longitudinal designs and/or intervention studies
Period	Studies have to be published between May 2008 and April 2018
Language	Studies have to be written in the English language

Appendix B. List of projects and programs identified through the search

Best Buddies Jobs Program	https://www.bestbuddies.org/blog/2015/12/04/best-buddies-jobs-program/
Better Outcomes & Successful Transitions for Autism (BOOST-A™)	https://step-a.azurewebsites.net/
Bridges From School to Work Program	http://www.bridgestowork.org/about-bridges/what-we-do/
Oregon Youth Transition Program (YTP)	https://ytp.uoregon.edu/
Postsecondary Education Research Center (PERC) project	https://perc.utk.edu/
Project Panther LIFE's curriculum	http://fiuembrace.fiu.edu/home/fiu-embrace-panther-life/
SITE Program	http://site.iupui.edu/
TEACCH Program	https://teacch.com/
Getting a Life Project	http://www.gettingalife.org.uk/
Greenside Studio	http://www.greenside.herts.sch.uk/Learning/GreensideStudio.html
TOPS Program	https://www.scvths.org/Page/149
Triumph Transition Program	https://triumphservices.org/
UI REACH Program	https://education.uiowa.edu/services/reach

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Chapter # 17

THE RELATIONSHIP BETWEEN PARENTS' EDUCATION AND STUDENTS' SELF-ASSESSMENT OF THEIR OWN STUDY PREREQUISITES AND ASPIRATIONS

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ABSTRACT

In this chapter, we explore the importance of self-assessment for students in achieving success in their studies. Self-assessment involves evaluating one's own learning processes and outcomes. However, we focus on secondary school students' self-assessment of their study predispositions, aspirations, and motivation for success. This includes their knowledge, competencies, abilities, talents, and educational goals. Academic success encompasses various factors such as learning objectives, skills acquisition, satisfaction, persistence, and post-college performance. The study investigates the influence of parents' education on their children's careers. The authors examined the self-assessment of educational prerequisites and aspirations of 900 secondary school students aged 15-18 years. The results show that more than half of the respondents believe they have the necessary technical study prerequisites. However, self-assessment of study predispositions is not related to gender or field of study. The study also found that students' aspirations to succeed are related to their mother's education, not their fathers'. Overall, self-assessment is a crucial tool for students to achieve success in their studies. By evaluating their study predispositions and aspirations, students can set educational goals for themselves and work towards achieving them. The study also highlights the importance of parental education in influencing their children's educational aspirations.

Keywords: self-assessment, prerequisites and aspirations for the study, academic success, parents' education.

1. INTRODUCTION

Student self-assessment is an essential prerequisite and tool for successful learning. It is also its purpose and should be purposefully cultivated during schooling. Student self-assessment is the subject of interest of pedagogues, psychologists and sociologists studying its use in education and its role in the overall development of the personality, processes of socialisation and the fulfilment of the fundamental life roles of an individual, especially as a participant in the labour market. It can take several forms and relate to (educational) processes and their products. It is usually consistent with the evaluation of external evaluators. The influence of family and school shapes self-assessment, and it can also focus on the individual's prerequisites for studying the chosen field and identifying their aspirations to succeed. This paper examines these two outcomes of self-assessment in their uniqueness and, at the same time, concerning the achieved level of education of the student's parents, assuming that this level can influence both outcomes. The results of empirical research can be helpful in the theoretical completion and updating of the concepts of study prerequisites and study aspirations, as well as for educational practice, which is forming them purposefully and unintentionally.

2. SELF-ASSESSMENT OF STUDY PREREQUISITES AND ASPIRATIONS

The issue of student self-assessment is a subject of research interest for several reasons, mainly didactic, psychological, and sociological. From a didactic point of view, it is shown to positively affect learning outcomes since it functions as a feedback tool within the formative assessment. Through self-assessment, students collect information, identify, assess, and reflect on their own works based on explicit criteria and standards (Karaman, 2021). Dividing self-assessment into several types seems useful for educational practice. The first allows students to compare their performance with desired goals and revise it accordingly. Another self-assessment type requires students to assess their performance on a test by marking, grading, or ranking. Thirdly, self-assessment with rubrics, scripts, or checklists is also common for students to assess their work. (Karaman, 2021; Andrade, 2010; Hattie & Timperley, 2007; Brown & Harris, 2013). Andrade (2019) states, based on several pieces of research, that when the act of self-assessing is given a learning-oriented purpose, students' self-assessments are relatively consistent with those of external evaluators, including professors, teachers, researchers, and expert medical assessors. Andrade (2019, p. 10) aptly emphasises the importance of self-assessment: "Self-assessment is the act of monitoring one's processes and products to make adjustments that deepen learning and enhance performance. Although it can be summative, the evidence presented in this review strongly suggests that self-assessment is most beneficial, in terms of both achievement and self-regulated learning, when it is used formatively and supported by training."

Another type of self-assessment not mentioned by the authors would be self-assessment preceding the actual teaching or learning process, which is more psychological. It would be possible to list the self-assessment of personality, intellect, motivation or other prerequisites for education and learning. These assumptions are intertwined, and clear boundaries cannot be drawn between them. The "synthetic" concept of "prerequisites for studying the chosen field" was used in the following research on the population of secondary school students as it is comprehensible to this age group. It included personal (will, interest, recognition of the value of education) and academic prerequisites (represented in students mainly by previous results learning and success in the admission procedure). In the research, the internal motivational prerequisites for studying were named the variable "educational aspirations" and also determined by self-assessment. The sociological reason for the interest in the self-assessment of young adolescents can be connected with its application in the formation of their relationships in peer groups (which are primarily school classes), the gradual linking of studies with practice and the formation of relationships to the future profession and later search for a place in the labour market.

Study predispositions (preconditions, prerequisites) are a set of knowledge, (key or transversal) competencies, (cognitive) abilities, talents, study aspirations and study motivations. The breadth of understanding of this concept depends primarily on why we deal with them and for what purpose we define them. That is usually the case in admission procedures at a secondary school or university, requiring transparent operationalisation into an effective tool for measuring them. Since 2015, a uniform entrance examination has been introduced in the Czech Republic for all secondary school study programs ending with a school-leaving examination. It consists of a test in the mother tongue and mathematics, and its minimum weight in the admission procedure is 40%. It is criticised, among other things, because it does not work with the cut score (Malach & Vicherková, 2018). Our research examined study prerequisites in the form of their subjective reflection by interviewing secondary school students using a simple and understandable question "Do you think that you have the prerequisites for the chosen field of study?" Students chose one of the offered variants: a) definitely yes, b) rather yes, c) I don't know, d) rather no, and e) definitely no.

Setting educational aspirations is crucial as it motivates and drives individuals to achieve their desired educational goals (Fraser & Garg, 2011). Despite its significance, the professional community has no singular definition or agreement regarding the term (Quaglia & Cobb, 1996). Essentially, educational aspiration refers to an individual's aspirations or hopes of attaining something in education. In some instances, the term aspiration, may be used interchangeably with expectation (Hong, 2022). An individual's current state, including their talents, prior education, determination, and motivation, typically characterises their ability to achieve a specific educational goal, such as obtaining a particular degree or field of education.

Educational aspiration is a term that has been studied and explained using various psychological, pedagogical, and sociological theories. According to psychological research, it is a part of the performance motivation construct we need to achieve. Strong achievement motivation is crucial for students' engagement, overcoming difficulties, and ultimately completing their studies. When individuals have the motivation to achieve their goals, they are more likely to pursue work that they perceive as valuable and compete with others (Covington, 2000). This drive can come from an internal or external source. Intrinsic motivation is when interest or enjoyment sparks it in the task, and it is organic to the person, not a product of external pressure. On the other hand, extrinsic motivation comes from outside the person. From a pedagogical perspective, educational aspirations are viewed as a characteristic of the learner that can be cultivated educationally to improve their skills and abilities.

According to a study by Quaglia and Cobb (1996, p. 131), it is possible to impact students' aspirations by indirectly influencing whole group aspirations. This fact has enormous implications for schools, which should strive to create an environment that fosters aspirations. However, not only schools play a role in helping young people develop and achieve their aspirations. Professionals and volunteers who work closely with youth are also essential. As Gutman and Akerman (2008) note, numerous studies have shown that aspirations are significant predictors of educational and occupational attainment among young people (p. 15). While data on educational aspirations is comparatively easily accessible, no common agreement exists on measuring the concept. Typically, researchers will ask survey participants to select from a range of educational options to gather data on their idealistic and realistic aspirations. For instance, a common question might be, "What is the highest level of education you would like to achieve?" (Trebbels, 2015). Aspiration is a subjective variable reflecting an individual's desires and ideas about their education, learning, and career goals. The aspiration of the respondents for the status of a successful student requires the characterisation of the concept of academic success all actors of education usually perceive in different ways and not in all its breadth. York, Gibson and Rankin (2015) created a model of academic success, which (includes) academic achievement, attainment of learning objectives, acquisition of desired skills and competencies, satisfaction, persistence, and post-college performance. According to the fifteen interviewees of teachers, Fauziyyah, Maharani, Rosdiani and Suparman (2018) state that the construct good student has four aspects or categories. The first draws from their academic skill. The second aspect depends on the student's personality, and the third is based on their proficiency, with the reflection defining the last category. However, it must be admitted that survey respondents aged 15-18 may have had their own subjective concept of academic success containing only one or a few elements from the complete model of academic success according to York et al. (2015) or just some of its four aspects according to Fauziyyah et al. (2018).

As part of our research, we asked our survey respondents: "Do you want to be successful at secondary school?" They had the option to choose from five different answers, including "definitely yes," "rather yes," "I do not know," "rather not," and "certainly not."

3. PARENTS' EDUCATION AND CHILDREN'S EDUCATION ASSUMPTIONS AND ASPIRATIONS

Sociologists consider the parents' educational attainment to be part of the family's cultural capital, alongside wealth, prestige and social position. Parental income reflects the number of economic resources available to the individual. At the same time, the parents' educational attainment affects the availability and intensity of culturally educational content and relevant stimuli that the given individual receives (Kohoutek, Lounek, Šmídová & Korečková, 2021). A study by Madarasova Geckova, Tavel, van Dijk, Abel and Reijneveld (2010) found that the higher the parents' cultural capital (their education), the greater the probability of aspirations to continue their studies. A prominent role is attributed to the influence of parents and their ideas on children's education. If parents attribute high status to education, their children have high aspirations regardless of the socio-economic conditions they come from (Hrubá, 2017). It has even been confirmed that socio-psychological aspects play a more significant role than class characteristics or children's mental abilities in forming a student's educational aspirations (Katriňák, 2006). Many authors focus on parents' influence on children's choice of further study path. International PISA research (Palečková, Tomášek, & Basl, 2010; Blažek, Janotová, Potužníková, & Basl, 2019) pointed to the influence of social origin on the choice of educational and professional paths among fifteen-year-old students. Vendel (2007) concluded that external social resources were a decisive factor in students' decision to study in high school and concluded that other influential people were acquaintances of parents with work experience in the field the student was considering. Kniveton (2004) researched a sample of 348 pupils aged 14 to 18 in secondary school and found that mothers strongly influence pupils' decisions about the type of study. Zehringrová's research findings (2017) showed that the pupils' decisions about their secondary school were made mainly by themselves, without significantly adapting to their parents' wishes or the pressure of the environment. The children were most influenced by their parents, more by their mothers than by their fathers. Furthermore, this research showed that "children from families with lower socio-economic status, including lower levels of parental education, have lower aspirations for higher education" (p. 69).

Straková, Simonová, and Soukup (2020), following previous studies and research, developed the construct of "academic optimism", which includes a teacher's perception of self-efficacy, trust in students and their parents, and an emphasis on students' educational outcomes. They found that academic optimism does not directly affect students' knowledge and skills in mathematics and reading literacy but affects other aspects, such as the sense of belonging to the school. Logically, the question arises as to whether or not to introduce a similar construct, "academic optimism of the parent", for the family environment. It would express their belief in their ability to lead their child to the highest educational goals, that they are doing everything necessary, and confidence in their child that they will actively pursue education. We believe that the level of academic optimism of parents would increase with the level of their educational attainment. We consider the aspirations of students to continue further studies at a higher level of school or the aspirations to obtain a relevant exit certificate after finishing school (e.g. a university diploma) as only one specific group of aspirations. There are other groups of aspirations consisting of the desire of the student to learn or get to know something new or the desire to be a good, successful student. The last group of aspirations can be referred to as study-process aspirations. In this paper, we are

dealing with this aspiration "to be a successful student", as the direct connection between the education of each parent and their child's aspirations to be a good, successful student has not yet been investigated. We assume that children of more educated parents will have a higher level of this kind of procedural educational aspirations.

4. RESEARCH METHODOLOGY

The presented research aimed to determine the proportion of students in the research group who believe they have the prerequisites to study the selected field and the proportion of pupils who aspire to be successful students based on their self-assessment. At the same time, it was investigated whether the positive statements of students regarding their study prerequisites and aspirations are related to the achieved level of education of fathers and mothers.

These objectives were converted into the following research questions.

- What proportion of students in the research group, based on self-assessment, believe they have the prerequisites to study the selected field?
- Is the self-assessment of prerequisites for study moderated by the gender of the pupils and the field they are studying?
- What proportion of students in the research group, based on self-assessment, state that they aspire to be successful?
- Is there any relationship between the achieved level of formal education of the respondents' fathers and mothers and the self-assessment of the prerequisites for studying the selected field?
- Is there any relationship between the level of formal education of the respondents' fathers and mothers and the pupils' aspirations to be successful students?

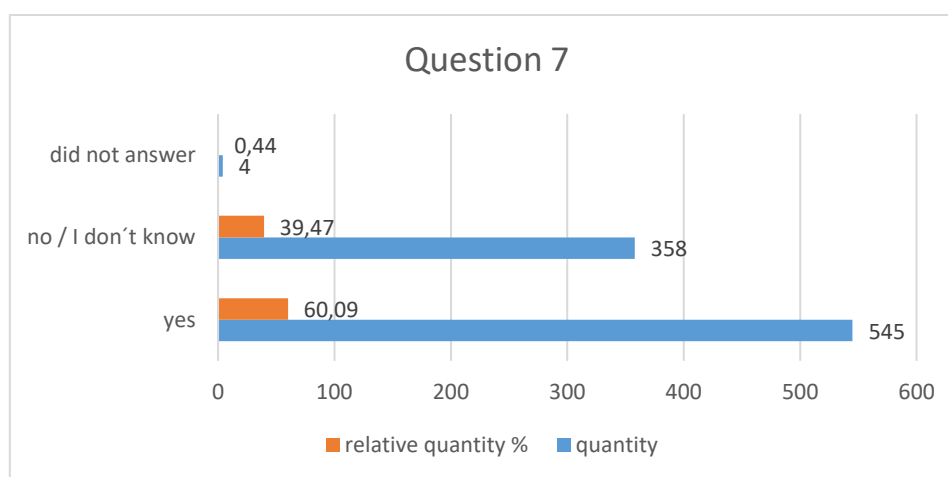
The research was carried out within the TACR project at the Faculty of Education of the University of Ostrava. The data were collected using an author's questionnaire containing 29 items (20 closed and nine open or semi-open). Five items and their results are presented in this paper. Data collection was carried out from September 2020 to February 2021 on a deliberately selected research sample of 907 respondents (students of 6 technical secondary schools) in the Moravian-Silesian Region of the Czech Republic. Most of the research group consisted of boys (884, i.e., 97.46%), and only 21 (2.32%) respondents were girls. Three-quarters (630, i.e., 69.40%) of respondents studied a four-year engineering field completed with a school-leaving examination, and only a third of 266 (29.33%) respondents studied another field of study (non-engineering). Students' answers to item 10: "Your father's education level is: (primary, apprenticeship - no school-leaving examination, secondary with the school-leaving examination, higher vocational and university)" confirmed that more than half of the respondents (471, 51.93%) had a father with a secondary school diploma or other higher education and 417 (45.98%) respondents had a father with a primary or secondary education without a school-leaving examination. Question 8: "Your mother's education level is: (primary, apprenticeship - no school-leaving examination, secondary with the school-leaving examination, higher vocational and university examination)." The answers: more than half of respondents (593, 65.38%) stated that their mother's education level was a secondary school with a school-leaving examination and higher, and a third of respondents (306, 33.74%) answered that their mother's highest educational attainment was primary or secondary without a school-leaving examination (apprenticeship).

5. RESULTS

The introduction of a specific questionnaire item or the formulation of a research hypothesis usually precedes the presentation of research results in graphs or tables for clarity.

Question 7: "Do you think you have the prerequisites for the selected (technical) profession?" More than half (545, 60.09%) of the respondents answered that they think they have the prerequisites for the selected (technical) profession, 358 (39.47%) respondents answered they do not think (or do not know) they have the prerequisites for the chosen (technical) profession and four respondents did not answer (0.44%).

*Graph 1.
Self-assessment of study prerequisites.*



In hypothesis H1, the relationship between subjectively assessed assumptions about the study and the student's gender was assumed. "Students-boys more frequently think they have the prerequisites to study at a technical secondary school than students-girls."

*Table 1.
The relationship between study prerequisites and gender.*

Pearson's chi-square = 0,087602 degree of freedom = 1 significance p= 0,767248			
Question 1	Question 7 (yes)	Question 7 (no / I don't know)	Line totals
boy	531 (530,34)	349 (349,66)	880
girl	12 (12,66)	9 (8,34)	21
Column totals	543	358	901

Since the calculated chi-square value is less than the test criterion value and the significance value is greater than the chosen significance level of 0.05, no statistically significant relationship was found between the students' gender and the self-assessment of study prerequisites. The formulated hypothesis was not confirmed. Thus, self-assessment of study prerequisites is not related to gender.

The relationship between parents' education and students' self-assessment of their own study prerequisites and aspirations

Hypothesis H2 assumed a connection between subjectively assessed prerequisites for study and the field focus of secondary school studies: "Students of engineering specialisation more frequently think they have prerequisites for study than students of other specialisation".

*Table 2.
The relationship between the field of study and study prerequisites.*

Pearson's chi-square = 0,506606 degree of freedom = 1 significance p= 0,476612			
Question 4	Question 7 (yes)	Question 7 (no/I don't know)	Line totals
four-year field of study completed by school leaving exam (engineering)	385 (380,26)	245 (249,74)	630
another field of study	154 (158,74)	109 (104,26)	263
Column totals	539	354	893

Since the calculated chi-square value was less than the test criterion and the significance value was greater than the chosen significance level of 0.05, no statistically significant relationship was demonstrated between self-assessment of study prerequisites and study focus. The formulated hypothesis was not confirmed. The self-assessment of prerequisites for the study is thus not related to the field of study.

Hypothesis H3 expressed the relationship between subjectively assessed preconditions for study and mother's education: "Students who think that they have preconditions for the selected profession more frequently have a mother with a high school diploma or higher than students who do not think so."

*Table 3.
The relationship between a mother's education and study prerequisites.*

Pearson's chi-square = 2,946447 degree of freedom = 1 significance p= 0,086067			
Question 7	Question 8 (secondary education with school-leaving exam or higher)	Question 8 (primary/apprenticeship)	Line totals
yes	370 (358,11)	172 (183,89)	542
no / I don't know	222 (233,89)	132 (120,11)	354
Column totals	592	304	896

As the calculated chi-square value is less than the test criterion value and the significance value is greater than the selected significance level of 0.05, no statistically significant relationship was confirmed between the examined variables. The formulated hypothesis was not confirmed. Thus, it cannot be concluded that the self-assessment of study prerequisites relates to the education of students' mothers.

Hypothesis H4 expressed the relationship between subjectively assessed preconditions for study and father's education: "Students who think they have preconditions for the selected profession more frequently have fathers with a high school diploma or higher than students who do not think so."

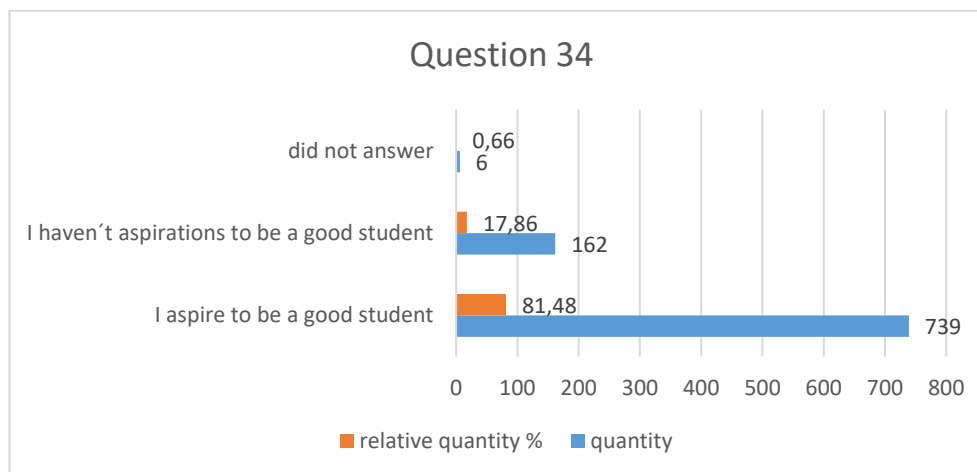
Table 4.
The relationship between father education and study prerequisites.

Pearson's chi-square = 0,723316 degree of freedom = 1 significance p= 0,395058			
Question 7	Question 10 (secondary education with school-leaving exam or higher)	Question 10 (primary/apprenticeship)	Line totals
yes	289 (282,81)	243 (249,19)	532
no / I don't know	182 (188,19)	172 (165,81)	354
Column totals	471	415	886

Since the calculated chi-square value is less than the test criterion value and the significance value is greater than the chosen significance level of 0.05, no statistically significant relationship was confirmed between the examined variables. The formulated hypothesis was not confirmed. Thus, it cannot be assumed that the self-assessment of study prerequisites relates to the education of students' fathers.

Item No. 34: "Do you want to be successful in secondary school: (I aspire to be a good student, I haven't aspirations to be a good student)" offered two possible answers. It was found that the majority (81.48%) of respondents aspire to be good students. However, less than a fifth of students (17.86%) do not aspire to be good students.

Graph 2.
Aspirations to be a good student.



The relationship between the subjective assessment of the aspirations to be successful in studies and the mother's education was formulated in hypothesis H5. "Students whose mothers have completed at least secondary school education with a school-leaving exam are more likely to say that they have the aspirations to succeed at secondary school than those whose mothers have a lower education".

The relationship between parents' education and students' self-assessment of their own study prerequisites and aspirations

Table 5.
The relationship between a mother's education and study aspirations.

Pearson's chi-square = 5,107974 degree of freedom = 1 significance p= 0,023816			
Question 8	Question 34 (I aspire to be a good student)	Question 34 (I haven't aspirations to be a good student)	Line totals
secondary school with school-leaving exam and higher	496 (483,80)	91 (103,20)	587
primary school (apprenticeship)	240 (252,20)	66 (53,80)	306
Column totals	736	157	893

Given that the calculated chi-square value was greater than the test criterion value and the significance value was less than the chosen significance level of 0.05, a statistically significant relationship between the investigated variables was demonstrated. Students' aspirations to be successful in their studies are related to their mothers' education. Hypothesis H5 was confirmed.

In hypothesis H6, the relationship between the subjective assessment of the aspirations to be successful in studies and the father's education was formulated. "Students whose fathers have completed at least secondary school education with a school leaving examination are more likely to express that they have the aspirations to succeed in secondary school than those whose fathers have a lower education."

Table 6
The relationship between a father's education and study aspirations.

Pearson's chi-square = 0,74950 degree of freedom = 1 significance p= 0,386634			
Question 10	Question 34 (I aspire to be a good student)	Question 34 (I haven't aspirations to be a good student)	Line totals
secondary school with school-leaving exam and higher	390 (385,08)	79 (83,92)	469
primary school (apprenticeship)	335 (339,92)	79 (74,08)	414
Column totals	725	158	883

Given that the calculated chi-square value is less than the test criterion value and the significance value is greater than the chosen significance level of 0.05, no statistically significant relationship was demonstrated between the investigated variables. A student's aspirations to be successful in their studies is unrelated to their father's education. Hypothesis H6 was not confirmed.

6. DISCUSSION

Data quantifying the number of students who, based on self-assessment, believe they have the prerequisites to study the selected field and consider themselves ambitious to be successful cannot be compared with similar data from other researchers. It is only possible

to compare them with the current educational reality data, specifically those obtained in the common part of the school-leaving examination in the Czech Republic for the last three years (Centrum pro zjišťování výsledků vzdělávání, 2020, 2021 and 2022). The data are in quite significant agreement. In our research group, 17.8% of pupils stated they had no aspirations to be successful students. It is remarkable that in 2020, 17.5% of students failed the didactic test in mathematics, 2% more year-on-year. In 2022, 14.1% of pupils failed the Czech test, which is 3.9% more than last year. In 2021, 16.8% of pupils failed the didactic test in mathematics, but only 4.9% of graduates failed the Czech language. In 2022, the failure rate of secondary school graduates in the didactic test in Mathematics reached 10.1% and the Czech language didactic test 9.4%. An interesting question arises of whether a very similar proportion of students with no aspirations to succeed and the proportion of unsuccessful students in the school-leaving exam (primarily mathematics) is a random phenomenon or whether it can be anticipated due to the premature resignation of students to the regular completion of secondary school studies. Further research could focus on finding an answer to this question.

The research confirmed that the educational aspirations of secondary technical schools' students in the Moravian-Silesian Region of the Czech Republic are related to the level of education of mothers and are not related to the level of education of fathers. However, the self-assessment of the study prerequisites is not related to the level of education of the student's parents. This finding is contrary to Zehringrová's (2017) research, stating that mothers have a more significant influence on the choice of the future educational path of their children.

The authors are aware of the study's limits, lying mainly in the number of respondents, allowing the validity of the research conclusions to be applied only to the sample set. The authors perceive another limitation in that both investigated constructs, or variables - students' prerequisites for study and student aspirations to be successful in their studies - are relatively broad and can be broken down into sub-elements that may not be known to the respondents in full. The researchers made no effort to clarify the content and breadth of these constructs to the respondents before administering the questionnaires. This fact could influence the choice of their answers to the dichotomously formulated question.

7. CONCLUSIONS

More than half of the respondents believe they have the required (technical) study prerequisites. Self-assessment of study prerequisites is not related to the student's gender. Self-assessment of study prerequisites is not related to the field of study. It cannot be confirmed that the self-assessment of study prerequisites relates to the education of students' mothers. It cannot be assumed that the self-assessment of study prerequisites relates to the education of students' fathers. A significant majority of respondents aspire to be good students. Students' aspirations to be successful in their studies are related to their mothers' education. Students' aspirations to be successful in their studies are not related to their fathers' education. Empirical findings can be helpful for the theoretical completion and updating of the concepts of study prerequisites, study aspirations, and educational practice. The self-assessment competencies of young people are formed purposefully and unintentionally within the practice concerning their prerequisites for education, study aspirations and educational processes and learning and its results.

REFERENCES

- Andrade, H. (2010). Students as the definitive source of formative assessment: Academic self-assessment and the self-regulation of learning. In H. Andrade & G. Cizek (Eds.), *Handbook of formative assessment* (pp. 90–105). New York, NY: Routledge.
- Andrade, H. (2019). A Critical Review of Research on Student Self-Assessment. *Frontiers in education*, 4(87). <https://doi.org/10.3389/educ.2019.00087>
- Blažek, R., Janotová, Z., Potužníková, E. & Basl, J. (2019). Mezinárodní šetření PISA 2018. Národní zpráva. [International survey PISA 2018. National report]. Praha: Česká školní inspekce. Retrieved from https://www.csicr.cz/Csicr/media/Prilohy/PDF_el._publikace/Mezin%C3%A1rodn%C3%AD%20%C5%A1et%C5%99en%C3%AD/PISA_2018_narodni_zprava.pdf
- Brown, G. T. L., & Harris, L. R. (2013). *Student self-assessment*. In J., H., McMillan (Ed.), *The SAGE handbook of research on classroom assessment* (pp. 367-393). Thousand Oaks, CA: SAGE. Retrieved from https://www.researchgate.net/publication/233871127_Student_self-assessment
- Centrum pro zjišťování výsledků vzdělávání (2020). *Centrum zpracovalo výsledky maturitní zkoušky v roce 2020 do podrobné statistické analýzy*. [The Centre processed the results of the school-leaving examination in 2020 into a detailed statistical analysis]. Retrieved from <https://cermat.cz/aktuality/85-aktuality/298-centrum-zpravovalo-vysledky-maturitni-zkousky-v-roce-2020-do-podrobne-statisticke-analyzy>
- Centrum pro zjišťování výsledků vzdělávání (2021). *Tisková zpráva: Výsledky společné části maturitní zkoušky v řádném termínu jarního zkušebního období 2021*. [Press release: Results of the common part of the school-leaving examination in the regular term of the spring exam period 2021]. Retrieved from <https://cermat.cz/aktuality/aktualita/329-tiskova-zprava-vysledky-spolecne-casti-matriculation-examinations-in-the-council-term-of-the-spring-examination-period-2021>
- Centrum pro zjišťování výsledků vzdělávání (2022) *Tisková zpráva: Výsledky společné části maturitní zkoušky v jarním zkušebním období 2022*. [Press release: Results of the common part of the school-leaving examination in the spring examination period 2022]. Retrieved from <https://cermat.cz/aktuality/aktualita/357-tz-vysledky-mz-dt-jaro-2022>
- Covington, M.V. (2000). Goal theory, motivation, and school achievement: An integrative review. *Annual Review of Psychology*, 51(1), 171-200. <https://doi.org/10.1146/annurev.psych.51.1.171>
- Fauziyyah, G., Maharani, U., Rosdiani, A. M. & Suparman, A (2018). What Makes a Good Student: Voice from Teacher. *English Education and Applied Linguistics (EEAL) Journal*, 1(3), 243-251. <https://doi.org/10.31980/eealjournal.v1i3.1707>
- Fraser, M., & Garg, R. (2011). Educational Aspirations. In Levesque R.J.R. (eds), *Encyclopedia of Adolescence*. Springer, New York, NY. https://doi.org/10.1007/978-1-4419-1695-2_147
- Gutman, L. M., & Akerman, R. (2008). *Determinants of aspirations [Wider Benefits of Learning Research Report No. 27]*. London: Centre for Research on the Wider Benefits of Learning Institute of Education, University of London. Retrieved from <https://discovery.ucl.ac.uk/id/eprint/1541614/>
- Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, 77(1), 81–112. <http://dx.doi.org/10.3102/003465430298487>
- Hong, Y. (2022) *The Educational Hopes and Aspirations of Left-Behind Children in Rural China. An Ethnographic Case Study*. Abingdon, Oxon, New York: Routledge.
- Hrubá, L. (2017). Sociální determinanty vysokých vzdělanostních očekávání rodičů. [Social Determinants of High Parental Educational Expectations.]. *Sociológia* 49(5), 463-481. Retrieved from http://www.sav.sk/index.php?lang=sk&doc=journal-list&part=list_articles&journal_issue_no=11114197#abstract_14169
- Karaman, P., (2021). The impact of self-assessment on academic performance: A meta-analysis study. *International Journal of Research in Education and Science (IJRES)*, 7(4), 1151-1166. <https://doi.org/10.46328/ijres.2344>

- Katrňák, T. (2006). Faktory podmiňující vzdělanostní aspirace žáků devátých tříd základních škol v České republice [Factors determining the educational aspirations of ninth-graders of primary schools in the Czech Republic]. In Matějíř, P.; Straková, J. et al.: *Nerovné šance na vzdělání: Vzdělanostní nerovnosti v České republice* [Unequal Opportunities for Education: Educational Inequalities in the Czech Republic] (pp. 173-193). Praha: Academia.
- Kniveton, B. H. (2004). The Influences and Motivations on which Students Base their Choice of Career. *Research in Education*, 72(1), 47–57. <https://doi.org/10.7227/RIE.72.4>
- Kohoutek, J., Lounek, V., Šmídová, M., & Korečková, J. (2021). Situace absolventů v podmínkách postmasového vysokoškolského vzdělávání: Stále jen reprodukce elit? [The Status of Graduates in Post-Mass Higher Education: Are We Still Just Reproducing Elites?] *Sociologický časopis [Czech Sociological Review]*, 57(1), 47–73. <https://doi.org/10.13060/csr.2021.002>
- Madarasova Geckova, A., Tavel, P., van Dijk, J. P. Abel, T., & Reijneveld, S. A., (2010). Factors Associated with Educational Aspirations Among Adolescents: Cues to Counteract Socioeconomic Differences? *BMC Public Health*, 10(154). <https://doi.org/10.1186/1471-2458-10-154>
- Malach, J. & Vicherková, D. (2018). *Refleksja na temat pojedynczego egzaminu wstępnego do szkoły średniej z maturą*. In. *Wspomaganie rozwoju kompetencji diagnostycznych nauczycieli, Katowice*. [Reflection on the single entrance exam to secondary school with the school-leaving exam. in. Supporting the development of teachers' diagnostic competences, Katowice], 265-278. Retrieved from https://www.ptde.org/pluginfile.php/1378/mod_page/content/13/PTDE_2018_265.pdf
- Palečková, J., Tomášek, V., & Basl, J. (2010). *Hlavní zjištění z výzkumu PISA 2009. Umíme ještě číst?* [Key findings from the PISA 2009 research. Can we still read?]. Praha: UIV.
- Quaglia, R. J. & Cobb, C. D. (1996). Toward a Theory of Student Aspirations. *Journal of Research in Rural Education*, 12(3), 127-132.
- Straková, J., Simonová, J. & Soukup, P. (2020). Vliv akademického optimismu na výsledky žáků středních škol. [The Impact of Academic Optimism on Achievement of Upper Secondary School Students]. *ORBIS SCHOLAE*, 2020, 14(3), 73–92. <https://doi.org/10.14712/23363177.2021.5>
- Trebbels, M. (2015). *The transition at the end of compulsory full-time education Educational and future career aspirations of native and migrant students*. Wiesbaden: Springer VS Wiesbaden. <https://doi.org/10.1007/978-3-658-06241-5>
- Vendel, Š. (2007). *Výskum školskej a profesijnej orientácie žiakov: výsledky Slovenska s dôrazom na mimobratislavské regióny*. [Research on school and professional orientation of pupils: results from Slovakia with an emphasis on regions outside Bratislava]. Bratislava: Štátny pedagogický ústav.
- York, T. T.; Gibson, Ch. & Rankin, S. (2015). Defining and Measuring Academic Success. *Practical Assessment, Research, and Evaluation*: 20(5). <https://doi.org/10.7275/hz5x-tx0>
- Zehringrová, A. (2017). *Faktory ovlivňující volbu další vzdělávací dráhy žáků deváté třídy ZŠ*. [Diplomová práce]. [Factors influencing the choice of further educational path of ninth grade elementary school students. [Thesis]. Praha: Univerzita Karlova. Retrieved from <http://hdl.handle.net/20.500.11956/93174>

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Chapter # 18

ACTIVE FOREIGN LANGUAGE LEARNING PRACTICES IN HIGHER EDUCATION: THE PERSPECTIVE OF ACTORS

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ABSTRACT

The digital age and Generation Z are key features within the current panorama of teaching-learning practices in higher education and drive innovative student-centred strategies, oriented towards the reality of the labour market. The article describes an experience of pedagogical activation carried out through project-based learning using digital tools, with undergraduate Media Studies students of the School of Education in Viseu (Portugal), towards the acquisition of skills in French and English, during the academic year 2021-2022. The objective was to renew teaching practices, so as to foster greater student motivation on the part of forthcoming media professionals, by enhancing their competences and confidence with concern to spoken and written interaction within the context of foreign languages for specific purposes. The dynamics of learning combined with authentic contexts and digital tools, encourages teachers to rethink their methodology and objectives, in order to be more innovative. One accounts for the chosen strategy and the various steps followed, evaluates the path of both students and teachers, analyses the benefits, the drawbacks and the impact in terms of acquired skills and concludes with reflections for forthcoming work projects.

Keywords: higher education, foreign language, specific purposes, project pedagogy, digital tools, transversal competences.

1. INTRODUCTION

The concern with teaching-learning innovation, regardless of the age group, is not new. At the higher education (HE) level, it has also become a consistent focal point in the studies/research aimed at improving teaching practices and learning performances.

In *Standards and guidelines for quality assurance in the European HE Area* (European Association for Quality Assurance in Higher Education, European Students' Union, European University Association, and European Association of Institutions in Higher Education, 2015), the European Network for Quality Assurance in HE recalls some fundamental principles in this area: students' active role in their own learning process and the relevance of student-centred learning to stimulate motivation, self-reflection and engagement, which encourages learner autonomy, while ensuring guidance from the teacher.

The Higher Education Assessment and Accreditation Agency (2021) stresses the importance of valuing transversal skills, communication and collaborative and multidisciplinary work, adopting active learning methodologies.

Pedagogical engineering has seen strong progress in recent years, particularly in vocational pathways in HE. The predominant classical model of knowledge transfer has evolved towards a pedagogy focused on the student and on his/her professional and social adaptation (Boelen & Chaubet, 2020). Due to the use of digital tools, the project-based learning (PBL) process is encompassed within the perspective of the socio-constructivist active methodologies, bringing about an easier development of transversal skills and the acquisition of student autonomy (Jones, 2019).

This experience of the active learning of foreign languages (FL) in HE constitutes a follow up to previous work by the authors, corollary of the conclusions of the studies undertaken within the LEE project framework (Costa Lopes et al., 2018) and JASM project (Delplancq et al., 2021). The experimental design follows the PBL methodology, with 24 undergraduate Media Studies students of the School of Education (ESEV) of the Polytechnic Institute in Viseu (Portugal). The objective is to describe this experience from the point of view both of the students and the teachers, and to show how PBL, combined with the use of digital tools, makes it possible to mobilise the transversal skills necessary for the field work profiles and students' professional competences, to increase students and teachers' motivation and to work on soft skills, in addition to the hard skills acquired within the curricular unit (CU).

2. ACTIVE LEARNING IN HE

Several studies have pointed out the limits of the teaching methodologies traditionally used in HE and stressed the importance, for learners, of an awareness of how to be, of teamwork and productive interactions, with the aim of acquiring autonomy and the ability of evaluating the process in a student-centred learning environment (Bégin-Caouette, Champagne-Poirier, Loiola, Beaupré-Lavallée, & Paradis, 2021). The urgent need to provide students with hard and soft skills confirms these limitations of traditional teaching, with the risk of an artificial understanding on the part of students. In this scenario, the investigational dimension, valued in the academic and professional context today (Guo, Saab, Post, & Admiraal, 2020), is also missing.

Pedagogical activation requires a real commitment from students in their learning process, whose progression can only occur on the basis of their ideas, their proposals and their fulfilment, which require the completion of concrete tasks (St-Jean & Dupuis Brouillette, 2021). The benefits are varied for students: greater motivation, better preparation for the labour market with the implementation of situations closer to reality, a more open work environment (Jung, Ruth, & Donghun, 2017), among others. To promote proactivity, autonomy and critical thinking, which are key competences in today's global reality, active learning involves the use of active methodologies. Students acknowledge that they prefer interactive dynamic classes, which focus on practice and on a fruitful exchange between the lecturer and themselves (Sousa, Cruz, Santos, & Cândido, 2018).

One of the well-known examples of pedagogical activation is PBL, where student involvement is ensured by the research activities they have to carry out to develop a project, conducive to the construction of knowledge and the production of content and subject-matters related to the real world of their training field (Krajcik & Shin, 2014). The guiding dimensions in designing the strategies are the learning objectives, student participation in dynamic activities, collaborative work, the use of technologies and the creation of feasible artefacts, so as to guarantee the success of the project linked to the training objectives and closely connected to professional demands.

The methodology developed by the teacher in this context should also include an appropriate structure for the development of interaction and individual responsibility, digital tools for collaboration, information processing and production, motivating and suitable tasks for teamwork and a feedback routine at all stages of the process (Fournier-St-Laurent, Normand, Desrosiers, & Bernard, 2019). In this scenario, the use of digital tools allows the teacher to prepare motivating tasks to be carried out in a collaborative way within the classroom. Thus s/he tries to overcome students' reluctance. The presentation, at the beginning of the course, of a clear rationale and framework for the planned strategies,

the approach to the class, the dynamic management of interactions, the support of the teacher as learning progresses and the clarity and transparency of the assessment process are other key factors for success.

The implementation in the classroom of a culture of sharing, of self-evaluation and other evaluation, with students involved in a collaborative assessment source of construction of knowledge and skills also contributes to the updating of learning (Soubre, 2021).

3. ACTIVE LEARNING USING DIGITAL TOOLS IN FL TEACHING IN HE

In HE training courses other than specialised FL ones, the search for student motivation and the incentive to work with FL according to labour market needs, among other aspects, require an increased effort from teachers, in a process of constant reflection on their practices, their positioning and consequent updating.

Digital tools should allow for learning processes to be re-designed (Habowski, Conte, & Trevisan, 2019). The rational use of social media in FL learning in HE has proven to be a powerful aid for the ease of access and the motivation and attention it induces in students, digital natives of the 21st century (Oliveira, Brasileiro, Rodrigues, & Ferreira, 2020). The study by Saqr, Fors and Nouri (2018) highlights a positive correlation between student performance, classroom interaction and student-centred methodology using social media in HE.

Even though Pikhart and Botezat (2021) state that this methodology needs further studies and analysis for its real impact to be understood; much as they insist on the role of the teacher and on the fact that several variables may have an impact on digital learning, highlighting age, personality, motivation and students' abilities, both teachers and students respond positively to the pedagogical implementation of the use of social media

Embedded in collaborative learning of FL skills, the use of social media improves student participation and interest in training and the level and quality of teaching (Eghtesad, 2020). Facebook and Instagram are social networks regularly referenced in the specialised literature. However, the success of FL learning in this framework is not inseparable from the underlying methodology (Delplancq et al., 2019).

The PBL experience reported in this article took place in the 2021-2022 academic year and concerns a group of HE students in Portugal involved in the learning of French and English as FL. It presents the methodology followed, introducing social networks as agents of motivation, sharing and creativity, describes the working strategies developed along the way and discusses the results in the context of previous studies.

4. ACTIVE FL LEARNING EXPERIENCE IN HE IN PORTUGAL

4.1. Experimental group

The 24 students involved attended the FL option *FL applied to the new media and cyberspace*, a CU taught in the 2nd year of the undergraduate Media Studies Course in ESEV during the 2nd semester of the 2021-2022 academic year. This course aims to train media professionals in the fields of journalism, audio-visual production and direction and communication consultancy and promotes research in these areas. Throughout the 4 semesters of the first 2 years of the course, it offers compulsory training in FL with 12 ECTS, that can be complemented with the optional CU mentioned above, to which 4 ECTS are allocated, this requires 45 hours of actual lessons and 63 hours of independent student work. At this point in their training, students have already attended CU within the audio-visual field, information and communication technology, journalism, photography and cyber culture.

4.2. Framework

The working methodology proposed to students rests on a PBL perspective, using digital tools in a collaborative environment, likely to foster the acquisition of autonomy in the preparation and completion of tasks. It aims to deepen previously acquired knowledge in FL and to consolidate work on FL skills through activities devised within the framework of projects to be developed during the semester, mobilizing FL skills and transversal and interdisciplinary competences, essential for students' future professional life. The themes for the projects were of free choice, but with the requirement they disclose the reality seen in society and feasible in terms of the collection of diverse and sufficient material to work regularly throughout the semester using digital tools. As a result, they should also allow for presentations in the classroom and original and creative publications thereafter.

4.3. Methodology

The two teachers (one English-speaking, the other French-speaking) worked together concerning the preparation of lessons, their implementation in the classroom, and all the required guidance and corrections. The work proposal was presented by the teachers to the students in the 1st session of the semester. Besides defining the work methodology and the learning strategies, the presentation also focused on the theoretical framework, on the justification of the adopted approach, on the project development stages, on the evaluation phases (of the project, of the students by the teachers, of the students among themselves, of self-evaluation and of the teachers by the students), on the expectations and expected results, and on the dissemination of this work. All the students agreed, showing enthusiasm and interest in participating in the experiment. The teachers also put forward a negotiable proposal for evaluation, based on the principle of continuous evaluation, with regular delivery of assignments on the *Moodle* platform and a grade based on participation and publications in terms of originality, quality and creativity throughout the semester. It obtained a favourable opinion from students.

A class representative was elected. The students organised themselves into groups, without any particular indications, and 8 groups of 3 elements each were created. Each group had to choose a spokesperson. The students were given one week to decide which social network(s) they wanted to favour for sharing the work and the name(s) of the account(s). They also had to define the project theme and develop a work plan.

The evaluation of the FL level was planned for the 2nd session. It was based on the 4 usual written and oral skills of comprehension and expression, on the basis of original tests designed according to the principles of the CEFR and inspired by the DELF, DALF and TOEFL tests. The response time was controlled for each block of skills. The average level in English was between B1 and B2 for the 4 skills; concerning French, it was B1 for comprehension and A2 for expression.

In this same session, the groups had to present their projects to the class in both FL. The themes chosen were drug use, visually impaired persons' communication problems, academic traditions, urban sport, inequalities in sport, animals within society, mental health and the Army. Improvements were introduced based on the interaction with teachers and colleagues. The work plans were revised and delivered on the *Moodle* platform, of open consultation to all registered students. The *Facebook* group was created for the whole class, ensuring that the demands for confidentiality be met alongside with the request for institutional authorizations and invitations to follow the publications. Some student groups decided to go ahead with *Instagram* accounts as well. Requests were sent to the interviewees concerning the proposed themes, in order for students to collect more knowledge for a better reflection. Then, the students started the contacts for the interviews, that could be done in person or remotely (mail, telephone, *Zoom*), but with the necessary image archive.

The teachers supervised the preparation of the list of contact entities and the drafting of the requests, as well as all the interview scripts.

In the middle of the semester, the team's expert in photography and digital art led a 90-minute session about *Documentary Recording*. He reinforced the idea that creativity was one of the essential abilities to distinguish oneself in the labour market, and that the specialised skills for the future profession should come alongside with other skills, namely in terms of digital tools. He developed his intervention around the quality of the image and the material, the relationship between the private space and the public sphere, and the transmission of information through images, for a relevant documentary photography. The students evaluated this session as very positive, as it allowed them to have a new look on the project productions. At this time of the year, students and teachers took stock of the work carried out so far and reflected on the difficulties encountered and the consequent improvements. The teachers had to help in the reorientation of some projects (urban sport, mental health and the armed forces), in order to overcome the lack of responses to the interviews. They also had to encourage all the groups to show more creativity.

Throughout the semester, the groups carried out image capture and interviews. All texts and posts for social networks were corrected by the teachers and presented to the class. This way, the various language competences were improved, which required collaborative work, together with the acquisition of autonomy in the completion of the assignments, with corresponding flexibility and rapid adaptation to the situation. The weekly self- and peer-evaluation and teachers' remarks ensured the logic of the learning path and confirmed that all students were comfortable with the project, but also allowed for a better identification with the tasks on their part, the creation of a working environment favourable to the integration of all students in this new methodological learning environment, a constant repositioning in terms of quality, and a reflection on the creativity and impact of the productions in FL. To boost the creative spirit, teachers encouraged the use of online design platforms to diversify the images associated with the publications.

The productions that resulted evolved over time in terms of language level, diversity in genres (theoretical and opinion articles, reports, interviews, ...) and creativity and dynamism concerning the publications. Students moved from simple editing of images with captions to proposing more elaborate and attractive posts. The work delivered for assessment purposes confirmed this evolution. However, it is important to say that teachers' availability in this learning model must be highly above that of the traditional one. Support was given both inside and outside the classroom, with very short response times on the part of teachers, so as not to delay the work progress. Thus, in addition to the 3 hours per week in the classroom, each teacher devoted approximately 3 more hours outside the classroom to solve student queries and correct activities concerning all the groups.

A final qualitative assessment was carried out at the end of the semester. Each group had to present and justify in both FL, orally and in writing, the whole route taken and make a synthesis of the publications. This reflection also formalised their self-evaluation concerning the project work and the improvement of FL skills and of transversal and complementary competences. The class was then asked to participate in other evaluation both of colleagues and teachers and in the evaluation of the methodology itself. The quantitative assessment of the FL level evolution was carried out through the evaluation of the assignments presented, published and delivered on the *Moodle* platform.

5. FUTURE RESEARCH DIRECTIONS

It is recommendable that the experiment be repeated using other digital tools, accessible through smartphone applications. It would be interesting to complete the research team with

a specialist in digital communication, who could also help boost students and teachers' creativity.

6. DISCUSSION

PBL is clearly a motivating methodology for the students involved. Together with digital tools, it allows for the development of FL skills in HE, but also of transversal competences, essential for entering the labour market. A strict organization is required at the beginning of the tasks and the establishment of a culture of sharing, self-evaluation and constructive criticism, as well as the acquisition of a form of autonomy which is vital for the successful completion of the tasks. The students reacted very well to this methodology, showing enthusiasm and concern for improving their performance from the outset. The *Moodle* platform proved to be a vital tool for sharing information and work, prior to its dissemination.

Considering the CU quantitative results, we can state that the FL level of all students increased by one degree, both at the oral and written levels. From the monitoring of the activities and the qualitative evaluation (carried out through conversations on the basis of questions and free comments) throughout and at the end of the semester, we can conclude that students appreciated the freedom in choosing the theme of their projects and in designing the course. They acknowledged having acquired autonomy and being more comfortable with communicating in FL. Students considered the session on photography as beneficial and the follow-up (suggestions, reorientation, corrections) by the teachers as very useful. They acknowledged that they found it difficult to take advantage of all the benefits of autonomy, even regarding the collaborative nature of the work, namely due to the lack of innovative ideas and creativity in the various stages of the activities. Students spontaneously confessed that they preferred conformism in the tasks and in the use or research of new digital tools to make the final result more attractive.

It was very important to observe student attitudes, their behaviour, their evolution, to be able to confirm whether they are comfortable with the adopted methodology. It was not just a question of CU evaluation.

The role of the teaching staff is clearly to be well aware of the demands of the course they're teaching, which requires new strategies, an excellent knowledge of the challenges of the course at issue and its realities, flexibility, immediate adaptability, increased availability, even outside the classroom, help with reorientation when a problem arises and the ability to offer various types of support besides the one having to do with the FL. For example, to cope with the delays related to the lack of answers to the interviews, the teachers had to adjust the tasks in several sessions, proposing interviews at ESEV or research on the subject to, among other ideas, write opinion articles and compare with other realities across the world. This was a problem in all groups, independently of the theme chosen. In a way that might seem paradoxical, this kind of support is much more demanding and requires much more work and rigour than the preparation of lessons within the traditional methodology, but it is also much more rewarding considering the learning environment, inside and outside the classroom. The preparation of the sessions must follow strict criteria in terms of work rhythm, timetable and evaluation. Teachers had to get to know digital tools better immediately, identifying the ones easily manageable in the school context, essentially with the use of the smartphone and sporadic help from the computer. In order to arouse more creativity, they had to exemplify cases of good practices.

7. CONCLUSION

The learning experience described aims to be a contribution to the process of pedagogical innovation for the teaching of FL in HE. PBL, together with the use of social networks and digital tools, allows for the reinforcement of linguistic skills combined with social and cultural knowledge in this experience of working with FL in the aforementioned undergraduate Media Studies course. Enabling students to choose their project themes and the work methodology to achieve it, while mobilising transversal skills specific to their future profession, helped to improve not only their motivation, sense of responsibility, autonomy and competences in FL, but also the level of practice essential to adapt to the labour market. The activities were organised with the same objective: to produce relevant, original material in both FL, within the scope of the defined project, for oral and written sharing during lessons and for public dissemination.

Learning was based on collaborative work, fruitful interactions in the implementation of authentic contexts, inside and outside the classroom. Different communication aspects were worked on and not only in FL: communication within a team, in the classroom and during the evolution of projects (interviews, news, videos, ...). To develop their work, the students had to do research, find contacts, look for creative ideas for the presentation of their productions in the different social networks and in the classroom. They had to show constructive critical thinking towards the work of their colleagues and self-criticism. The difficulties encountered in carrying out their projects forced them to be flexible and to question themselves, seeking solutions to their problems and adapting quickly to the stumbling blocks of the work in progress.

All groups of students encountered the same difficulties: being creative for a better dynamic presentation of the accomplished work, knowing how to reorient the work plan and strategies to circumvent the unexpected and offering constructive criticism.

Thus, it is at all these different levels, in addition to the obvious help in FL, that teachers play a major role. With monitoring and reinforcement on their part, students quickly end up by renewing the learning environment and welcoming the new approach with another look. Teachers' role evolves from *sage on the stage to guide on the side*, with teachers feeling the need to review their working strategies, update their own knowledge and show more creativity, flexibility, availability, dynamism and adaptability. Teachers have to mobilise skills other than those specific to FL learning in HE. They have to be closely aware of the course objectives and study plans, the students' profiles and the needs of the labour market. They also require extensive knowledge of the topics covered and the tools used. Only in this way can they provide guidance and monitoring of the learning journey inside and outside the classroom. This implies an investment of time and energy, which goes well beyond the simple preparation of the course sessions and the classic evaluation process. This path knows neither routine nor habits; it is in perpetual evolution during the semester and from year to year. It therefore requires a search for improvements in both students' and teachers' practices, and a constant adaptation to new tools and new demands. Providing specific training competences to the forthcoming media professional and accommodating FL work into a professional practice framework allows students to better understand the interest and importance of FL, and also to better identify with their educational path.

REFERENCES

- Bégin-Caouette, O., Champagne-Poirier, O., Loiola, F. A., Beaupré-Lavallée, A., & Paradis, P. (2021). Faire face aux transformations dans l'enseignement supérieur: une conceptualisation des interactions entre différentes innovations pédagogiques [Addressing transformations in higher education: a conceptualisation of the interactions between different pedagogical innovations]. *Enjeux et société*, 8(2), 216-242. <https://doi.org/10.7202/1078496ar>
- Boelen, V., & Chaubet, P. (2020). Deux conditions et deux mécanismes pédagogiques favorables à la réflexion conduisant à des mobilisations et changements: étude du cas d'un cours universitaire en éducation relative à l'environnement [Two conditions and two pedagogical mechanisms favouring reflection conducive to mobilisation and change: case study of a university undergraduate education course pertaining to environment]. *Enjeux et société*, 7, 183-216. <https://doi.org/10.7202/1073365ar>
- Costa Lopes, A., Oliveira, A., Amante, F., Oliveira, I., Abrantes, J., Jesus Pato, M. L., Amaral, O., Relvas, S., Fidalgo, S., & Delplancq, V. (2018). Foreign languages and employability: a complex relationship. Case study in the region of Viseu (Portugal). *Proceedings of EDULEARN18*, 0614-0618. <https://doi.org/10.21125/edulearn.2018.0246>
- Delplancq, V., Costa, A. M., Oliveira, A. M., Rego, B., Fidalgo, S., Amante, F. S., & Relvas, S. (2019). Teaching foreign languages in higher education in the digital age: an experience of pedagogical innovation. *Millennium - Journal of Education, Technologies, and Health*, 4e, 75-80.
- Delplancq, V., Costa, A.M., Amaro Costa, C., Coutinho, E., Oliveira, I., Pereira, J., Lopez Garcia, P., Gillain, R., Amante, S., Fidalgo, S., & Relvas, S. (2021). Storytelling and digital art as a means to improve multilingual skills. In M. Carmo (Ed.), *Education and New Developments 2021* (pp. 344-347). Lisbon, Portugal: inScience Press. <https://doi.org/10.36315/2021end073>
- Eghtesad, S. (2020). Apprentissage collaboratif d'expression écrite du français sur instagram [Collaborative learning of written expression in French on Instagram]. *Plume, Revue semestrielle de l'Association Iranienne de Langue et Littérature Françaises*, 16(31), 29-53. <https://doi.org/10.22129/plume.2020.238786.1150>
- European Association for Quality Assurance in Higher Education, European Students' Union, European University Association, & European Association of Institutions in Higher Education (2015). *Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG)*. Brussels, Belgium.
- Fournier-St-Laurent, S., Normand, L., Desrosiers, C., & Bernard, S. (2019). Les aménagements gagnants d'une CLAAC: ce qu'en disent les étudiants [The winning layouts of a CLAAC: what students say]. *Pédagogie collégiale*, 32(2), 32-38.
- Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: student outcomes and measures. *International Journal of Educational Research*, 102, 1-13. <https://doi.org/10.1016/j.ijer.2020.101586>
- Habowski, A. C., Conte, E., & Trevisan, A. L. (2019). Por uma cultura reconstrutiva dos sentidos das tecnologias na educação [Towards a reconstructive culture of the significance of technology in education]. *Educação & Sociedade*, 40. <https://doi.org/10.1590/ES0101-73302019218349>
- Higher Education Assessment and Accreditation Agency. (2021). *Strategic plan 2021-2024*. Retrieved from https://www.a3es.pt/sites/default/files/A3ES_Plano_Estrategico.pdf
- Jones, L. (2019). Comunicación mediada por tecnologías: Aprendizaje y enseñanza de la lengua extranjera [Communication mediated by technologies: Learning and teaching of a foreign language]. *Review of Comunicación mediada por tecnologías: Aprendizaje y enseñanza de la lengua extranjera*, 23(3), 47-51. <https://doi.org/10125/44695>
- Jung, H., Ruth, E., & Donghun, L. (2017). Students' satisfaction on their learning process in active learning and traditional classrooms. *International Journal of Teaching and Learning in Higher Education*, 29(1), 108-118.
- Krajcik, J., & Shin, N. (2014). Project-based learning. In R. Sawyer (Ed.), *The Cambridge Handbook of the Learning Sciences* (pp. 275-297). Cambridge: Cambridge University Press. <https://doi.org/10.1017/CBO9781139519526.018>

- Oliveira, P., Brasileiro, B., Rodrigues, F., & Ferreira, M. (2020, August). *The pedagogical use of virtual networks: report of an experience*. Paper presented at the International Congress of Education and Technologies, online. Retrieved from <http://cietenped.ufscar.br/submissao/index.php/2020/article/view/1568>
- Pikhart, M., & Botezat, O. (2021). The impact of the use of social media on second language acquisition. *Procedia Computer Science*, 192, 1621-1628. <https://doi.org/10.1016/j.procs.2021.08.166>
- Saqr, M., Fors, U., & Nouri, J. (2018). Using social network analysis to understand online problem-based learning and predict performance. *PLOS ONE*, 13(9). <https://doi.org/10.1371/journal.pone.0203590>
- Soubre, V. (2021). *L'agir évaluatif partagé: une ressource dynamique pour l'enseignement et l'apprentissage des langues étrangères dans un contexte d'enseignement supérieur* [Shared evaluative action: a dynamic resource for teaching and learning foreign languages in a higher education context] (Doctoral dissertation, University of Geneva). Retrieved from <http://archive-ouverte.unige.ch/unige:150813>
- Sousa, M. N. C., Cruz, C. A., Santos, Z. M. S. A., & Cândido, A. L. (2018). Students' knowledge about active methodology in the construction of the innovative teaching learning process. *Revista Interdisciplinar Encontro das Ciências*, 1(1), 61-74.
- St-Jean, C., & Dupuis Brouillette, M. (2021). Contextualisation des pédagogies actives à l'université: comment mettre l'étudiant au coeur de ses apprentissages? [Contextualisation of active pedagogies at university: how to place the student at the core of his/her learning achievements?]. *Revue internationale des technologies en pédagogie universitaire*, 18(1), 114-124. <https://doi.org/10.18162/ritpu-2021-v18n1-11>

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Chapter # 19

EXPLORING ASSESSMENT TYPES, INSTRUMENTS AND METHODS OF ASSESSING KNOWLEDGE, SKILLS AND VALUES IN HIGHER EDUCATION

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ABSTRACT

This study aimed to explore the assessment types, instruments and methods of assessing knowledge, skills and values in higher education. The challenge was that lecturers could not comprehend, differentiate and apply assessment types, instruments and methods when assessing. The lecturers indicated that this could be attributed to the lack of assessment policy, strategy, awareness campaigns, workshops, orientation and framework that stipulates the use of assessment types, instruments and methods. The researchers have not come across literature that addressed the aforementioned. Participants were 10 lecturers who were purposively sampled and interviewed from seven Faculties at the University of Technology in South Africa. The question was: "To what extent are the assessment types, instruments and methods used by lectures to assess students' knowledge, skills and values? A qualitative case study method was used to answer this question. Semi-structured interviews and document analysis were used for collection. Atlas. ti. was used for analysis. It was found that examinations, assignments, tests, presentations and discussions were interpreted by lecturers as assessment types and methods. Assessment types were not explicit in the module descriptors. Lecturers must develop assessments that are relevant, progressive and just in time.

Keywords: types, instruments, methods, knowledge, skills, values.

1. INTRODUCTION

Research revealed that higher education's actual use of assessment types, instruments, and methods is not adequate (Medland, 2016). This inadequacy leads to the gap between the knowledge, skills and values learners need to acquire when learning (Ridgway, McCusker, & Pead, 2004). Knowledge, skills and values are needed to succeed in the increasingly global, technology-infused 21st-century workplace. The challenge in this study was that lecturers struggled to comprehend, differentiate and apply assessment types, instruments and methods (aTIMs) when designing assessments. This was raised by lecturers during the short learning programme on the assessment that is conducted two or three times a year at the study university. It was also evident during the interviews that lecturers could distinguish between the types, instruments and methods of assessment as well as when, where and how to apply them. This was also discovered during the analysis of the module descriptor document. A module descriptor is a document used to describe the module plan for transferability, continuity, regulatory and review purposes. This document contains the name, duration, credits, purpose, unit, assessment strategy and assessment criteria of the module as well as issues relating to assessment Types, instruments and methods used to assess the module. It should also indicate the resources needed for students to succeed. Literature indicated that this challenge poses a gap between what has been learned, taught and assessed. For this reason, the researchers proposed aTIMs framework that could be used by lecturers to ease

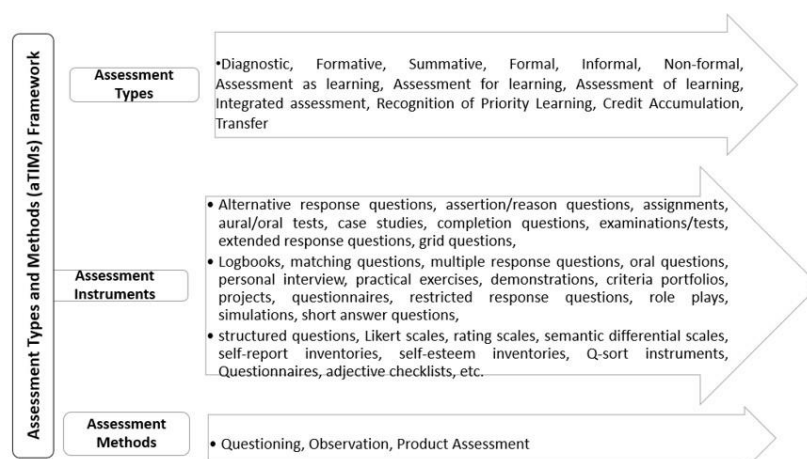
the problem. In this regard, Ridgway et al. (2004) mentioned that today’s world of work requires a shift in assessment strategies to better measure the skills and values that are highly expected.

Assessment is the process used to identify, gather and interpret information and evidence against the required competencies to make a judgement about a learner’s KSVs (SAQA, 2014, 2022). The assessment indicates what the institution gives priority to in making judgements (Boud & Falchikov, 2007). These authors further stated that assessment has a powerful backwash effect on all teaching and learning activities. In this study, assessment refers to the process that guides the lecturers on what, when, where and how to assess to make a judgement about KSVs that should be acquired by the learners. On the other hand, assessment guides the learners on what, when, where and how to perform academically. Assessment is a general item, which consists of aTIMs used to gather information about learner KSVs (Allan, 1999; Ekbatani & Pierson, 2000; Lambert & Lines, 2000). The purpose of assessment is to help lecturers identify learners’ strengths and weaknesses and assist both the lecturer and learners to monitor the learning progress that motivates learners to improve their performance (Masters, 2022). Sulistyarini (2022), further indicated that the purpose of assessment in education is to measure learners’ progress and reflect an understanding of each learner. Assessments are divided into three categories relating to types, instruments and methods.

2. aTIMs FRAMEWORK

Figure 1 illustrates the proposed assessment types, instruments and methods (aTIMs) framework intended to assist the lecturers with the comprehension, differentiation and application of aTIMs. When assessing the knowledge, skills and values (KSVs), three (3) assessment methods should be employed all the time without fail. When designing assessment tasks for KSVs, relevant and or discipline-specific assessment instruments should be used. It is the responsibility of the discipline-specific stakeholders to decide on the selection of these instruments. When planning assessments for KSVs, it is critical to decide on or a combination of any of the twelve (12) assessment types to indicate the intention of the assessment to be undertaken.

Figure 1.
The proposed assessment types, instruments and methods (TIMs) framework.



3. RELATED LITERATURE

3.1. Types of assessment

Literature reveals that the assessment types are processes or intentions that must be well-constructed and designed as useful tags when planning assessments (Scriven, 1967). Assessment types include diagnostic, formative, summative, informal, non-formal, formal, assessment as, for and of learning, credit accumulation and transfer, recognition of prior learning as well as integrated assessment (SAQA, 2022). It is critical in this study to define the identified assessment types to provide a clear understanding for those who would wish to use these assessment types when planning paper-based, online, oral or practical assessments.

Diagnostic assessment is an assessment conducted before teaching or training starts (SAQA, 2014, 2017). Formative assessment takes place in the context of classroom interaction (Csapó & Molnár, 2019). Summative assessment is an assessment conducted at the end of sections of learning or the end of a whole learning programme (SAQA, 2014). Informal assessment is any judgements made or feedback given in the course of teaching and learning. Informal assessments may be in written form but are not usually recorded (SAQA, 2017). Non-formal assessment means planned educational interventions that are not intended to lead to awarding of qualifications. (SAQA, 2019, 2022). Formal assessment means the assessment for which assessment processes, tools, and results are recorded towards the achievement of a qualification (SAQA, 2014). Assessment as Learning (AAL) creates reflective learners who have the agency to decide on their next learning step (Dann, 2014). Assessment for Learning (AFL) focuses on monitoring the quality of the learning process and on providing continuous feedback to guide learning and teaching, which can positively influence learning processes (Westbroek, Van Rens, Van den Berg, & Janssen, 2020). Assessment of learning (AOL) is usually conducted at the end of a unit of work (Dann, 2014). The Credit accumulation and transfer (CAT) is an arrangement the diverse features of both credit accumulation and credit transfer are combined to facilitate lifelong learning and access to the workplace (SAQA, 2014, 2019). Recognition of Prior Learning (RPL) is a process through which non-formal, informal and formal learning can be measured and mediated against learning outcomes for recognition within and across different contexts (SAQA, 2019). Integrated assessment indicates how the assessment will be undertaken to determine a learner's applied competence and successful completion of learning in the qualification (SAQA, 2022).

3.2. Assessment instruments

Assessment instruments refer to the nature of the assessment task given to the learner to do (SAQA, 2017). For example, alternative response questions, assertion/reason questions, assignments, aural/oral tests, case studies, completion questions, examinations/tests, extended response questions, grid questions, logbooks, matching questions, multiple response questions, oral questions, personal interviews, practical exercises, demonstrations criteria, portfolios, projects, questionnaires, restricted response questions, role plays, simulations, short answer questions, structured questions and many hundred others Likert, rating, semantic differential scales, self-report inventories, self-esteem inventories, Q-Sort instruments, questionnaires, adjective checklists, etc. (Hopkins, 1998; SAQA, 2017). The selection of these assessment instruments should be relevant to learning and teaching whether is for contact, distance or online mode of delivery. In addition, it is critical that the selection should also be discipline-specific.

3.3. Assessment methods

Assessment methods refer to the activities that a lecturer engages in as they assess the learner's work namely questioning, observation and product assessment (SAQA, 2017).

These methods should lead to direct evidence. Questioning refers to asking questions orally, writing employing paper-based or online. These questions are answered orally, on paper or using an electronic device. Observation refers to observing the learner while he/she is carrying out tasks, real or simulated. Product assessment refers to assessing something the learner has produced after the task has been completed (SAQA, 2017). It is critical that methods of assessment should be translated into teaching and learning methods that could also be applied in an online environment to bridge the gap between learning, teaching and assessment. In doing so, it would be conducive for lecturers to assess KSVs in each of the aTIMs and avoid assessing the knowledge/cognitive domain only.

3.4. Assessment of knowledge

Knowledge is a set of organised statements of facts or ideas, presenting a reasoned judgement or an experimental result, which is transmitted to others through some communication medium in some systematic form (Maton, 2014). The assessment of knowledge involves the acquisition of intellect. The knowledge/cognitive domain is one of the three domains (skills/psychomotor and values/affective) that are used in assessing. Literature shows that this domain gets the most attention than others and therefore creates problems between graduates and employers (Sulistyarini, 2022; Krathwohl, 2002). There are normally six major categories, which are in a hierarchy, starting from the simplest intellect to the most complex. The researchers, therefore, argue that the lecturers have to intentionally make the effort to contextualise these steps from the cognitive domain in their respective disciplines to address insufficiencies in the assessment of this area (Chweu, Mji, & Simelane-Mnisi, 2021).

3.5. Assessment of skills

The skills, commonly referred to as manual or physical body skills are normally developed in an intended discipline-specific setting (Baharom, et al., 2016). In such settings, learners can develop and practice both their practical and hands-on skills. It is important to be able to measure and assess these skills. Therefore, the various aTIMs involved in implementing the skills domain must be discussed in detail to ensure that they are effective (Baharom, et al., 2016). Assessing the skills Includes assessment of the physical procedures in execution. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or most complex (Simpson, 1966; Dave, 1970; Harrow, 1972). There are normally seven major categories listed from the simplest to the most complex movement, coordination and use of the motor-skill areas. The researchers contend that to remedy deficiencies in the assessment of this area, lecturers should deliberately attempt to contextualise these steps from the skills domain in their respective fields.

3.6. Assessment of values

Values are as important and lasting beliefs or ideals shared by the members of a culture or stakeholders about what is good or bad and desirable or undesirable and have a major influence on a person's behaviour and attitude as well as serve as broad guidelines in all situations (Popham, 1999). In contrast to intellect and performance assessment, the assessment of values does not measure the content that learners know or the skills they can perform, what it measures instead are learners' dispositions (Popham, 1999). The challenge presented by working with, and in, the values domain must not be ignored simply because it presents difficulties and is more contentious than the intellect or performance domains (Sumsion & Goodfellow, 2004). The skills and values domains are the least applied and least understood of all of Bloom's taxonomy trilogy (Sideeg, 2016). This sentiment is observed in the studies that were conducted in New Zealand, Canada & Poland that showed that the assessment of values was not organised and that others claim to

have integrated them into the teaching and learning programmes, however, none could provide details on the application of assessment of values in the assessment practice (Ananiadou & Claro, 2009). If the teaching purpose is to change values rather than to transmit information, then the instruction should be structured to progress through the levels of the values domain (Micklich, 2012). The researchers concluded that to address deficiencies in the assessment of this area, lecturers should consciously try to contextualise these steps from the values domain in their respective fields i.e., discipline-specific.

4. METHODS

The question posed in this study was: To what extent are the assessment types, instruments and methods used by lectures in various disciplines to assess students' knowledge, skills and values? To answer this question a qualitative case study was used to explore the assessment of aTIMs for assessing KSVs in higher education to provide the aTIMs framework for use by lecturers. The qualitative case study provides a tool for researchers to study complex phenomena within their context (Creswell, 2009) Data were collected using semi-structured interviews and document analysis (module descriptors). The semi-structured interview is conducted using interview questions that predetermine and incorporates open-ended questions so that the lecturers could provide in-depth responses (Guest, Namey, & Mitchell, 2013). The interview questions included three questions such as which assessment types do you use to assess KSVs? Which assessment instruments do you use to assess KSVs? Which assessment methods do you use to assess KSVs? Document analysis is a type of qualitative research in which documents were reviewed to assess an appraisal theme (Frey, 2018).

The document analysed in this study comprised 14 module descriptors from the 7 Faculties of the study university. A module descriptor is a document used to describe the module plan for transferability, continuity, regulatory and review purposes. This document contains the name, duration, credits, purpose, unit, assessment strategy and assessment criteria of the module as well as issues relating to assessment types, instruments and methods used to assess the module. A module descriptor also indicates the resources to be used. Data were analysed using Saldaña's (2021) thematic analysis approach in Atlas. ti. The researchers uploaded 5 interview documents relating to assessment practice, assessment of KSVs and 14 module descriptors. In this case, 103 codes were created, and the computer-generated 370 quotations. From these codes, three themes relating to assessment types, instruments and methods were created. Ethics approval was received from the study university to conduct this research.

4.1. Participants

Participants in this study were 10 lecturers who were purposively sampled and interviewed from seven Faculties in various disciplines at the University of Technology in South Africa. These participants all attended the short learning programme on assessment at the study university. Purposeful sampling wants to discover, understand and gain insight into the phenomena and therefore researchers must select a sample from which the most can be learned (Creswell, 2009). The lecturers were selected from the seven faculties at the study university. These lectures comprised seven females and three males.

4.2. Validity and reliability

This study employed a triangulation technique to validate the findings. It draws its findings from the literature, document analyses and interviews. (Creswell, 2009; Tashakkori & Teddlie, 1998). It may be argued that the purposes of assessment found in this study

corroborate with the literature as well as contributes to the improvement of assessment practices in higher education.

5. FINDINGS AND DISCUSSION

The findings are presented according to themes relating to assessment types, instruments and methods for assessing KSVs.

5.1. Assessment types for assessing KSVs

The findings revealed that lecturers were interpreting types of assessment as tests, examinations, assignments, class tests, presentations, online assessments and discussions. Lecturers indicated the *tests and group discussions*. It was found that most lecturers were reluctant to indicate the assessment they used for assessing the skills because they were not aware that this was expected of them. However, L7, stated that *he usually employs practical assessment, in which the learner sits next to the computer and receives a question paper*. It was also found that none of the lecturers responded to assessing the values. The findings also showed that none of the 14 module descriptors mentioned or differentiated assessment types for measuring KSVs. It was found that assessment types were not explicit in the module descriptors. It may be argued in this study that most of the lecturers used the assessment types mostly to assess knowledge and ignore the skill and values. In this case, Hoque, Chowdhury, Hossen, & Arjumand (2021) emphasised that lecturers should select the assessment types that will support teaching strategies to enhance knowledge (cognitive), skills (psychomotor), and values (affective). It is critical that lecturers used various assessment types also assess skills and values so that they could be able to align what they teach with what is required in the workplace. This in turn will produce future-ready graduates who are competent. The researchers contend that assessment types are time-oriented processes that are meant to direct and inform the lecturer regarding how often and when to assess learning. These types of assessments indicated in figure 1.1, can be used to determine the intent of the lecturer's assessment design and be used to prepare assessments of KSVs.

5.2. Assessment instruments for assessing KSVs

The findings indicated that lecturers used different assessment instruments to assess KSVs, relating to tests, assignments, homework, question papers, online assessments/tools, and rubrics to mark assessments. In terms of the assessment instruments for assessing knowledge, L1 indicated that he used *online assessments*. L2,3,4,6,7,8 9 indicated *tests and assignments*. L5, said *group discussions* while L10 said *rubrics*. Regarding the assessment instrument for assessing the skills, L1 stated that they do not focus on the skills since they do not always have the programs that would allow them to prove that learners have learned the skill. L3 said that *she enjoys practical case studies and presentations*, while L5 and L7 said that they *favour group discussions*. It was also found that all lecturers were unable to provide answers regarding the assessment instrument for assessing the values. However, some indicated that they would be willing to utilise one if one were made available for them. It was found that from 14 module descriptors, the majority did not provide assessment instruments, except for module descriptor 7 from Faculty D, which revealed *exams, assignments, class activities, and semester examinations*. It was also found that this module descriptor made use of assessment tools such as *checklists, rubrics, and notes*. However, no differentiation was made in the module descriptor as to whether the instruments or tools offered were for measuring SKVs. It may be observed in this study that lecturers were using various assessment instruments to test knowledge mostly. It was clear that lecturers struggled to apply assessment instruments that would assist them to ask skills and values. In this case, lecturers were unable to respond to how values were assessed. However, some indicated that they

would be willing to explore the instrument that helps in assessing values. In this regard, SAQA (2017) highlighted that assessment instruments should be crucial to understand and applied adequately as they relate to the nature of the assessment task given to the learner. Furthermore, Medland (2016), argued that the assessment of skills and values should be considered and given more priority than they presently receive. The researchers argue that lecturers should carefully select and makes sense of the instrument indicated in figure 1.1 to figure out which ones are relevant to use for either knowledge, skills or values in the relevant discipline. Furthermore, lecturers should make use of assessment instruments that promote authenticity and real-life experience to harness the skills and values of the graduates in the degree they are pursuing. In this case, the appropriate use of assessment instruments would ensure that future graduates are equipped with 21st-century skills.

5.3. Assessment methods for assessing KSVs

It was found in this study that lecturers made use of different assessment methods relating to tests, online assessments, group discussions, etc. Concerning assessing knowledge, the findings revealed that all lecturers used *examinations* and *assignments*. L8 revealed the use of *examinations*, *assignments* and *practical* methods. Regarding the methods for assessing skills, L1 was adamant that he *does not assess skills but provided the learners with a theory as the programs did not allow the learners to acquire the skills*. Meanwhile, L4 claimed that *the assessment method involved tests and case studies*. The findings revealed that assessment methods for assessing KSVs were described in 14 modules. It was discovered that module descriptor 7, divided assessment methods into formative and summative assessments. Formative assessments consisted of one-on-one crit sessions, group discussions, informal class discussions, oral presentations, assignments and tutorial exercises, self-assessment, oral questions e-test based on an essay, multiple-choice, matching, and short type of questions. Summative assignments involved practical assessment tests and examinations, short online tests, 3-hour examination paper-based on essays, multiple-choice, matching and short types of questions. Furthermore, module descriptor 7 revealed assessment methods as questioning/product, product and questioning/product. It may be argued that module descriptor 7 described types of assessment as assessment methods. This shows the misunderstanding of the use of assessment types and methods in designing module descriptors. SAQA (2017) argues that questioning, observing, and product assessment are the methods that lecturers should use when assessing a learner as a direct primary source of evidence. The findings revealed that all lecturers indicated that their assessment methods were not assessing values. Radwan (2022) foresaw the demand for assessments that place a strong emphasis on the values domain to provide a valid indicator of the effectiveness of learning and to be used in practical assessment procedures. Ridgway et al. (2004) also noted the need for a change in assessment practice to better capture the values and skills that are highly demanded in today's workplace. To satisfy industrial demands, the assessment of values should be considered in all assessment methods and exhibited in the process for questioning, observation, and product assessment. This implies that the education sector would have to adjust the manner they prepare graduates so that they could be qualified for future employment trends. In this case, the industry would believe that fresh graduates are adequately prepared for the modern workplace.

6. CONCLUSION

In an attempt to provide a solution to the challenge identified in this study of lecturers grappling to comprehend, differentiate and apply aTIMs when designing assessments at the study university, it may be seen that assessing KSVs is essential. This is because most of the lecturers at the study university in South Africa used the assessment types mostly to assess

knowledge and ignore the skill and values. Lecturers were using various assessment instruments to test knowledge more than assessing skills and values. In terms of assessment methods, it may be observed from this study that lecturers confused the use of assessment types and methods and did not assess the values. It is for these reasons that this study proposed aTIMs framework. Based on the study results in this chapter, it can be concluded that in ensuring the administration of assessment practice, lecturers should be guided by the proposed aTIMs framework to select the aTIMs. If all these elements are included in the assessment processes, they have the potential to improve the assessment quality standards that are expected by all lecturers at the study university in South Africa.

It is essential that lecturers develop assessments that are relevant and just in time. Lecturers should appropriately select the relevant instrument that assesses what it intended to assess according to what was planned and communicated. It is critical that three assessment methods (questioning, observation and product assessment) provided in the aTIMs framework are utilised in the assessments to close the gap between learning, teaching and assessment in contact, distance or online mode of delivery. Assessment tasks should present sections indicating assessment domains (KSVs) to support the lecturers in demonstrating their assessment goals. A further study could be conducted to investigate the lecturers' perspectives on the aTIMs using the mixed method.

7. RECOMMENDATIONS

It is critical that lecturers develop assessments that are relevant, progressive and just in time. Research is required, to test the practicability of the proposed aTIMs framework for assessing KSVs with a larger sample. Discipline-specific research could be conducted relating to the research question in this chapter. A study is needed on how to offer workshops to lecturers on aTIMs and KSV to see how practices and perspectives evolve through this process. A study on learning more about lecturers' reasons for limiting assessment practices is required. Finally, it is critical to investigate the application of assessment methods to learning, teaching and assessment.

REFERENCES

- Allan, D. (1999). Testing and assessment. *English Teaching Professional*, *11*, 19-20.
- Ananiadou, K., & Claro, M. (2009). 21st century skills and competences for new millennium learners in OECD countries. *OECD Education Working Papers No. 41*. <https://doi.org/10.1787/218525261154>
- SAQA, (2014). Policy for credit accumulation and transfer within the National Qualifications Framework. Pretoria: SAQA
- SAQA, (2017). National policy and criteria for designing and implementing assessment for NQF qualifications and part-qualifications and professional designations in South Africa. Pretoria: SAQA
- SAQA, (2019). National policy for the implementation of the recognition of prior learning. Pretoria: SAQA
- SAQA, (2022). Policy and criteria for the registration of qualifications and part-qualifications on the National Qualifications Framework. Pretoria: SAQA
- Baharom, S., Hamid, R., Khoiry, M. A., Mutalib, A. A., Hamzah, N., & Kasmuri, N. (2016). Effectiveness of teaching and learning method in concrete laboratory works. *Pertanika Journal of Social Sciences and Humanities*, *24*(1), 63-76.
- Boud, D., & Falchikov, N. (2007). Introduction: Assessment for the longer term. In *Rethinking assessment in higher education* (pp. 13-23). Routledge. <https://doi.org/10.4324/9780203964309>

- Chweu, E. M., Mji, A., & Simelane-Mnisi, S. (2021). Exploring systematic assessment of knowledge, skills and values using blooms taxonomy at a university of technology. In *EDULEARN21 Proceedings* (pp. 8267-8274). IATED. <https://doi.org/10.21125/edulearn.2021.1667>
- Creswell, J. W. (2009). *Research designs: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: Sage Publications.
- Csapó, B., & Molnár, G. (2019). Online diagnostic assessment in support of personalized teaching and learning: *Frontiers in Psychology*, *10*, 1522. <https://doi.org/10.3389/fpsyg.2019.01522>.
- Dann, R. (2014). Assessment as learning: blurring the boundaries of assessment and learning for theory, policy and practice. *Assessment in Education: Principles, Policy and Practice*, *21*(2), 149-166. <https://doi.org/10.1080/0969594X.2014.898128>
- Dave, R. H. (1970). Psychomotor levels in developing and writing objectives. *Educational Innovators Press*.
- Ekbatani, G. V., & Pierson, H. D. (2000). Promoting Learner-Directed Assessment. *Learner-directed Assessment in ESL*, 151-152. Lawrence Erlbaum Associates.
- Frey, B. B. (Ed.). (2018). *The SAGE encyclopaedia of educational research, measurement, and evaluation*. Sage Publications. <http://doi.org/10.4135/9781506326139.n685>.
- Guest, G., Namey, E. E., & Mitchell, M. L. (2013). *Collecting qualitative data: A field manual for applied research*. Sage.
- Harrow, A. J. (1972). A taxonomy of the psychomotor domain: A guide for developing behavioral objectives. *Longman Publishing Group*.
- Hopkins, K. D. (1998). *Educational and psychological measurement and evaluation*. Allyn and Bacon, A Viacom Company. MA 02194; Internet: <http://www.abacon.com>.
- Hoque, S. S. I., Chowdhury, A. A., Hossen, M. R., & Arjumand, D. (2021). Can tailoring skills be delivered through e-learning platform; perspective of the three-learning domains (cognitive, affective and psychomotor domain). *American International Journal of Education and Linguistics Research*, *4*(1), 31-38. <https://doi.org/10.46545/aijeler.v4i1.290>
- Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into Practice*, *41*(4), 212-218. https://doi.org/10.1207/s15430421tip4104_2
- Lambert, D., & Lines, D. (2000). *Understanding Assessment: Purposes, Perceptions, Practices*. Routledge Falmer. <https://doi.org/10.4324/9780203133231>
- Masters, G. N. (2022). Keynote: Reimagining the purpose of assessment. In K. Burns (Ed.), *Research Conference 2022: Reimagining assessment: Proceedings and program*. *Australian Council for Educational Research*. <https://doi.org/10.37517/978-1-74286-685-7-10>
- Maton, K. (2014). Building powerful knowledge: The significance of semantic waves. *Knowledge and the future of the curriculum: International studies in social realism*, 181-197. https://doi.org/10.1057/9781137429261_12
- Medland, E. (2016). Assessment in higher education: Drivers, barriers and directions for change in the UK. *Assessment and Evaluation in Higher Education*, *41*(1), 81-96. <https://doi.org/10.1080/02602938.2014.982072>
- Micklich, D. L. (2012). The Effect of Affective Domain Characteristics on Behavioral or Psychomotor Outcomes. *Developments in Business Simulation and Experiential Learning*, *39*, 164-172.
- Popham, W. J. (1999). *Classroom assessment: What teachers need to know*. Allyn and Bacon, A Viacom Company, MA 02194; World Wide Web: <http://www.abacon.com>.
- Radwan, A. (2022). The post-pandemic future of higher education. *Dean and Provost*, *23*(6), 1-5. <https://doi.org/10.1002/dap.30987>
- Ridgway, J., McCusker, S., & Pead, D. (2004). Literature review of e-assessment. Futurelab.
- Saldaña, J. (2021). The coding manual for qualitative researchers. *The Coding Manual for Qualitative Researchers*, 1-440. Thousand Oaks, CA: Sage Publications
- Scriven, M. (1967). The Methodology of Evaluation. In Tyler, RW, Gagne, RM, Scriven, M.(ed.): *Perspectives of Curriculum Evaluation*. *The Methodology of Evaluation*. In Tyler, R, Gagne, R, Scriven, M.(Ed.): *Perspectives of Curriculum Evaluation*, p. 38-83. Chicago. Rand McNally.
- Sideeg, A. (2016). Bloom's Taxonomy, Backward Design, and Vygotsky's Zone of Proximal Development in crafting learning outcomes. *International Journal of Linguistics*, *8*(2), 158-186. <https://doi.org/10.5296/ijl.v8i2.9252>

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- Simpson, E.J. (1966). The classification of educational objectives: Psychomotor domain. *Illinois Journal of Home Economics*, 10(4), 110–144.
- Sulistyarini, W. (2022). Analysis of cognitive aspects of test techniques in Islamic education learning. *EDUKASI: Jurnal Pendidikan Islam (e-Journal)*, 10(2), 166-190. <https://doi.org/10.54956/edukasi.v10i2.278>
- Sumsion, J., & Goodfellow, J. (2004). Identifying generic skills through curriculum mapping: A critical evaluation. *Higher Education Research and Development*, 23(3), 329-346. <https://doi.org/10.1080/0729436042000235436>
- Tashakkori, A., & Teddlie, C. B. (1998). *Mixed methodology: Combining qualitative and quantitative approaches* (Vol. 46). Thousand Oaks, CA: Sage Publications.
- Westbroek, H.B., Van Rens, L., Van den Berg, E., & Janssen, F. (2020). A practical approach to assessment for learning and differentiated instruction. *International Journal of Science Education*, 42(6), 955-976, <https://doi.org/10.1080/09500693.2020.1744044>

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Chapter # 20

CLASS SINGING BY PRE-SERVICE GENERALISTS: INDIVIDUAL LEADING AND CO-TEACHING

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ABSTRACT

This study contributes to filling the gaps in how pre-service generalist teachers develop skills to lead class singing. In this chapter, I present the case study of two generalists who co-led class singing in their second-year internship while they taught individually in their first- and third-year internships. The comparison of the co-led lesson with the individual lessons shows significant differences in how the two generalists led the singing and managed the class. The focus of this study is on their use of audio devices and musical instruments. I filmed the internship lessons over the course of their three-year teacher training and analysed the moments when the trainees used audio devices and musical instruments. The analysis of the individual lessons shows changes in the in-situ practice of the two generalists using an audio device, guitar and body percussion. The analysis of the co-led lesson shows how the trainees collaborated on classroom management from a didactic and musical point of view.

Keywords: music education, class singing, song leading, co-teaching, pre-service teacher, teacher training.

1. INTRODUCTION

Generalist teachers play a key role in music education in pre-school and primary schools because they can include musical activities in their daily teaching, which contribute to the transmission of this cultural practice (King, 2018; Stadler Elmer, 2015). However, there is still little research on the in-situ practices of generalists, particularly during their training.

To our knowledge, no studies have focused longitudinally on the professional development of generalists in music education or on the co-leading of lessons. Several studies have reported difficulties and issues related to the training of generalists in music education (de Vries, 2013; Garvis, & Riek, 2010). Other studies have highlighted that the value generalists give to music education in preschool and primary schools represents a potential for change in their actions (de Vries, 2014; Collins, 2014). Some research on the professional development of undergraduate music students has also focused on initial field teaching experiences and peer-team teaching (Brenan, & Witte, 2003; Paul et al., 2001; Hicks, 1982).

Our research contributes to knowledge about music education delivered by generalists with a three-year longitudinal study of the development of teachers' knowledge and skills to lead class singing. Each member of our team was responsible for analysing specific skills.

In this paper, I present the case study of pre-service teachers Martha and Sarah, who taught individually in their first- and third-year internship classes and together in their second-year internship. This provides an example of co-led class singing. I focus on the development of their skills in using audio devices (AD) and musical instruments (MI), including body percussion. My analysis aims to describe how Martha and Sarah led the class

singing using playback, guitar, and body percussion when they taught separately and to examine how they shared the musico-didactic tasks in the co-led lesson.

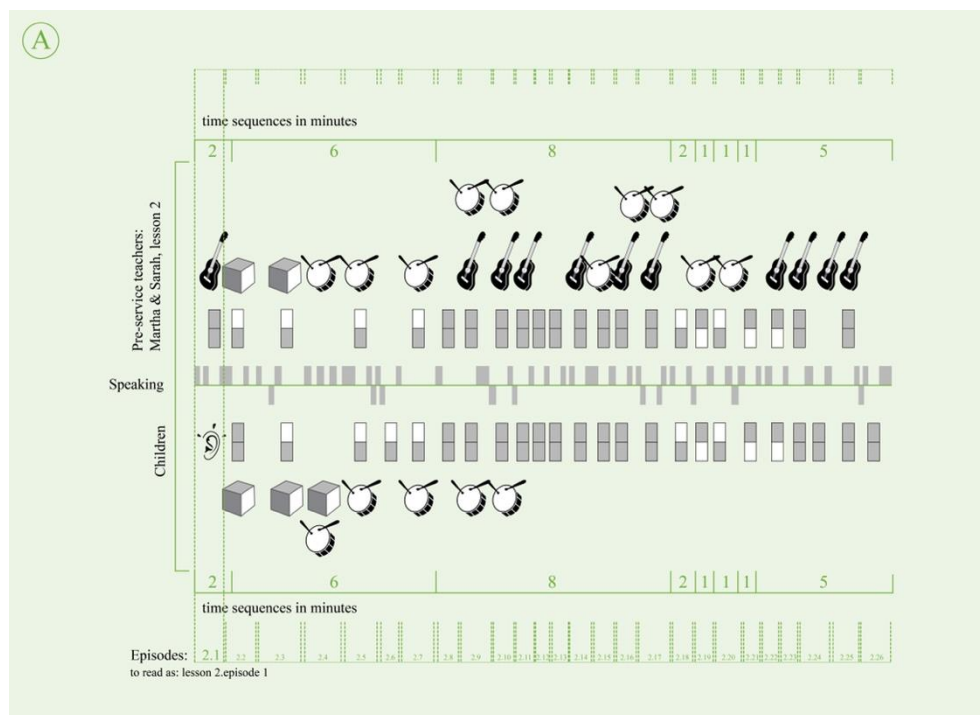
2. DESIGN AND METHOD

Martha and Sarah were attending the three-year training course as generalists when they joined our study according to European and national ethical requirements of consent to participate. During their internships, I recorded one lesson a year, requiring them to teach the children a new song. I attended the lessons in person and videotaped them. The data set of the two case studies consists of a total of five videotaped lessons: two individual lessons for both (first- and third-year training), and the video of the co-led lesson in the second year.

I transcribed the videotaped lessons using the Lesson Activities Map methodology (Savona, Stadler Elmer, Elisa, Joliat, & Cavasino, 2021). Lesson Activities Maps (LAMaps) provide an overview of the temporal organisation of lesson activities and enable the overall context to be considered when some moments are selected for in-depth analysis.

Figures 1, 3 and 4 show Martha and Sarah’s five lessons transcribed with the LAMap methodology. Table 1 shows the key to the symbols and icons to read the LAMaps. Figure 1 shows the lesson co-led by Martha and Sarah in their second-year internship. Figure 3 shows Martha’s first- and third-year individual lessons and Figure 4 shows Sarah’s individual lessons. In the LAMaps, simultaneous activities are displayed vertically. These are numbered progressively and termed “episodes” (abbreviated: Ep.) as shown in Figure 1.

*Figure 1.
Class singing lesson co-led by pre-service generalists Martha and Sarah
in their second-year internship.*



Class singing by pre-service generalists: individual leading and co-teaching

Table 1.
Key for reading the symbols and icons of the LAMap transcription methodology.















LAMap Key				
	Single verse	Verse(s) of the target song momentarily not in focus	 Movements	Movements not related to the semantic content of the lyrics (dancing, marching, etc.)
	Single verse, melody and lyrics	Singing with lyrics	 Material support	Use of realia such as pictures, tissue paper, puppets, etc.
	Single verse, melody only	Singing the melody without lyrics by producing single syllables, e.g. la-la-la	 Piano	Use of the instrument as song accompaniment or on its own
	Single verse, lyrics only	Lyrics recited, i.e. verse metre is implicitly present	 Guitar	Use of the instrument as song accompaniment or on its own
	Single verse, metric pulse or rhythm only	Metric pulse or rhythm without lyrics or melody, expressed by body percussion or vocal sound	 Audio devices	Song reproduced or voice accompanied by audio support, e.g. Mp3, CD-Room
	Listening	Instruction to listen attentively	 Percussion instruments or/and body percussion	Use of the instrument as song accompaniment or on its own, or metric sound production by body percussion
	Semantic gestures	Gestures related to the semantic content of the lyrics	 Sounds with voice and body	Sound production with the voice and/or the body without metre

Figure 2.
Class singing lessons led individually by pre-service generalist Martha in the first- and third-year internship.

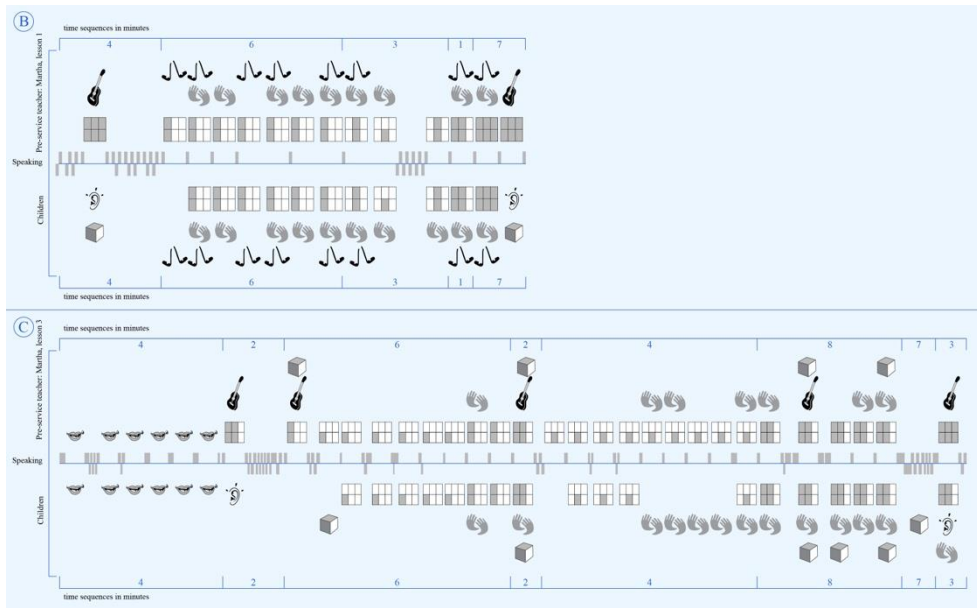
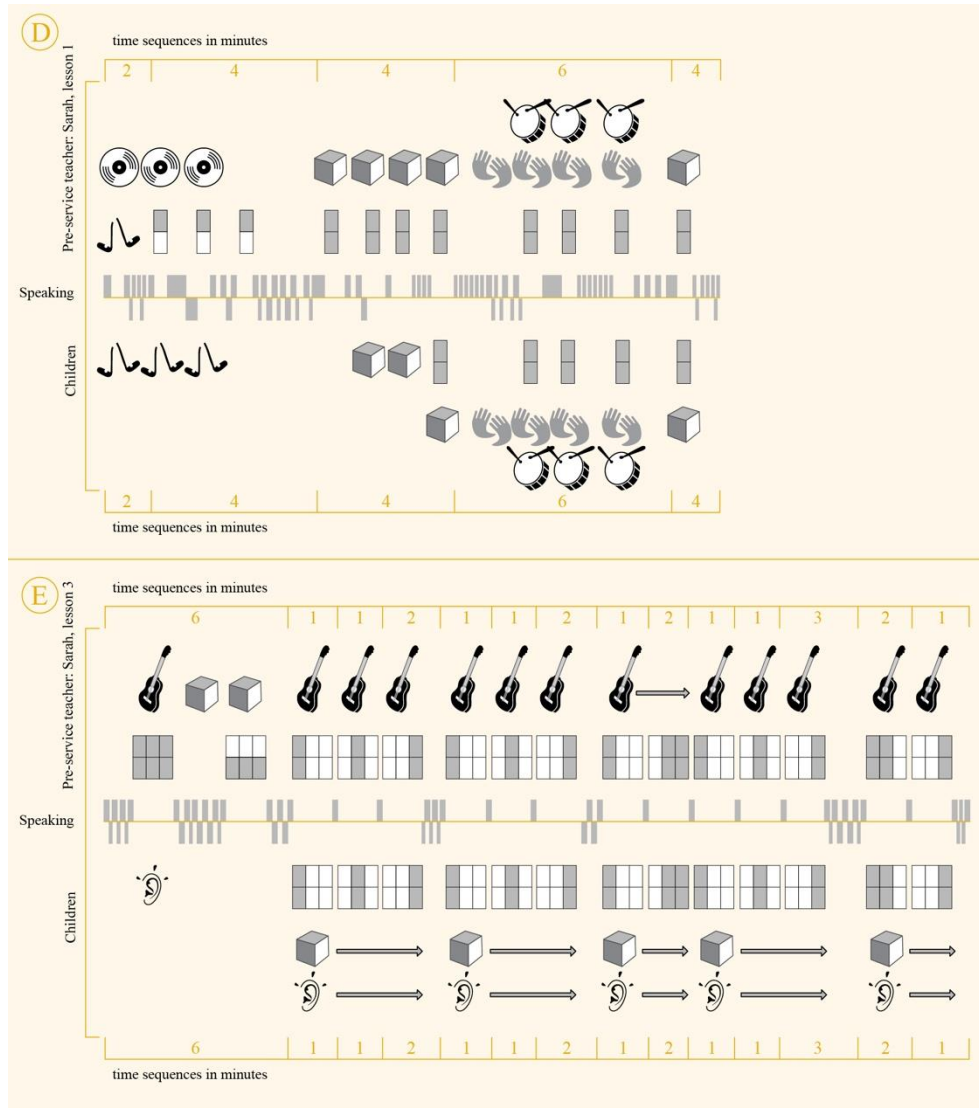


Figure 3.
Class singing lessons led individually by pre-service generalist Sarah in the first- and third-year internship.



Based on the epistemological interest of exploring the use of audio devices (AD) and musical instruments (MI) in individual and co-led song teaching, I selected lesson episodes in which Martha and Sarah used them and analysed them thoroughly from a musico-didactic perspective (Mayring, 2015, 2021; Huber, 2020; Tuma, Schnettler, & Knoblauch, 2013). In the next section I present the analysis of the lessons. I refer to Martha's and Sarah's lessons with the following labels, in which the numbers 1, 2 and 3 each indicate the year of training: Martha-1, Martha-2 and Martha-3, and Sarah-1, Sarah-2 and Sarah-3.

3. DATA ANALYSIS

In the co-taught lesson (Figure 1) Martha-2 and Sarah-2 used the guitar and body percussion. The LAMaps of the individual lessons (Figure 2 and Figure 3) show that Martha used the guitar in both lessons, while Sarah used an audio device (MP3) in the first-year lesson (Figure 3, Sarah-1) and the guitar in the third year (Figure 4, Sarah-3). The LAMap shows which tools Martha and Sarah used but does not show how this was done. Furthermore, it is not possible to reconstruct from the LAMap the repartition of tasks between Martha and Sarah in the co-teaching lesson. To explore in detail the use of AD and MI in individual and co-guided lessons, I present in Table 2 the results of the analysis of the three lessons in comparison.

Table 2.
Comparison of the use of audio device, body percussion and guitar in Martha and Sarah's individual and co-led class singing lessons.

First year: individual lesson		Second year: co-led lesson		Third year: individual lesson	
Martha; guitar		Martha & Sarah guitar and body percussion		Martha; guitar	
Episodes	Use	Episodes	Use	Episodes	Use
1.1	GI + GFA	2.1	GSP + GFA	3.1	GI + GFA
1.2	GI + GFA	2.4	BPW (C)	3.2	GI + GFA
Sarah; guitar		2.5	BPW (C)	3.4	GI + GFA
Episodes	Use	2.7	BPW (C)	3.5	GI + GFA
1.1	ABM	2.9	BPW (C) + GSP + GFA	3.6	GI + GFA
1.2	ABM	2.10	BPW (C) + GSP + GFA	3.7	GI + GFA
1.3	ABM	2.11	GSP + GFA	Sarah; guitar	
1.7	BPP (T and C)	2.14	GSP	Episodes	Use
1.8	BPP (T and C)	2.15	BPW (T)	3.1	GI + GFA
1.9	BPP (T and C)	2.16	GSP + BPW (T)	3.2	GI + GFA
		2.17	GSP + BPW (T) + GFA	3.3	GI + GFA
		2.18	<i>a cappella</i>	3.4	GI + GFA
		2.19	BPW (T)	3.5	GI + GFA
		2.20	BPW (T)	3.6	GI + GFA
		2.21	<i>a cappella</i>		
		2.22	<i>a cappella</i>		
		2.23	GSP + GFA		
		2.24	GSP + GFA		
		2.25	GSP + GFA		
		2.26	GSP + GFA		

Key:	GI	Guitar introduction	BPP	Body percussion part of song, (C = class) or (T = teacher)
	GFA	Guitar full accompaniment	BPW	Body percussion whole song, (C = class) or (T = teacher)
	GSP	Guitar starting pitch	ABM	Audio device for background music

The overview in Table 2 shows significant differences in the use of instruments between the individual and co-led lessons. It is relevant that the use of the guitar and body percussion is not only more frequent in the co-led lesson than in the individual lessons but most importantly much more varied and differentiated with various combinations. The analysis shows that in the individual lessons Martha always used the guitar to play the introduction and full accompaniment, while Sarah-1 used the audio device as background during other activities and Sarah-3 the guitar to play the introduction and continue with the full accompaniment. In the co-led lesson, the guitar was used to play the starting pitch only and/or the full accompaniment only, while body percussion was integrated both as a class activity with the active involvement of the children and as an action performed exclusively by Martha and Sarah.

In the following paragraphs, I present a detailed analysis of the actions of the co-led lesson and how Martha and Sarah distributed the tasks between them. Then, I describe their individual lessons to provide an overview of their professional development, with the focus on using AD and MI in leading class singing.

3.1. Martha and Sarah's co-led class singing lesson in their second-year internship

The LAMap in Figure 1 provides an overview of the organisation of the lesson activities and the interaction between the pre-service teachers and the class. However, the LAMap does not show in detail how Martha and Sarah shared the song teaching leading and the classroom management between them. I analysed each episode individually to identify the distribution of their tasks. Table 3 shows that I developed a system of definitions by which I was able to identify 15 specific actions carried out by Martha and Sarah during their co-led lesson.

Table 3.
Definitions developed for the actions identified in the class management and song leading in the lesson co-led by Martha and Sarah.

	Actions	Definitions
1	Announcing	Communicate to the class what they are going to do without (yet) giving instructions on what to do, or explaining how to do it.
2	Asking children for demonstration	Ask the class to show themselves what the teacher has explained or demonstrated previously, e.g. movements, singing or reciting the lyrics.
3	Collecting children's ideas	Ask the class to contribute their own ideas for the activity they are doing, e.g. a type of singing variation.
4	Counting	Count to let the class know when to start singing or reciting the lyrics, e.g. with "1, 2, 3".
5	Demonstrating	Give the class examples of how to do something, e.g. singing, reciting or showing.
6	Explaining	Tell the class how to do something without necessarily demonstrating it with an example, e.g. that they will sing the song by singing only part of it or with a variation.
7	Giving feedback	Give the class an evaluation immediately after an activity done together or alone, e.g. on the way they sang or tapped the puls.
8	Instructing	Tell the children what to do, without explaining or demonstrating how.
9	Listening	Focus only on listening to the class singing or reciting the lyrics autonomously.
10	Playing	Use musical instruments to produce the proper sound, e.g. play the starting pitch of the song, an introduction or the full accompaniment.
11	Signalling	Use non-verbal means to communicate something to the children, e.g. eye contact to signal when to start singing.
12	Singing	Singing the whole song or parts of it (single verses), alone or together with the children.
13	Tapping	Provide the children with a metric pulse while singing or reciting the lyrics of the song, alone or together, e.g. through body percussion.
14	Contextualising	Presenting and/or sharing something with the class by setting it in a real or imaginary context, e.g. a story.
15	Reciting	Saying the lyrics of the song without singing them.

Class singing by pre-service generalists: individual leading and co-teaching

Below, Table 4 shows the distribution of the actions done by Martha and Sarah in each analysed lesson episode.

Table 4.
Overview of the distribution of song leading and class management in the lesson co-led by the generalists Martha and Sarah.

Martha and Sarah's co-led class singing lesson				
Episodes	Use of guitar and body percussion	Action Management		
		Martha only	Sarah only	Together
Ep. 2.1	GSP + GFA	Playing	Announcing lesson purpose Instructing to open and close eyes	Signalling song beginning with eye contact
Ep. 2.4	BPW (C)		Announcing to tap feet Demonstrating tapping feet	Tapping feet
Ep. 2.5	BPW (C)	Instructing to tap feet	Asking individual children to tap feet Demonstrating how to tap their feet	Tapping feet Reciting the lyrics of the song
Ep. 2.7	BPW (C)	Instructing to tap feet		Tapping feet Reciting the lyrics of the song
Ep. 2.9	BPW (C) + GSP + GFA	Playing Counting	Instructing to sing	Singing the song Tapping feet
Ep. 2.10	BPW (C) + GSP + GFA	Playing Counting	Instructing to sing	Singing the song
Ep. 2.11	GSP + GFA	Playing starting pitch Singing starting pitch Counting	Instructing to sing	Tapping feet Singing the song
Ep. 2.14	GSP	Playing starting pitch Announcing singing variation (humming, singing with closed lips)	Instructing to sing with closed lips Demonstrating how to sing with the closed lips	Singing with closed lips
Ep. 2.15	BPW (T)		Explaining singing variation (singing quickly)	Singing with closed lips
Ep. 2.17	GSP + BPW (T) + GFA	Playing	Collecting children's ideas (singing very loud) Signalling with the finger to be quiet	Tapping feet Signalling song beginning by counting Singing with variation
Ep. 2.18	<i>a cappella</i>		Explaining singing variation (very low, like a bear) Signalling song beginning by counting	Singing with variation
Ep. 2.19	BPW (T)	Signalling with the finger to be quiet	Instructing to repeat the variation (very low, like a bear) Giving feedback on the singing variation	Tapping feet Signalling song beginning by counting Singing with variation

A. Savona

Episodes	Use of guitar and body percussion	Action Management		
		Martha only	Sarah only	Together
Ep. 2.20	BPW (T)		Collecting children's ideas (like a fish) Explaining singing variation (silent singing, only moving the lips) Demonstrating singing variation	Signalling with the finger to be quiet Tapping feet Signalling song beginning by showing 1, 2, 3 with their fingers
Ep. 2.21	<i>a cappella</i>		Collecting children's ideas (like a mouse) Signalling to be quiet Instructing Explaining singing variation (very high pitched, like a mouse)	Tapping feet Singing with variation
Ep. 2.22	<i>a cappella</i>	Explaining singing variation (syllables "mia-o", like a cat)	Collecting children's ideas Explaining singing variation	Signalling with the finger to be quiet Singing with variation
Ep. 2.23	GSP + GFA	Instructing Playing Singing starting pitch (first time)	Giving feedback	Singing starting pitch (second time after interruption) Signalling song beginning with eye contact Singing the song
Ep. 2.24	GSP + GFA	Playing Instructing Singing starting pitch	Instructing Signalling song beginning by counting Tapping feet Singing (whispering)	Listening to the children's singing
Ep. 2.25	GSP + GFA	Playing Instructing Singing starting pitch	Instructing Signalling song beginning by counting Tapping feet	Signalling song beginning by counting Singing the song
Ep. 2.26	GSP + GFA	Playing Instructing Singing starting pitch Announcing lesson end	Instructing Signalling song beginning by counting Tapping feet Singing (whispering)	Signalling song beginning by counting Listening to the children's singing

Table 4 shows that in this lesson, it was Martha who used the guitar, both to play the starting pitch and the full accompaniment. Thus, Martha set the key of the song and harmonically supported singing. It was then Martha who counted “1, 2, 3” to signal the beginning of the song in episodes 2.9, 2.10 and 2.11. Sarah, on the other hand, was mainly responsible for communicating the lesson’s goals to the children, introducing them to new activities, instructing them on what to do, and giving them some feedback.

In episodes 2.4 and 2.5, Sarah instructed the children to tap their feet alternately by demonstrating this. Then the children’s tapping slowly joined hers and Martha’s as well. Together, Martha and Sarah recited the lyrics of the song while continuing to tap their feet while the children did the same. In episode 2.11, Sarah instructed the children to sing simultaneously with the tapping of their feet while Martha played and sang the starting pitch.

Distributing the tasks in this way, Sarah set the metre and tempo of the song in advance with body percussion and Martha set the key by playing and singing the starting pitch.

Body percussion was intermittently present in this lesson, but, after episodes 2.4, 2.5 and 2.7, was no longer performed by the children, instead only by Martha and Sarah. In this way, they established the pulse of the song to ensure metric stability when working on the recited lyrics or some singing variations.

Table 4 shows that in episodes 2.18, 2.21, 2.22, Martha and Sarah used neither guitar nor body percussion. I considered these episodes for analysis because they were part of a series of singing variations that began in episode 2.14 and ended in episode 2.22. Table 5 displays the singing variations in detail. The “Singing variations” column shows how the singing was varied from time to time, some of which consisted of changes in dynamics, timbre and speed. The column “Use of guitar and body percussion” shows how Martha and Sarah used the guitar and body percussion in different ways and combinations, or did not use them at all. On the right, Table 5 shows how I grouped the use and non-use of guitar and body percussion according to their musical function during each variation.

Table 5.
Overview of singing variations and the use and non-use of the guitar and body percussion when performing them.

Martha & Sarah		
Lesson episodes	Singing variations	Use of guitar and body percussion
Ep. 2.14	Humming, singing with closed lips	GSP
Ep. 2.15	Singing fast	BPW (T)
Ep. 2.16	Singing very softly	GSP + BPW (T)
Ep. 2.17	Singing very loudly	GSP + BPW (T) + GFA
Ep. 2.18	Singing very low (like a bear)	a cappella
Ep. 2.19	Singing very low (like a bear)	BPW (T)
Ep. 2.20	Silent singing, only moving the lips	BPW (T)
Ep. 2.21	Very high-pitched (like a mouse)	a cappella
Ep. 2.22	Syllables 'me-ow' (like a cat)	a cappella

1.	Setting tonality with starting pitch on the guitar
2.	Setting tonality with starting pitch and supporting this and the metre with full accompaniment
3.	Setting tonality with starting pitch on the guitar and supporting metre with body percussion
4.	Supporting the metre with body percussion
5.	No setting or supporting tonality and metre: no guitar and no body percussion

Table 5 shows that some variations were performed with guitar and body percussion and others without. This is an interesting aspect of managing the use of MI. When and why did Martha and Sarah use guitar and body percussion and when and why did they not?

Analysis of the singing variations shows that, probably intuitively, Martha and Sarah did not accompany some of the variations with guitar and body percussion for two reasons. Firstly, these variations did not allow the melody and metre to be properly produced, and secondly, they were unusual and difficult to perform, especially singing very low or very high. Thus, the musical functions properly provided by guitar accompaniment and body percussion, i.e. harmonic and metric, were inhibited. In episodes 2.18 and 2.19 they sang the

variation “very low, like a bear”. Therefore, in both episodes, the melody of the song was distorted both by Martha and Sarah and by the children. Some of the children, for example, held their hands in front of their mouths to obtain the lowest and darkest sound possible. In episode 2.21, the variation consisted of singing “like a mouse” and replacing the lyrics with “squeak”. The melody sung by Martha and Sarah remained stable, while some children sang so high to imitate a mouse that the melody was distorted again. In episode 2.22, they sang “like a cat”, with the syllables “me-ow”. As in the variation with the mouse squeak, the children started to say “meow” very loudly without singing the melody properly.

Episode 2.20 highlights of the relevance of body percussion. Sarah had collected the children's suggestions for the new variation. She then explained and demonstrated to everyone the idea of singing by moving their lips without making a sound. Martha and Sarah started to tap the pulse with their feet, then they showed “1, 2, 3” with their fingers instead of counting aloud. All together they started to mime the lyrics of the song with their lips. By mimicking the text without making sounds, the song consisted of neither the lyrics nor the melody. What, then, remained of the song's structure? The only musical component present in this episode was the pulse of the song that Martha and Sarah established by tapping their feet. Body percussion was essential to provide a reference for the children as they mimicked the lyrics.

3.2. Martha and Sarah's individual lessons in their first-year and third-year internships

In this paragraph, I describe the class singing lessons that Martha and Sarah led individually in their first- and third-year internships.

3.2.1. Martha's first-year and third-year lessons

Martha played the guitar in both individual lessons, mostly to play the starting pitch, an introduction and/or the full accompaniment. Martha-1 used the guitar at the beginning and end of the lesson (LAMap in Figure 3(B)). Martha-1 played and sang the song by heart and was so confident that she could sing and play the guitar at the same time and flexibly switch focus from the instrument to the children. At the beginning of the lesson, Martha-1 and the children were sitting in a circle, in the middle of which was the closed case with the guitar inside. Martha-1 asked the children what it could contain and one child replied: “a guitar!”. Then Martha-1 invited the child to open the case. Next, she asked what they could do with this guitar and one child replied: “We can sing songs.”. Thus, Martha-1 asked the children to close their eyes and listen carefully, played the introduction with the guitar and then sang the song accompanying herself. Thereafter, Martha-1 continued the lesson by working on the content of the lyrics. At the end of the lesson, Martha-1 asked the children to close their eyes and “imagine all the parts of the song” without singing. Martha sang the song by playing the introduction and continuing with the full accompaniment.

The LAMap in Figure 3(C) shows that Martha-3 worked on the semantic content of the song with semantic gestures. Martha-3 played the introduction, continued with the full accompaniment and sang while the children had to put the pictures in the same order as the verses (Ep. 3.18 and 3.29). In this lesson, the singing with accompaniment was only interrupted in Ep. 3.16, 3.27, 3.29, 3.30 and 3.31 when Martha wanted to make semantic gestures with the children. There, for the first time in this lesson, she and the children sang *a cappella*. Here, Martha's singing was less stable than while singing with the accompaniment.

3.2.2. Sarah's first-year and third-year lessons

In the first-year lesson, Sarah-1 used an MP3 and body percussion, as well as singing *a cappella*. Sarah-1 used the MP3 as a background music for other activities (Table 2): when the children entered the classroom and took their seats (Ep. 1.1), and to let the children move freely like polar animals (Figure 3 (E), Ep. 1.2 and 1.3). The song playback was used as a background, so that Sarah-1 paused it when she wanted to finish the "main" activity without waiting for the song to end. The playback was the song Sarah-1 had selected to teach the children, played on the piano, without the voice. In this lesson, the MP3 replaced the full harmonic accompaniment that Sarah could have played on her own with a musical instrument and provided a stable melodic guidance. By using it as a background, Sarah-1 was preparing herself and the children to sing, as the pitch, tempo and metre of the song had been set. The lyrics were the only component of the song's linguistic-musical structure that the MP3 could not deliver, being a piano-only version.

In episodes 1.7, 1.8 and 1.9 (Figure 3 (E)) Sarah-1 invited the children to point to the corresponding pictures while she sang *a cappella*. Here, singing *a cappella* allowed Sarah to slow down or interrupt the flow when necessary to give the children time to identify the pictures. This would not have been possible if she had sung with MP3 accompaniment.

In episodes 1.11, 1.12 and 1.3 Sarah-1 partially integrated body percussion because she matched the metrics of the names of the three characters in the song to body percussion instead of semantic gestures as for the rest of the lyrics.

The LAMap of the third-year lesson (Figure 3 (E)), shows that Sarah-3 sang the whole song while accompanying herself with the guitar (Ep. 3.1), and that she combined singing with dramatising the content of the song, first with puppets (Ep. 3.4 to 3.9 and Ep. 3.10 to 3.14) and then with a sledge (Ep. 3.15 and 3.16). Both times, it was the children who used the objects to dramatise, as Sarah-3 always played the guitar (Table 1).

When Sarah-3 sang the song for the first time (Figure 3 (E), Ep. 3.1), she performed it in full, without interruptions. In this way, she presented it to the children semantically and structurally in its entirety. The analysis of the singing performance during the dramatisation showed how Sarah-3 segmented the song and then attempted to reunify it. To do this, Sarah-3 also made use of the guitar. In fact, at the beginning she stopped both the singing and the accompaniment altogether, to give the children feedback after each verse. Then, Sarah-3 continued playing the guitar accompaniment even while giving verbal feedback. In this way, she maintained the dynamic flow of the song, implicitly signalling to the children that they would immediately continue with the next verse.

The detailed description of Martha's and Sarah's individual lessons showed that the two pre-service generalists were very confident in leading class singing and in the skilled use of AD and MI during their lessons. Below, I discuss the results of the analysis.

4. DISCUSSION AND CONCLUSIONS

In this chapter, I presented the microanalysis of the development of the practice of leading class singing over a three-year timeframe. Yet, this is the first research of its kind to take a longitudinal approach to class singing led by pre-service teachers. Using the LAMap methodology, I shown the analysis of five individual and co-teaching class singing lessons in a highly visual method and analysed complex video data capturing the lessons in their entirety. This enabled me to observe and describe the mutable nature of skill development in song teaching.

In this section, I summarise what two pre-service generalist teachers, Martha and Sarah, did at different stages of their training in class singing lessons, four of which were conducted individually and one co-taught. My analysis focused on the use of AD and MI and the discussion addresses two points: (1) the individual development of the two generalist trainees during their three-year training; (2) the similarities and differences in the use of AD and MI between the individual lessons and the co-led lesson.

(1) Martha and Sarah used AD and MI in their individual lessons. Martha used a guitar in both lessons, while Sarah used an MP3 in the first-year lesson and the guitar in the third-year lesson. Analysis of Martha's lessons showed that she was already familiar with the guitar in the first-year lesson. In both lessons, Martha sang and played by heart. This allowed her to maintain eye contact with the children. The full guitar accompaniment was such a support for Martha that her singing was less stable only in the episodes when she sang *a cappella*, when she made semantic gestures with the children.

The fact that Sarah used an MP3 in her first year and accompanied her singing with the guitar in her third year should not necessarily be understood as a sign of the development of her skills in terms of "improvement" or the acquisition of new skills. The use of one or the other instrument could, for example, have been determined by the lesson goals set by Sarah. Since the analysis presented in this chapter is exclusively based on lesson observation, I cannot comment on Sarah's musical biography or the goals she had set for her teaching. However, the video analysis showed that Sarah used both MP3 and guitar in a useful way for the planned activities, demonstrating her ability to segment the song and adapt the activities to the children's learning time.

(2) I summarise and discuss the similarities and differences in the use of AD and MI between individual and co-leading lessons as follows:

a) Similarities. In both the individual and co-led lessons, Martha and Sarah used AD and MI to play full accompaniment (Sarah-1, MP3; Martha-1, Martha-3 and Sarah-3, guitar; Martha-2, guitar in the co-led lesson). Since the first-year lessons, the two trainees have been using AD and MI to support their singing skills to sing the melody in a stable way and enrich class singing in terms of both "acoustic contextualisation" and "socio-cultural contextualisation". By "acoustic contextualisation" I denote the function of AD and MI to provide metric and tonal "context" to the singing. The full accompaniment supported the singing in terms of tonality and supported the metric pulse of the song.

Although singing is possible through the human voice only as the primary and indispensable instrument, the use of AD and MI during singing emphasises the ritual nature of this cultural practice in two aspects: 1) Anthropologically, the use of instruments during singing represents an extension of the body to intensify the rhythmic impulse of movement (Sachs, 1914, 2006). The use of AD and MI during class singing enriched the collective experience both audibly and visually. Martha and Sarah did this in every lesson, even with body percussion on its own, as this intensified the metric pulse. As an example of good practice, body percussion, as well as other percussion instruments, is easily accessible to children and allows them to experience the ritual character of singing by synchronising not only their voices but also their own movements with those of others; 2) AD and MI are culture-specific artefacts (Reckwitz, 2002). Their use during class singing lessons provides children with a "socio-cultural contextualisation" of such artefacts in singing practice.

b) Differences. Martha and Sarah's second-year class singing lesson shows that the co-led practice provided the trainees with some advantages over the lessons they taught individually in the first and third year. In individual lessons, Martha and Sarah did not use AD and MI when they had to demonstrate or perform movements or gestures together with the children. By contrast, during the co-led lesson, Martha and Sarah did not have to leave out either the guitar or body percussion because they divided the tasks between them. Martha played the guitar and provided tonal and metric support, while Sarah had her hands free to instruct with gestures.

Only during some singing variations did Martha and Sarah not use the guitar or body percussion. Yet Martha and Sarah might have intuitively rejected guitar accompaniment and body percussion because they "interfered" with the characteristics of certain variations. This shows the in-situ accommodation of the two trainees' developing skills. In these variations, the melody and metre could not be properly performed and were unusual and difficult to sing because they sang very low or very high, or with an animal sound. The musical functions that should have been performed by the guitar accompaniment and body percussion, i.e. the tonal and metric functions, were inhibited and may have "prompted" Martha and Sarah to give up MI.

The analysis of the case study presented in this chapter provides an example of how the practice of intergenerational cultural transmission works in pedagogical institutions, in the context of individually led or co-led class singing by generalists. Focusing on the use of AD and MI in the lessons of two pre-service teachers, the study shows the centrality of this material aspect of singing practice from anthropological, musical and pedagogical perspectives. On the one hand, the use of one's body and instruments to intensify, coordinate and synchronise movements in group singing, as in a ritual. On the other hand, the support that the use of AD and MI provides for singing, and the challenges that their manipulation brings in classroom management. The way in which Martha and Sarah made decisions and compromises in the case of individual leading and the organisation and assignment of tasks in the case of co-leading show the changes in the development of their skills to lead class singing.

This research offers relevance on several levels beyond that of class singing. This includes 1) an innovative research methodology using LAMap; 2) a method for analysing the development of teaching skills and 3) the chance to provide teacher trainees with feedback during their training. The method of this study might be used in other fields of teacher education. This chapter offers an opportunity for other researchers and educators to consider how similar research methods could be applied to their understanding of practice.

REFERENCES

- Brenan, C., & Witte, R. (2003). Team Teaching in the Secondary Instrumental Music Classroom. *Music Educators Journal*, 89(3), 31–35. <https://doi.org/10.2307/3399855>
- Collins, A. (2014). Neuroscience, Music Education and the Pre-service Primary (Elementary) Generalist Teacher. *International Journal of Education & the Arts*, 15(5), 1–21.
- de Vries, P. (2013). Generalist teachers' self-efficacy in primary school music teaching. *Music Education Research*, 15(4), 375–391. <https://doi.org/10.1080/14613808.2013.829427>
- de Vries, P. A. (2014). Music without a music specialist: A primary school story. *International Journal of Music Education*, 33(2), 210–221. <https://doi.org/10.1177/0255761413515818>
- Garvis, S., & Riek, R. (2010). Improving Generalist Teacher Education in the Arts. *The International Journal of the Arts in Society: Annual Review*, 5(3), 159–168. <https://doi.org/10.18848/1833-1866/cgp/v05i03/35851>

- Hicks, C. E. (1982). Team Teaching: Sharing the wealth (of talent). *Music Educators Journal*, 69(3), 42–43. <https://doi.org/10.2307/3396021>
- Huber, M. (2020). Video-based content analysis. In M. Huber & D. E. Froehlich (Eds.), *Analyzing Group Interactions* (1st ed., pp. 37–48). Routledge.
- King, F. (2018). Music Activities Delivered by Primary School Generalist Teachers in Victoria: Informing Teaching Practice. *Australian Journal of Teacher Education*, 43(5), 48–59. <https://doi.org/10.14221/ajte.2018v43n5.4>
- Mayring, P. (2015). *Qualitative Inhaltsanalyse: Grundlagen und Techniken*. Beltz GmbH, Julius. <https://www.beltz.de>
- Mayring, P. (2021). *Qualitative Content Analysis*. Sage Publications Ltd.
- Paul, S. J., Teachout, D. J., Sullivan, J. M., Kelly, S. N., Bauer, W. I., & Raiber, M. A. (2001). Authentic-Context Learning Activities in Instrumental Music Teacher Education. *Journal of Research in Music Education*, 49(2), 136–145. <https://doi.org/10.2307/3345865>
- Reckwitz, A. (2002). The Status of the “Material” in Theories of Culture: From “Social Structure” to “Artefacts.” *Journal for the Theory of Social Behaviour*, 32(2), 195–217. <https://doi.org/10.1111/1468-5914.00183>
- Sachs, C. (1914). Die Hornbostel-Sachs’sche Klassifikation der Musikinstrumente. [The Hornbostel-Sachs Classification of Musical Instruments]. *Die Naturwissenschaften*, 2(51), 1056–1059. <https://doi.org/10.1007/bf01495319>
- Sachs, C. (2006). *The History of Musical Instruments (Dover Books on Music)* (Illustrated). Dover Publications.
- Savona, A., Stadler Elmer, S., Elisa, A., Joliat, F., & Cavasino, G. (2021). The Lesson Activities Map: A Domain-Specific Lesson Transcription Methodology. *European Journal of Educational Research*, 10(2), 705–717. <https://doi.org/10.12973/eu-jer.10.2.705>
- Stadler Elmer, S. (2015). *Kind und Musik: Das Entwicklungspotenzial erkennen und verstehen*. [Child and music: recognising and understanding the developmental potential]. Springer.
- Tuma, R., Schnettler, B., & Knoblauch, H. (2013). *Videographie: Einführung in die interpretative Videoanalyse sozialer Situationen*. Springer VS.

ADDITIONAL READING

- Hürlimann, A., & Savona, A. (2022). Generalist Teachers’ Development in Teaching Songs in Class. In T. Buchborn, T. De Baets, G. Brunner, & S. Schmid (Eds.), *Music is What People Do – Perspectives on Music (Education) as a Praxis*. *European Perspectives on Music Education* (pp. 87–108). Helbling.
- Liao, M. Y., & Campbell, P. S. (2014). An analysis of song-leading by kindergarten teachers in Taiwan and the USA. *Music Education Research*, 16(2), 144–161. <https://doi.org/10.1080/14613808.2013.851661>
- Liao, M. Y., & Campbell, P. S. (2015). Teaching children’s songs: a Taiwan–US comparison of approaches by kindergarten teachers. *Music Education Research*, 18(1), 20–38. <https://doi.org/10.1080/14613808.2015.1049256>
- Stadler Elmer, S. (2021b). Song Transmission as a Formal Cultural Practice. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.654282>
- Stadler Elmer, S. (2022). How a young child sings a well-known song before she can speak. *British Journal of Music Education*, 39(3), 292–301. doi:10.1017/S0265051722000304

Class singing by pre-service generalists: individual leading and co-teaching

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Section 2
Projects and Trends

Chapter # 21

THE PERFECT MATCH FOR EDUCATION FOR SUSTAINABLE DEVELOPMENT: HUMAN NEEDS VERSUS SUSTAINABLE ALTRUISM?

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ABSTRACT

Altruistically speaking, humanity has now reached a point where it has recognized that it has a responsibility to achieve a development that is sustainable, to wit the United Nations Sustainable Development Goals (SDGs). This notwithstanding, as an intrinsically selfish creature, humanity also has a need to fulfil its own needs. This concept is set out by Maslow. Education is undeniably a linchpin in marrying these two concepts, aiming to meet the challenges and the needs of both today's and future generations. Whether and how these needs are met for any learner affects the learner's motivation to learn and the educator's motivation to teach. Therefore, it is paramount to reflect on the type of education that best "cultivates and guides the sustainable humanity" of the learners. This is the challenge facing today's Anthropocene society. Hence, this conceptual chapter attempts to distil a number of tangibles from the marriage of the SDGs with Maslow's hierarchy of human needs. One of the concrete outcomes is a series of features which aim to frame any realignment and transformation process for education for sustainable development (ESD). Finally, this chapter should fuel research and steer governance.

Keywords: educational guidance, transformative learning, human needs, Maslow, paradigm shift, Sustainable Development Goals

1. INTRODUCTION

Our world is continually progressing, and we must endeavor to re-adjust it towards a path that is sustainable. This entails a new way of doing things that nurtures our environment while at the same time ensuring justice, social equality and economic stability. This progress, however, is impossible without education, just as education should always be geared to progress. Logically, therefore, the concept of sustainability must be critical in any educational transformation. With this chapter we expand on the work of numerous writers, such as Maslow (1943, 1971, 1987); Papalia and Olds (1989); Berger (2000); Bee and Boyd (2006); United Nations (2017); Kioupi and Voulvoulis (2019); Quendler, Lamb, and Driouech (2020); UNESCO (2021). The aim is to synthesize their perspectives and develop sensible approaches in this area. Any approach must be based on the vision of a just and equitable future for the next generations on a stable and resilient planet. With this in mind, we, first, describe the status quo of current education and then identify the unique challenges for a paradigm shift towards an education for sustainable development. Then we outline the necessity for a certain education in today's society and identify the unique challenges that education faces – in particular with regard to its alignment with the United

Nations Sustainable Development Goals (SDGs), as well as Maslow's human needs. Subsequently, one of the principle outcomes of this contribution is a series of eight features which could be used as a template for any realignment of education aiming to achieve sustainable development at the same time as fulfilling Maslow's needs. Finally, further research may build upon these conclusions so that researchers are spurred to examine the topic in more detail in future practical work. Moreover, these findings will clarify the needs of learners within a sustainable context and identify where action for continuous information and awareness-raising, networking, and research activities as well as political governance has to be taken.

2. BACKGROUND: EDUCATION IS THE WAY TO GO

We live in a world of manifold, complex relationships within a knowledge society, and at a time where technological developments are continually imposing "game changes" with hitherto unimageable rapidity. Everything is in a constant state of flux leading to additional challenges coming up daily. As said, education plays a crucial role in addressing any challenges. Nevertheless, the former is itself also subject to a paradigm shift, as described below.

2.1. Our World Today

The sustainability crisis, political crises, natural disasters, as well as health crises, are characteristic of the diverse and heterogeneous society of the twenty-first century. Economic, environmental, social, and cultural inequalities are all exacerbated as a result of these crises. Moreover, living in today's society could be described as belonging to a "nowist culture" and a "hurried culture" because we value brand-new, high-impact items over those that require exploration (Bertman, 1998). We propose that in order to address the Anthropocene's dilemma, education must be tailored to engender a sense of responsibility towards both the global and the local, an ethos of accountability and humanity at the same time as enabling all individuals to achieve their full potential. This is in line with aiming at a development that is sustainable, as described by the SDGs (United Nations, 2015), as well as meeting individual human needs, as defined by Maslow (1943). Both are part of transformative sustainable learning paths in a digital era (cf. Quendler, Lamb, & Driouech, 2020).

2.2. Our Education Today

Education, at its core, is about preparing learners to be active, successful, and contributing members of society. Conventionally, education has been understood as preparation for life, as personal realization, and as an important component of progress and social, academic, cultural as well as intellectual development. Moreover, education is crucially important for many of the policy outcomes that citizens and politicians care about (Burgess, 2016). At an individual level, education affects earnings, employability, and chance of succeeding in life, especially for those having started under disadvantaged conditions. It, therefore, also plays a key role in building a construct with helps people fulfil their own individual needs in a way that displays responsibility to the environment in the broadest sense. Despite this, a number of authors (Chomsky, 2002; Legendre, 2002; Marcotte, 2006; Morin, 2000; United Nations, 2017) claim that the current educational system is not suited to a human being's natural development. Moreover, education systems globally, and at all levels, have faced a variety of different challenges over the past couple of years. For instance, the pandemic caused a global learning crisis; technologies have changed and still are changing learning, teaching, and assessment; and the costs continue to

rise to levels that are unsustainable for some learners. This appears to be due to the difficulty in defining the primary functions of each degree of education in society (cf. Legendre, 2002). This necessitates greater clarity in the goals (why) and methods (how) of "education." (Giordan, 2002). On the one hand, the education system has seen the rise in the current «one-size-fits-all» approach that «teaches to the best» (cf. Jennings, Swidler and Koliba, 2005; Guidote, 2020). This is driven by factors such as economic productivity, the demand for measurable outcomes and formal accountability (Dulfer, Polesel, & Rice, 2012; McInerney, Smyth, & Down, 2011). On the other hand, there is growing international recognition of education as a key enabler for sustainable development. For instance, the International Commission on Education for the Twenty-first Century highlighted the importance of education in supporting human development (cf. Delors, 1996, p. 11); others are Environmental Education (EPA, 2021); Education for Sustainable Development (cf. United Nations, 2017; UNESCO, 2021), Sustainable Transformation through education (cf. Kioupi, & Voulvoulis, 2019); Friday for Future. These examples, as described by McInerney et al. (2011), respond to long-term demands for sustainable development, and planetary boundaries in facing the challenges of globalization, environmental issues, social exclusion, capitalism, and economic exploitation affecting local communities. Although each local community is characterized by its beliefs and culture, people may now be educated and exchange knowledge in new and fascinating ways thanks to modern technology. This leads to the more rapid blending of traditions and change in belief systems brought about by online experiences and interests rather than being taught in any local classroom. In this way, we communicate our beliefs and cultures without expecting our audience to adopt them, only to accept them.

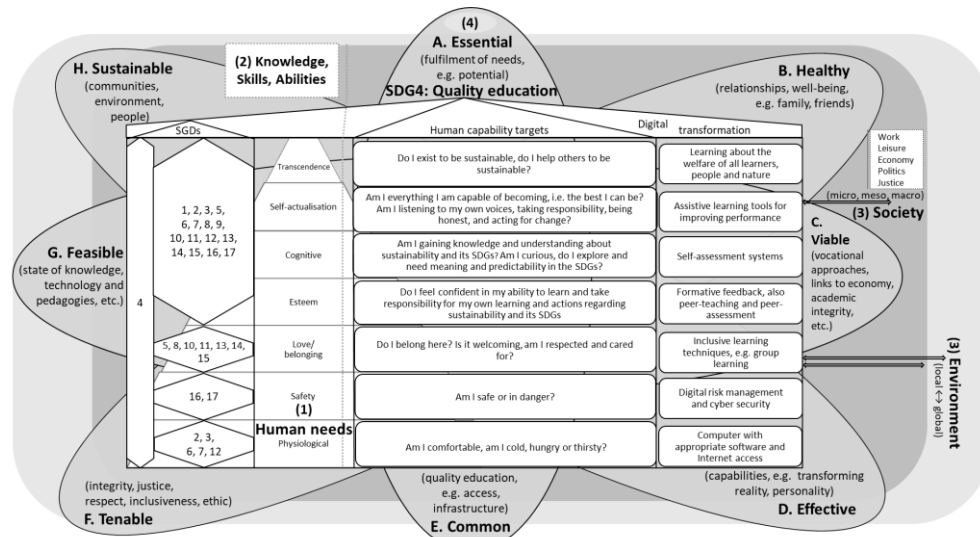
2.3. The Multi-level Paradigm Shift

The paradigm shift toward viewing the world in less economic and more sustainable terms is challenging the traditional way we think about education. Education for sustainable development (ESD) has evolved as a paradigm from today's challenges. Such an alignment of education aims to encourage learners in their interchange of knowledge to build values, attitudes and skills in order to act sustainably. Actually, what is meant here is to teach learners to behave in a way that meets their needs while respecting cultural diversity and the earth. (United Nations, 2017; UNESCO, 2021) Furthermore, whether and how these needs are met for any learner has an impact on both the learner's motivation to learn and the educator's motivation to teach. In this regard, it goes without saying that Maslow's hierarchy can be used to improve the quality of education (cf. SDG 4, FAO, 2022) as a function of motivation – despite the critics who say that needs do not follow a hierarchy (cf. Wahba & Bridwell, 1976). Nonetheless, when all levels of Maslow's hierarchy of needs are met, learners can show their full ability and enthusiasm to learn and act in a sustainable way. Rethinking education in this sense entails reshaping it around components that actually put the learner at the heart of the system, i.e. humanistic-centered education. A vast number of authors have emphasized this orientation (cf. Chomsky, 2002; Marcotte, 2006; Maslow, 1987; Morin, 2000; Piaget, 1983). On this track, we must think even further, prioritizing the multi-dimensional development of the learner in a multi-dimensional world in order to make him or her an autonomous person. Such a person is capable of becoming the best version of themselves by making fully conscious decisions for himself or herself (cf. Parmentier, 2002), rather than focusing merely on becoming a functional citizen, well-integrated in the economic and political system of society within a given environment. Current knowledge of the requirements for the proper development and functioning of a human being makes it possible today to redefine approaches for rethinking our education systems.

3. UNDERSTANDING THE BIG PICTURE

It is no longer a surprise that learners seek more from education than just a means to a safe place to work and an appropriate paycheck. Satisfying learners’ needs (cf. Brundtland report, United Nations, 2017) means scrutinizing the conventional wisdom around value proposition, diversity, inclusion, learners’ experience, learning and teaching models, and delivery channels across the entire educational landscape in relation to Maslow’s human needs (Maslow, 1943, 1987). Conversely, ESD also means to mainstream sustainability at all levels. This is also indicated by SDG Target 4.7 (United Nations, 2017, p. 48). Figure 1 exemplifies the synthesis.

Figure 1.
Synthesis of Maslow’s hierarchy of needs and the UN SDGs under educational context.



Source: adapted from Quendler, Lamb and Driouech (2020)

The fulfillment of their needs will shape how, what, when, and why learners will learn something. Each level, once met, imparts the ability and enhances the motivation to learn. Preferably, the learning environment should meet as many of the individuals needs as well as SDGs as possible. In the sense of Maslow, every learner is capable and theoretically desires to move toward a level of transcendence. A learner who has “self-transcendent” values is more likely to engage in sustainable behavior (Stern, 2000), show higher concern for environmental risks (Slimak, & Dietz, 2006), is more likely to perform specific actions such as recycling (Dunlap, Grieneeks, & Rokeach, 1983) or support climate mitigation policies (Nilsson, von Borgstede, & Biel, 2004).

Each learner is capable and can move from need to need or SDG to SDG by gaining understanding and experience with the proper support (McLeod, 2023), cf. capability targets. It is a natural phase of personal development, which occurs during every transition in meeting human needs and SDGs. This is also expressed by the theory of “transformative sustainable learning” (see Mezirow, & Taylor, 2011).

The needs combined with the SDGs show different incentives for learners and teachers as to why they want to learn and how this is capable of contributing to a life of dignity in a sustainable future. If their fundamental needs as humans are not fulfilled, the

learners might act irresponsibly. Learners need to be empowered to understand and shape the emerging challenges seeing them as concurrent to their own needs. Based on the SDGs (United Nations, 2017) and adapted Maslow's hierarchy of needs (Maslow, 1943, 1987) education and its training programs should enable each learner to achieve greater fulfilment of his or her potential under the auspices of sustainable development. This confirms the actual trend of changes in the production/development and in the consumption/use of information and knowledge. On that the role of learners is enhanced through a new form of collaboration, in which the learner is both a "producer of knowledge" and a service provider of applied knowledge (Driouech, Sisto, Lorusso, & Raeli, 2015, p. 239) in the form of being capable of acting sustainably. Following this the knowledge and capability gaps related to sustainability both in the individual and collective learning processes can be mastered in order to implement change successfully, as argued by Hubers (2020).

Figure 1 portrays the overlay of Maslow's hierarchy of needs with the SDGs and the subsequent distillation of eight features. It also gives capability targets in the form of questions which easily transform to a set of learning outcomes (check list) in an educational context. Moreover, any such system should also include appropriate didactics and technological gadgets, media and tools – some guidance is given by transformative pedagogy see table 1 and 2.

*Table 1.
Curriculum transformation and transformative pedagogy.*

Example/Description
Curriculum transformation
Sustainability issues and initiatives are driving change in education as emphasised by Wright, Cain, and Monsour (2015). Curricular reform is occurring in many ways, but few achieve transformative curricula by considering the SDGs and Maslow's needs in teaching efforts and learning outcomes. Such a curriculum also involves a process that asks faculty members to take a critical stance on the interest and activities aligned to the SDGS as well as the hierarchies and individualities within the classroom. Furthermore, they should interweave multiple perspectives and integrate student voices and knowledge into the learning process. This process emphasizes the power of engaging in critical reflection and authentic experience, as done by the University of Washington (2017).
Transformative Pedagogy
The conceptual framework for transformative pedagogy is based on autonomous teaching and learning. In addition, it argues for more systematic links to be developed between knowledge acquired at school/high school/university and knowledge gleaned by interacting in the context of wider society. Such a pedagogy supports teachers and students developing their identity as whole persons with relationships based on interdependence and moral values, i.e. teachers and learner, as "beings-in-relation" as well as "beings-in-becoming." Not only do teachers and students develop the capacity to express their meanings in the given context but learn to critique and shape their world. The process suggests that personal and social transformations depend on autonomy and that autonomy depends on morality. On that, there is a need for a more person-centred approach and for bringing school/high school/university life and wider community life into a more dynamic and fruitful alliance. The following examples in table 2 describe practical methods for teaching and learning in the case of transformative pedagogy. (Farren, 2016).

Source: own elaboration.

Table 2.
Select educational practices with a special focus on the SDGs.

Example/Description
Learning Café
The SDGs Café is a meeting of stakeholders to discuss (inter)national developments regarding the SDGs. This café covers a whole series of topics. Examples are given by the Netherland and Japan. The café is a space for in-depth exchange, see United Nations University (2016); SDG Café (2020).
ClimateCafé is a field education concept involving different fields of science and practice for capacity building in climate change adaptation. Lessons learned from this café will improve capacity building on climate change adaptation in the future, see Boogaard et al. (2020).
Eco Café is a place to explore how we can use education to nurture the values and ethical principles required in the transition to sustainable living and for building a peaceful global society. This café is a space for serious discussion, making sure everyone who wants to speak can do so, see Education for the Sustainable Development Goals at DMU (2023).
Participatory innovation process
In the hackathon , students with a background in natural science, social science, problem solving coding, designing, and app developing will provide (digital) new solutions to issues related to SDGs corporate, entertainment and gaming or new business ideas. Examples are OSS4SDG Hackathon (United Nations, n.d.), Digital Education Hackathon: Digital education for a sustainable world (Global MOOC and Online Education Alliance, 2023), SustHack (Sunway University, n.d.) or EDU-HACK (Global Opportunities, 2023). Hackathon attendees get the opportunity to network with some of the most forward-thinking students and academics from around the world, gain new perspectives and be inspired by people from all walks of life. Moreover, there is no better way to learn new technical skills or train collaboration amongst other.
Problem- and project-based Learning, incl. case studies
In the European Virtual Seminar on Sustainable Development students from 12 universities in Europe work together in international, multidisciplinary teams within an online social network. The learning objectives are (1) that students gain an understanding of the concept of sustainable development and apply it to a case study in Europe, 2) that students learn to collaborate with students from other disciplines, countries, and culture, using internet technology, whereby the ultimate goal of the case study is to come up with evidence-based recommendations on the topic. The case study groups are responsible for their learning process: keeping the learning and research process going and delivering integrated group products on time. (de Kraker & Corvers, 2014).
Green Flag projects are running in Sweden from pre-school through high school. Each school convenes its own environmental committee of teachers and students who develop at least five goals for the theme chosen [(1) climate and energy, (2) consumption, (3) cycles in the natural world, (4) lifestyle and health, (5) water resources, and (6) local environment]. From the goals, the committee sets activities and documentation measures. Green Flag projects must last at least 6 months. Upon completion, the schools collect the documentation and submit a report. The mission of Green Flag is that students develop the ability, through critical thinking, to take responsibility and an active role in sustainable development. (Cars & West, 2015).
Testing SDGs knowledge
The Sulitest tests the SDG knowledge. It is the world's first assessment tool for sustainable development and corporate social responsibility. Students are able to check on their SDGs knowledge. (SDSN YOUTH, n.d.).

Source: own elaboration.

For the sake of practical implementation, a series of eight prerequisite steps lead to the resulting outcome of eight features as identified in figure 1.

(1) Appreciate that the majority of learners, at all levels in their learning activities, are looking for more than just employability – that they would like to have their needs satisfied as well as the SDGs in the long-run.

(2) Recognize that learners' circumstances vary significantly in different learning activities and teams and are often very different from those of the teachers themselves.

(3) Analyze how effectively needs in connection with the SDGs are being met in each type of learning activity and each curriculum overall, benchmarking performance of peers and best practice.

(4) Identify how the different needs in connection with the SDGs can be better satisfied – typically through changes in educational ethos and culture, behaviors, and day-to-day learning practices.

(5) Act by creating initiatives, projects, and processes to help make learners feel more empowered, in their learning activities that are, as much as possible, more skills-based, autonomous, connected, interesting, or purposeful.

(6) Monitor and evaluate the results, both in terms of how satisfied learners, teachers and institutions are with the meeting of their needs in connection with the SDGs and in terms of commercial outcomes and personal well-being.

(7) Adjust the learning environment and architecture in order to address the needs and SDGs in an appropriate manner.

(8) Develop the curricula to anticipate implementation problems, not only concerning the learning and teaching techniques, objectives and outcomes but also, in collaboration with the many parties involved, regarding the overall transformation strategy.

4. PAVING THE WAY FOR EDUCATION FOR SUSTAINABLE DEVELOPMENT

Accordingly, education that is based on and for the SDGs as well as human needs implies the need for deep changes in educational values, assumptions, policy, and practice. It goes hand in hand with the renewed global commitment envisaged in the Education 2030 agenda. This may represent an opportunity to rethink the need for ESD in order to address the challenges arising from the changing education and policy landscape. For that we have to consider multiple worldviews and alternative knowledge systems, as well as new frontiers in science and technology such as advances in neurosciences and developments in modern technology. Moreover, a broader perspective should be adopted by shifting the focus to human needs, imagination, and activity in a wide-scale system of transformation (see Thomas, 2013, p. 172). When approached using the eight steps outlined above, figure 1 results in eight features which aim to assist in the implementation of any educational transformation.

(1) **Essential:** Is the fulfilment of needs part of a process of humanistic or human-centered education (Maslow, 1943, 1971, 1987)? Does education help a person to become the best human being possible according to his or her potential? How are the learner's needs fulfilled? How are the needs linked to sustainable development in an individual and collective sense? What is the role of needs in a transformative learning approach? (see Quendler, Lamb, & Driouech, 2020)

(2) **Sustainable:** Is sustainability integrated in any education system, both in terms of content and method? How are sustainability and the needs of the learners linked? Does sustainable digital modernization take place? Is the emphasis on the potential of SDG innovations to catalyze transformations to a more sustainable learning process of learners and corresponding working environments? (see Quendler, Lamb, & Driouech, 2020)

(3) **Healthy:** Does it embody and advocate healthy approaches to education (both learning and teaching), life, relationships, family and friends? Does education promote biological, mental, moral and social well-being? (see Fraiberg, 1967; Henderson, 1947; De Koninck, 2004)

(4) **Tenable:** Is it “ethically acceptable,” as Sterling (2008) puts it, “working with honesty, justice, respect, and inclusivity?” Are there a range of educational realities in light of the many different political, cultural, social, environmental and economic contexts throughout the world? (see Morin, 2000)

(5) **Feasible:** Does it deploy, promote and teach using the current state of knowledge, technology and pedagogies in a way that is practicable? Are substantial changes in the social networks of learners and in the development of practices, routines, preferences, and interests of various social learning groups instigated? Is the “how” of teaching and learning in the future already considered? (Quendler, Lamb, & Driouech, 2020; see European Union, 2016)

(6) **Viable:** Is the education system financially viable, meshing with the market, fostering employability on the one hand, while maintaining academic integrity on the other? Is the system financially self-sustaining or are there dependencies? Are the latter above reproach? Is education defined as a never-ending process? (Quendler, Lamb, & Driouech, 2020)

(7) **Effective:** Is an individual capable of achieving, depending on their particular circumstances, the various combinations of what he or she can do or be (see Sen, 1992, p. 38–34)? Are capabilities conceived as temporary, changeable outcomes of evolving long-term co-evolutionary processes? (see Quendler, Lamb, & Driouech, 2020; Toner, 2011) Does education multiply the human being’s ability to know and transform reality? Are learners capable of reasoning and evolving in their process of consciousness (see De Koninck, 2004)?

(8) **Common:** Does everyone have access to quality education guaranteed by a minimum of infrastructure? How can we ensure that ESD is a common good but individualism is guaranteed? Is ESD as a common good a valuable complementary concept for the governance of education in a changing environment? How can the public interest and societal/collective development in contrast to an individualistic perspective be preserved?

5. AN INCLUSIVE FIELD OF RESEARCH

Taking the long-term empowerment of learners through education – as outlined in this conceptual chapter, the implementation of such a paradigm shift goes hand in hand with further applied research as follows.

(i) A thematic section should aim to spell out a specific research agenda for such an approach considering the steps for implementation as well as the features by also uncovering existing research trajectories. This section would also outline how it might contribute to the quality of teaching and learning and transformation in general.

(ii) A case study section should collect best practice examples. This should look at whether good-practice examples illustrate an initial notion of the paradigm shift needed as well as highlight their innovation potential. Furthermore, a checklist together with an evaluation program for further implementation should be drawn up.

(iii) A training section should focus more on transformative pedagogy and technological needs in the form of training materials to foster any transition. The suitability issue of transformative pedagogy has to be more comprehensively discussed in the context

of curricular design, classroom structures, and compatibility with traditional teaching methods as well as modern technology applied.

(iv) A cooperation section should highlight the relevance of alliances between the different stakeholders based on a common vision. Moreover, it would point out the crucial role of the different forms of governance, especially the political one.

If we are truly interested in a transformation toward a more inclusive and sustainable future then we should consider the entire system of education. In this sense, education institutions may reimagine the future by designing and implementing strategies that improve learners' outcomes such as graduation rates and greater inclusion and responsibility, enhancing operational and administrative performance, and ensuring sustainability.

6. CONCLUSION

This conceptual chapter has outlined the theoretical framework and multifaceted foundations to match two concepts, namely the SDGs and Maslow's hierarchy of needs. Such an approach is based on thoughts that emerge from the "Zeitgeist" and is supported by literature. Moreover, it ensures that all young people, both now and in the future, have access to a sustainable and inclusive education by considering their individual needs as an intrinsic part of achieving the SDGs. In our view, however, practical implementation is still outstanding. The logical conclusion now is, therefore, action. This action taken to enable a shift in the educational paradigm should be facilitated by the marriage of Maslow and the SDGs. The steps and corresponding features distilled here, together with the future research outlined above should all lead to a realignment that is both altruistic and human. This should correlate with higher learning outcomes in line with Maslow's hierarchy and the SDGs, it should ensure a level of employability that is both modern and sustainable and finally it should strengthen a sense of responsibility and ownership among both learners and educators. Any such realignment should, furthermore, involve the continuous exchange of information, awareness-raising and networking in compliance with political governance.

REFERENCES

- Bee, H., & Boyd, D. (2006). *Lifespan Development* (4th ed.). Toronto: Pearson.
- Berger, K. S. (2000). *The Developing Person through the Life Span*. New York, NY: Worth Publishers.
- Bertman, S. (1998). *Hyperculture: The Human Cost of Speed*. Westport: Praeger.
- Boogaard, F. C., Venvik, G., Pedrosa de Lima, R. L., Cassanti, A.C., Roest, A. H., & Zuurman, A. (2020). ClimateCafé: An Interdisciplinary Educational Tool for Sustainable Climate Adaptation and Lessons Learned. *Sustainability*, 12(9), 3694. <https://doi.org/10.3390/su12093694>
- Burgess, S. (2016). *Human Capital and Education: The State of the Art in the Economics of Education* (IZA Discussion Paper No. 9885). Retrieved from <https://repec.iza.org/dp9885.pdf>
- Cars, M., & West, E. E. (2015). Education for sustainable society: attainments and good practices in Sweden during the United Nations Decade for Education for Sustainable Development (UNDESD). *Environment, Development and Sustainability*, 17, 1-21. Retrieved from <https://link.springer.com/article/10.1007/s10668-014-9537-6>
- Chomsky, N. (2002). *Chomsky on democracy and education*. Abingdon, England: Routledge.
- De Koninck, T. (2004). *Philosophie de l'éducation: essai sur le devenir humain [Philosophy of Education: Essay on Human Becoming]*. Paris, France: Presses universitaires de France

- de Kraker, J., & Corvers, R. J. M. (2014). European Virtual Seminar on Sustainable Development: international, multi-disciplinary learning in an online social network. In U. M. Azeiteiro, W. Leal Filho, & S. S. Caeiro (Eds.), *E-learning and Education for Sustainability* (pp. 117-136). Peter Lang Publishing. Environmental Education, Communication and Sustainability Vol. 35. <https://doi.org/10.3726/978-3-653-02460-9>
- Delors, J. (1996). *Education: The necessary utopia*. In J. Delors (Ed.), *Learning, the treasure within: Report to UNESCO of the international commission on education for the twenty-first century* (pp. 13–33). Paris, France: UNESCO.
- Driouech, N., Sisto, L., Lorusso, O., & Raeli, M. (2015). Alumni network and peer learning: experience of Mediterranean Agronomic Institute of Bari, *The Journal Agriculture and Forestry*, 61(1), 239-249. <https://doi.org/10.17707/agricultforest.61.1.31>
- Dulfer, N., Polesel, J., & Rice, S. (2012). *The experience of education: The impacts of high stakes testing on school students and their families: An educator's perspective*. Retrieved from <https://www.aph.gov.au/DocumentStore.ashx?id=214ba798-d9ff-4352-af6a-f698cfc7c082&subId=11560>
- Dunlap, R. E., Grieneeks, J. K., & Rokeach, M. (1983). Human values and pro-environmental behavior. In W. D. Conn (Ed.), *Energy and material resources: Attitudes, values, and public policy* (pp. 145-168). Boulder, CO: Westview Press.
- De Montfort University. (2023). *Eco Café*. Retrieved February 9, 2023, from <https://esdg.our.dmu.ac.uk/projects/eco-cafe/EPA> (2021). *What is Environmental Education?* Retrieved June 6, 2022, from <https://www.epa.gov/education/what-environmental-education>
- European Union. (2016). *Research evidence on the use of learning analytics—Implications for education policy*. Luxembourg: Publications Office of the European Union. <http://dx.doi.org/10.2791/955210>
- FAO. (2022). *Sustainable Development Goals: Ensure inclusive and quality education for all and promote lifelong learning*. Retrieved June 10, 2022 from <https://www.fao.org/sustainable-development-goals/goals/goal-4/en/>
- Farren, P. (2016). Transformative Pedagogy in Context: being and becoming. *World Journal on Educational Technology: Current Issues*, 8(3), 190-204. <https://doi.org/10.18844/wjet.v8i3.622>
- Fraiberg, S. H. (1967). *Les Années magiques: comment comprendre et traiter les problèmes de la première enfance [The Magical Years: How to Understand and Deal with Early Childhood Problems]*. Paris, France: Presses Universitaires de France.
- Giordan, A. (2002). *Une autre école pour nos enfants [Another school for our children?]* Paris, France: Delagrave.
- Global MOOC and Online Education Alliance. (2023). *SDG Hackathon: “Digital Transformation for a More Inclusive University Campus and Learning Environment”*. Retrieved February 9, 2023, from <https://mooc.global/event/sdg-hackathon-digital-transformation-for-a-more-inclusive-university-campus-and-learning-environment/>
- Global Opportunities. (2023). *EDU-HACK: Quality Education Hackathon for African and Middle East Countries*. Retrieved February 9, 2023, from <https://www.go-platform.com/opp/3065>
- Guidote, A. J. M. (2020). Teaching college chemistry in the time of COVID-19 pandemic: A personal account of teaching in the old normal vs. the new normal. *KIMIKA*, 31(1), 70-75. Retrieved June 1, 2022, from <https://doi.org/10.26534/kimika.v31i1.70-75>
- Henderson, V. (1947). *The Principles and Practice of Nursing*. Paris, France: InterEditions.
- Hubers, M. D. (2020). Paving the way for sustainable educational change: Reconceptualizing what it means to make educational changes that last. *Teaching and Teacher Education*, 93, 103083. <https://doi.org/10.1016/j.tate.2020.103083>
- Jennings, N., Swilder, S., & Koliba C. (2005). Place-Based Education in the Standards-Based Reform Era—Conflict or Complement? *American Journal of Education*, 112(1), 44-65. <https://doi.org/10.1086/444522>
- Kioupi, V., & Voulvoulis, N. (2019). Education for Sustainable Development: A Systemic Framework for Connecting the SDGs to Educational Outcomes. *Sustainability*, 11(21), 6104. <https://doi.org/10.3390/su11216104>

- Legendre, R. (2002). *Stop aux réformes scolaires: Pour dénouer la crise maintenant [Stop school reforms: To resolve the crisis now]!* Montréal, Canada: Gaetan Guérin.
- Marcotte, G. (2006). *Manifeste du mouvement humanisation [Manifesto of the humanization movement]*. Québec, Canada: Éditions Humanisation.
- Maslow, A. H. (1943). A Theory of Human Motivation. *Psychological Review*, 50(4), 370–396.
- Maslow, A. H. (1971). *The farther reaches of human nature*. New York, NY: Viking.
- Maslow, A. H. (1987). *Motivation and personality* (3rd ed.). Delhi, India: Pearson Education.
- McInerney, P., Smyth, J., & Down, B. (2011). “Coming to a *place* near you?” The politics and possibilities of a critical pedagogy of place-based education. *Asia-Pacific Journal of Teacher Education*, 39(1), 3–16. <https://doi.org/10.1080/1359866x.2010.540894>
- McLeod, S. (2023). *Maslow's hierarchy of needs*. Retrieved April 3, 2023, from <http://www.simplypsychology.org/maslow.html>
- Mezirow, J. & Taylor, E. W. (2011). *Transformative learning in practice: Insights from community, workplace, and higher education*. San Francisco, CA: Jossey-Bass.
- Morin, E. (2000). *Les sept savoirs nécessaires à l'éducation du futur [The seven skills necessary for the education of the future]*. Paris, France: Seuil.
- Nilsson, A., von Borgstede, C., & Biel, A. (2004). Willingness to accept climate change strategies: The effect of values and norms. *Journal of Environmental Psychology*, 24(3), 267–277. <https://doi.org/10.1016/j.jenvp.2004.06.002>
- Papalia, D. E., & Olds, S. W. (1989). *Human Development*. New York, NY: McGraw-Hill.
- Parmentier, M. (2002). *Le vocabulaire de Locke [Locke's Vocabulary]*. Paris: Ellipses.
- Piaget, J. (1983). *Piaget's theory*. In P. Mussen (Ed.) *Handbook of Child Psychology*. (4th ed., Vol. 1). New York: Wiley.
- Quendler, E., Lamb, M. J., & Driouech, N. (2020). Sustainable education, employability and job opportunities for next generations in the digital era. In M. London (Ed.). *The Oxford Handbook of Lifelong Learning* (pp. 483–526). New York, NY: Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780197506707.013.24>
- SDG Café. (2020). *Welkom bij het [Welcome to it] #SDGCafé*. Retrieved February 10, 2023, from <https://sdgcafe.nl/>
- SDSN YOUTH (n.d.). *Sulitest*. Retrieved from <https://sdgzone.com/engage/how-can-i-test-my-knowledge/>
- Sen, A. (1992). *Inequality re-examined*. Oxford, England: Oxford University Press.
- Slimak, M. W., & Dietz, T. (2006). Personal values, beliefs, and ecological risk perception. *Risk Analysis*, 26(6), 1689–1705. <https://doi.org/10.1111/j.1539-6924.2006.00832.x>
- Sterling, S. (2008). *Sustainable education—Towards a deep learning response to unsustainability*. Policy and Practice: A Development Education Review, 6, 63–68. Retrieved from <https://www.developmenteducationreview.com/issue/issue-6/sustainable-education-towards-deep-learning-response-unsustainability>
- Stern, P. C. (2000). New environmental theories: Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, 56(3), 407–424. <https://doi.org/10.1111/0022-4537.00175>
- Sunway University. (2023). *#SUSTHACK – The Hackathon Approach to Sustainable Development*. Retrieved February 10, 2023, from <https://university.sunway.edu.my/explore/thinkpieces/SUSTHACK>
- Thomas, C. D. (2013). The Anthropocene could raise biological diversity. *Nature* 502 (7). <https://doi.org/10.1038/502007a>
- Toner, C. (2011). Evolution, naturalism, and the worthwhile: A critique of Richard Joyce's evolutionary debunking of morality. *Metaphilosophy*, 42(4), 520–546. <https://doi.org/10.1111/j.1467-9973.2011.01710.x>
- UNESCO. (2021). *Global education monitoring report. 2021/2: Non-state actors in education. Who chooses? Who loses?* Paris, France: Author. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000379875>
- United Nations University. (2016). *SDGs Cafe Series*. Retrieved February 9, 2023, from https://oui.unu.edu/en/events/events_cat/sdgscafe

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- United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development* (A/RES/70/1). Paris, France. Retrieved from <https://sustainabledevelopment.un.org/post2015/transformingourworld/publication>
- United Nations. (2017). *Education for sustainable development goals. Learning objectives*. Paris, France: UNESCO. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000247444>
- United Nations. (n.d.). *OSS4SDG Hackathon SDG#4 - Quality Education*. Retrieved February 9, 2023 from <https://ideas.unite.un.org/moodleapp/Page/Overview>
- University of Washington. (2017). *Curriculum transformation: Fostering inclusive classrooms*. Retrieved February 10, 2023 from <https://www.washington.edu/trends/curriculum-transformation-integrating-diversity-and-fostering-an-inclusive-classroom/>
- Wahba, M. A., & Bridwell, L. G. (1976). Maslow reconsidered: A review of research on the need hierarchy theory. *Organizational Behavior and Human Performance*, 15(2), 212–240. [https://doi.org/10.1016/0030-5073\(76\)90038-6](https://doi.org/10.1016/0030-5073(76)90038-6)
- Wright, M. F., Cain, K. D., & Monsour, F. A. (2015). Beyond Sustainability: A Context for Transformative Curriculum Development. *Transformative Dialogues: Teaching & Learning Journal*, 8(2). Retrieved from <https://td.journals.psu.edu/td/article/download/1151/611>

KEY TERMS & DEFINITIONS

Human capabilities: Human capabilities are the conditions or states of enablement that make it possible for learners to do things according to their perceived needs. They are a person's effective levels of empowerment to achieve valuable outcomes, such as being adequately nourished, taking part in the life of a community, or appearing in public without shame. Human capabilities can vary widely, from being able to fulfil basic material conditions (e.g. nutritional health), to more sophisticated social experiences (e.g. having meaningful relationships with other individuals and communities), to political power, (e.g. effectively participating in political decisions fostering sustainable development). The multidimensionality of these capabilities (see Figure 1) plays a role in understanding how the learning environment relates to human needs and SDGs. In question form, the capability targets in figure 1 easily lead to the definition of a set of learning outcomes or targets in the educational sense.

Human needs: Whether or not a human's life is sustainable depends on the level of fulfillment of a series of needs. Maslow catalogued these human needs as a hierarchy ranging from the 'basic' necessary for survival to the higher level of 'transcendence', the fulfillment of the previous level enabling one to concentrate on the next. It is quite clear that the fulfillment of any need acts as a driver and dictates human motivation. It is also quite clear that the fulfillment of any individual's needs may impact another's ability, capacity and opportunity to fulfill their own. It also goes without saying that the fulfillment of any individual's needs will have an impact on the physical environment (resource use, habitat, emissions etc.). The perception of needs is unique to each individual. The fulfillment of any particular need can form goals in an individual's life (health, happiness, employability, social standing etc.) and even be used as indicators to assess the level of 'satisfaction' attained.

Sustainable Development Goals: The Sustainable Development Goals (SDGs) or Global Goals are a collection of 17 interlinked global goals designed to be a "blueprint to achieve a better and more sustainable future for all." They also known as the Global Goals. These 17 SDGs are integrated—they recognize that action in one area will affect outcomes in others, and that development must balance social, economic and environmental sustainability. Education for sustainable development (ESD) is explicitly recognized in the SDGs as part of Target 4.7 of the SDG on education. At the same time, it is important to emphasize ESD's importance for all the other 16 SDGs. With its overall aim to develop cross-cutting sustainability capabilities in learners, ESD is an essential contribution to all efforts to achieve the SDGs. This would enable individuals to contribute to sustainable development by promoting societal, economic and political change as well as by transforming their own behavior.

The perfect match for education for sustainable development: human needs versus sustainable altruism?

Sustainable transformation: The transformation to sustainable development is about fostering a change through achieving the SDGs. This transformation towards sustainable futures is an alternative possibility for people and the planet. Sustainable transformation also requires a change in our educational system. This transformation may help us to step out of the "comfort zone" of our traditional mindset to overcome inherent limitations for an evolving planetary consciousness. A notion of a developmental or evolutionary perspective of human consciousness would be the key to inner transformation of the individual self as guided by Maslow's needs and the all-encompassing collective self - leading also to sustainable planetary transformation. The individual, personal level of transformative change is one dimension of a sustainable sociotechnical change processes.

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Chapter # 22

REFLECTIONS SHAPED BY THE COVID-19 PANDEMIC FOR MEDICAL EDUCATION IN CHINA, AND GLOBALLY

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ABSTRACT

The unprecedented global disruption introduced by the ongoing COVID-19 pandemic has highlighted the need to consider how to best prepare our learners to respond to the wide, interconnected array of global health challenges we face at this historical juncture. In 2019-20, when Professor Wei was a visiting professor at the University of Alberta, we began an East-West dialogue regarding the contributions of the medical/ health humanities to medical education. Following the emergence of the pandemic, we explored a broad literature base as they considered opportunities for reforming medical education to better prepare physicians to address complex global health circumstances and crises. Proposed directions for reorienting medical education include emphasizing systems science and public health competencies, promoting relationally-oriented identity formation and developing humanistic qualities and adaptive leadership ability through both systems-focused, humanities-informed curriculum and pedagogical processes. Ultimately, how successfully our learners respond to ongoing and emergent global health challenges will depend on how well we prepare them for the future. Recognizing increasing worldwide adoption of competency-based medical education, there is a pressing need to explore how to promote, and authentically assess, development of adaptive relational, collectivist competencies and capabilities.

Keywords: international exchange; medical education; medical humanities; public health; leadership; COVID-19.

1. INTRODUCTION

“The major problems in the world are the result of the difference between how nature works and the way people think.” (Bateson, 2011)

As a global community, we face multiple, complex health challenges associated with social inequities and economic disparities, changing demographics, and environmental concerns.

The Lancet's 2018 “Countdown” report on climate change describes health risks associated with rising temperatures, declining food security, and infectious disease (Watts et al., 2018). Alongside the opportunities that cross-continent movement of people, knowledge, and technology affords, there is also increased risk of outbreaks of disease (Madhav et al., 2017). Indeed, the novel coronavirus first reported in December 2019 rapidly evolved into the COVID-19 pandemic in 2020. Although projected to be transitioning to an endemic phase (Biancolella et al., 2022), health professional education has been disruptively impacted in various ways over the past several years (Hall et al., 2020; Reyna, 2020), and healthcare vulnerabilities have been laid bare worldwide. In a 2020 *Medical Teacher* editorial published,

Professor Trevor Gibbs asked “has this pandemic really made us think? Are we expressing a knee-jerk reaction to an immediate need or are we creating a new world of healthcare and health professions education?” (p. 738). Set against the backdrop of widespread adoption of competency-based assessment, our East-West discussions during the time we shared together in 2019-20, which have continued on at different points since then, offered us an opportunity to reflect on possibilities for enhancing medical education to help prepare physicians to address the global health challenges we currently face.

The global movement toward competency-based medical education (CBME) (Frank et al., 2010, 2017; ten Cate & Billett, 2014) has impacted educational programs around the world. A highly influential framework, Canada’s CanMEDS framework outlines competencies organized into medical expert, communicator, collaborator, leader, health advocate, scholar, and professional roles (Frank, Snell, & Sherbino, 2015). In the United States, the ACGME Framework includes patient care, medical knowledge, interpersonal and communication skills, professionalism, practice-based learning, and systems-based practice competencies (Swing, 2007). Similar frameworks have been introduced in the UK (General Medical Council, 2013), and elsewhere. In China, studies have explored a range of culturally appropriate competencies. For example, Liu, Tian, Chang, Sun, and Zhao (2016) identified administrative management, professionalism, diagnosis and treatment planning, interpersonal communication, disease prevention and health promotion, medical knowledge and lifelong learning, academic research, and teamwork, as important competencies. A qualitative study by Lio, Ye, Reddy, Dong, and Sherer (2016) identified communication and collaboration, professionalism, morality, and ethics, patient care, scholarship, and quality assurance as core competencies. Distinctive aspects of CBME include learner-centredness, focus on clearly articulated knowledge and skill outcomes, ongoing individualized assessment, and sequenced, time-independent progression (Frank et al., 2010). From a social learning and complexity perspective (Bleakley, 2017), CBME may be criticized as being overly reductionist and individual-oriented. Additional challenges include adequacy of assessment (Lurie, 2012; Santen, Ryan, & Coates, 2020), relative inflexibility in responding to skills and knowledge needed for emergent conditions and situations (Hawkins et al., 2015), in addition to other conceptual, psychometric, and logistical concerns (Norman, Norcini, & Bordage, 2014). Despite its limitations with respect to abstract, integrative critical and creative thinking, CBME is popularly considered to be more transparent and accountable than traditional, time-based approaches—many consider the advantages of CBME to outweigh any disadvantages (e.g., Holmboe et al., 2017).

In China, similar to other countries, it is clear many proposed core competencies refer to attributes associated with being a compassionate, effective healer and professional—qualities fostered through humanistic role-models, as well as the medical humanities (also referred to as “health humanities”) content and pedagogical approaches (Shapiro, Coulehan, Wear, & Montello, 2009; Jones, Blackie, Garden, & Wear, 2017). Overlapping, interdisciplinary fields, the medical/ health humanities (M/HH) encompass a wide range of health professions, communities, patients, and carers, engaging arts, humanities, and social sciences approaches and perspectives to improve health and healthcare for all. Contributing to high quality medical education, all disciplines included within the M/HH provide insight into the human experience of illness and suffering, responsibilities to self and caring for others, patients, colleagues, and larger society (New York University School of Medicine [NYUSOM], 1993). In China, Guo, Wei, Li, and Li (2016) outline four interrelated components comprising the medical humanities (as cited in Vuillermin, 2016, p. 3):

The highest level can be literally translated as ‘medical humanities spirit’ (医学人文精神), which implies the ultimate care for man and the respect for life. The next level is translated as ‘medical humanities care’ (医学人文关怀) —

humane care, meaning beneficence in biomedical research and healthcare. The third level is ‘the medical humanities’ (医学人文学科) — the interdisciplinary cluster of the humanities and social sciences that scrutinizes medicine from their own perspectives. Lastly, it refers ‘medical humanities competence’ (医学人文素质) — the ability to take benevolent actions in biomedical research and clinical care.

Together these interrelated components suggest M/HH competency is recognized through caring, context-sensitive, responsiveness to patient, community, and societal needs, as a healer, professional, and scholar. Duan (2017) has also outlined a vision for a ‘big’ or ‘great’ health humanities for China linked to Healthy China 2030 (Tan, Liu, & Shao, 2017), which includes concern for the complete health of individuals (physical, mental, and moral), as well as institutions and professionals that care for patients, and need to address social determinants of global health. Duan’s vision of an encompassing health humanities offers an opportunity to expand notions of individual competencies (something that an individual has, or not) to encompass more relationally-responsive, adaptive physician competencies.

In this chapter, we describe what we believe are pressing opportunities for helping prepare physicians for the urgent health challenges we face. Contributing to other pandemic preparedness calls to action (e.g., O’Byrne, Gavin, & McNicholas, 2020), we propose the need to develop health systems science and public health competencies. In addition, we also point to opportunities related to “being” and “becoming” a physician, including fostering relationally-oriented identity formation, supporting cultivation of medical humanistic competency, and building adaptive leadership. Our ideas are informed by the report of the independent commission on health professions education co-chaired by Professors Chen (President, China Medical Board) and Frenk (Dean, Harvard School of Public Health) entitled “Health Professionals for a New Century: Transforming education to strengthen health systems in an interdependent world” (Frenk et al., 2010), and the vision for medical leadership development proposed by Mangrulkar et al. (2020). Guo et al.’s (2016) multi-level definition of medical humanities, and Duan’s (2017) ‘big health humanities’, also helped shape our ideas.

2. GIVEN COVID-19, PROPOSED DIRECTIONS FOR REORIENTING MEDICAL EDUCATION

2.1. Develop Collaborative Competencies in Systems Science and Public Health

Overwhelmed hospitals and insufficient supplies of personal protective equipment combined with population movement in January, 2020 around the national Spring Festival (Lunar New Year) led the healthcare system in Wuhan in Hubei Province, China—ground-zero for COVID-19—to near collapse. Chinese government officials introduced a travel ban and 76-day “lockdown” one day before the holiday celebration to contain the spread of the virus and reduce the number of people seeking care. At that time, with hospital wards at capacity, many with COVID-19 symptoms were turned away. Many healthcare workers (HCWs) became infected with the virus—by early February, 1716 HCWs had contracted COVID-19, 63% of whom were at the frontlines in Wuhan (Wu & McGoogan, 2020). The overall multi-faceted public health emergency response, which also included organizational leadership consolidation, dispatch of HCWs from other regions to support emergency response efforts in Wuhan, implementation of other public health measures (infection control, procurement of personal protective supplies, early detection, etc.), and psychological support for frontline HCWs, helped to contain the outbreak (Pan et al., 2020).

As the pandemic progressed over time, it has tested the capacity and resilience of healthcare systems around the world, sounding an alert for expanded curricular content on

pandemic preparedness. Yang et al. (2020) noted “an integrated course on public health emergency response is virtually non-existent” (p. 789) in Chinese medical education. A recent review of global approaches to health crisis preparedness found training efforts in higher income countries tended to focus on “complex emergencies, bioterrorism, and mass casualty incidents” using complex, interactive simulations, while infectious disease was the predominant focus in lower income countries (Robinson et al., 2019; p. 3). Knowledge and perspectives from a wide array of M/HH disciplines along with M/HH pedagogical approaches and processes (e.g., narrative inquiry and reflection, etc.) have offered helpful lessons and insights (Jones, 2020; Van Bavel et al., 2020). However, we believe simple knowledge will be insufficient in helping our learners prepare for healthcare crises. Rather, as argued by psychologist John Shotter (1999, 2016) who based his inquiries into the dialogically-structured nature of human communication on our intrinsic interrelatedness, we believe that developing an expanded orientation to, attunement, and openness to responding to each other as ‘relational beings’ (e.g., see Casey, Watts, Frost, Kedmy, & Brett-MacLean, 2020), rather than ‘thinking machines’, will help create the social conditions needed to help us meet the challenges we face.

von Bertalanffy’s (1969) systems theory, or “general science of ‘wholeness’” (p. 37), which led to Engel’s (1977) biopsychosocial model and subsequent diverse applications of systems and complexity science in medical education (Bleakley, 2010; Cristancho, Field, & Lingard, 2019; D’Eon, 2017; Sturmberg, & Martin, 2009), may help us in this regard. In response to Frenk et al.’s (2010) call for a “redesign of professional health education” (p. 1923) to better meet the healthcare needs of patients and communities in our deeply interconnected world, Lucey (2013) argued for a shift from graduating a “siloed” expert physician to developing a “collaboratively effective systems physician” (p. 1640) who work interdependently with others in providing and improving care, and introduction of immersive, experiential, team-based learning to support development of collaborative competencies directed to improvement of complex health systems. Lingard (2016) has further argued that we need to move beyond the individualistic orientation framing much of medical education in the West, and develop educational practices to support the development of “collective competence”, described as the “distributed capacity of a system, an evolving, relational phenomenon that emerges from the resources and constraints of particular contexts” (p. S19). With respect to global health education, Eichbaum (2015, 2017) suggests the need to reconceptualize competencies as inclusive of both individualist and collectivist learning.

Effort will be needed to shift to health systems science and collectivist public health competencies. Gonzalo, Davis, Thompson, and Haidet (2020) described “mixed receptivity” (p. 250) in relation to engagement of medical students introduced to a new curriculum component focused on health systems science, attributing this to medical students viewing such learning as “peripheral to their future practice and not aligned with a professional identity that places emphasis on basic and clinical science topics” (p. 250). Nevertheless, given the COVID-19 pandemic, we are hopeful that recognition of the importance of health systems science and public health will lead to integration of these areas in health professions education and healthcare systems.

2.2. Shift to Relationally-oriented Identity Formation

HCWs across the world have been steadfast in their care of patients throughout the pandemic. From the beginning, they have stood firm in their resolve to provide the best patient care possible despite shortages of hospital beds, staff, medicine, and protective equipment.

Early on, many worked long shifts without drinking, eating, or going to the bathroom, to avoid replacing their protective gear while medical research groups frantically worked to

produce a vaccine to counter the virus, resulting in the development of an effective vaccine that was field-tested within about a year of the start of the pandemic, surprising many (Biancolella et al., 2022). In Wuhan and other regions of China, HCWs remained at the frontlines caring for patients, even as the situation grew increasingly worse. When they could no longer keep sleep at bay, they napped on a chair or the floor. Even with an ever-increasing number of cases, sorely in need of comfort and rest themselves, they provided comfort to patients in place of family members who were not allowed to enter the hospital. They were often the last person a COVID-19 patient saw before they died. Recognizing the extraordinary response of frontline HCWs, Shi and Jiao (2020) have described the COVID-19 pandemic as “a live class on medical professionalism” (p. 677).

Professionalism, the basis of medicine’s contract with society, demands placing the needs and interests of patients above the physician. Endorsed worldwide, the Medical Professionalism Project’s 2002 Charter of Medical Professionalism in the New Millennium (“the Charter”) details values and commitments directed to guiding the daily work of physicians. In addition to an encompassing set of responsibilities, including “commitment to professional competence” (p. 520), medical professionalism is founded on three principles: social justice, patient autonomy, and primacy of patient welfare. In 2011 an adapted version of the Charter was introduced in China (Jin, 2015). The Chinese Medical Doctor Declaration (“the Declaration”) establishes a commitment to universal professionalism aligned with Confucian and other Chinese cultural traditions. It includes six tenets: equality and benevolence, primacy of patients, honesty and fidelity to promises, commitment to excellence and prudence, incorruptibility and impartiality, and lifelong learning. Both in the Charter and Declaration, medical professionalism is described in rule-based, abstract terms. Although well-intended, such an approach is somewhat lacking as a means for influencing beliefs, values, and conduct. Dilnot (2017), a design theorist, argues that caring “as an ideal, an aspiration, a principle (is) without *operative purchase* ... (such concepts are) ‘indistinct’ ... they do not contain within itself the operative criteria by which it can become manifest” (p. 1) (emphasis added). Bleakley, Marshall, and Brömer (2006) similarly observed: “Learners may learn *about* something (propositional knowledge) but never really *inhabit* the learning or activity in which that learning is embedded (practical knowledge)” (p. 200). Abstract, rule-based professionalism can lead to pretending to understand, or passively, in limited ways, enacting professionalism commitments. Understanding of abstract concepts develops through encounters and interactions with material artifacts and/or other individuals (patients, learners, mentors, etc.). As a response to this, at least in the West, professional identity formation (PIF), or process of becoming or “being” a physician, has received increasing attention, in addition to “doing”. The 2010 Carnegie Foundation Report proposed PIF should be a major focus for medical education (Irby, Cooke, & O’Brien, 2010), an opinion echoed by many M/HH contributors (e.g., Boudreau & Fuks, 2015; Goldie, 2012; Wald, 2015; Wald et al., 2015).

Traditionally, physician identity has stressed individual accomplishment, responsibility, and accountability. In 1990, Miller proposed a pyramid model of competency evolving from cognitive understanding (knows, knows how), to behavioural competence evidenced in simulated and real-life, clinical settings (shows how, does). Recognizing the foundational importance of “the development of professional values, actions, and aspirations” (p. 181) to medical professionalism, Cruess, Cruess, and Steinert (2016) proposed that ‘Is’—an integrated sense of one’s moral professional identity (which we would suggest, is ever-developing)—be added to Miller’s model. Holden et al. (2015) refer to PIF as a “transformative journey through which one integrates the knowledge, skills, values, and behaviors of a competent, humanistic physician with one’s own unique identity and core values” (p. 762), that involves an ongoing process of personal and professional growth that

occurs through “mentorship, self-reflection and experiences that affirm the best practices, traditions, and ethics of the medical profession” (p. 762). In addition to describing qualitatively distinct and discontinuous stages associated with identity formation, Jarvis-Selinger, Pratt, and Regehr (2012) note the integral importance of social contexts, practice environments, and relationships. Involving active, developmental and relational processes (Cruess, Cruess, Boudreau, Snell, & Steinert, 2015; Frost & Regehr, 2013), PIF also recognizes the importance of patient-centred care, teamwork, and interprofessional collaboration. PIF develops through an orientation to being, being present, and embodied responsiveness to others, in the midst of various uniquely evolving situations and circumstances. For medical learners, dynamic processes of engagement support heightened awareness and understanding, while also providing a foundation for exploring and reflecting on their experiences. Work-integrated, interprofessional learning experiences provide opportunities for students to explore and internalize a commitment to medicine and its guiding ideals following a “self-altering” journey (Montgomery, 2006) that leads to “thinking, acting, and feeling” like a physician (p. 186). Ideally, remaining true to themselves, learners attune and respond to emergent possibilities for growth across a wide range of roles, relationships, and professional contexts (see Rutberg et al., 2017).

Along with Bleakley (2017), we believe there is a need to move beyond individualistic, “heroic doctor” identity formation to developing patient-centred, interprofessional team identities, and orientation to population and global health among our learners (Duan, 2017; Eichbaum, Reid, Coly, Naidu, & Omaswa, 2019). A focus on relationally-oriented identity formation throughout the continuum of medical education is needed to pursue best approaches for supporting the development of caring, compassionate physicians who, as “global citizens” (Wu & Noel, 2020) recognize the interrelatedness of our world and need to collaborate with others across systems and countries to address emergent health challenges and improve health both locally and globally.

2.3. Cultivate Medical Humanistic Competency

Viral pandemics exert “extraordinary and sustained demands on public health and health systems and on providers of essential community services” (US Department of Health & Human Services, 2017; p. 42). During the early days of COVID-19, many Chinese frontline HCWs described feeling afraid, lonely, exhausted, depressed, even hopeless (Du et al., 2020). In 2019, the World Health Organization (WHO) recognized chronic, work-related stress leading to burnout (feelings of exhaustion, depersonalization or cynicism, and reduced effectiveness) as an “occupational phenomenon”. Described as a global epidemic (*The Lancet*, 2019a), there is growing concern regarding rates of physician burnout around the world. A systematic review identified an overall prevalence of burnout symptoms among Chinese physicians ranging from 66.5% to 87.8% (Lo, Wu, Chan, Chu, & Li, 2018). Song et al. (2015) raised concerns about work overload in response to increasing rates of unexpected, sudden death among Chinese physicians from 2008 to 2015. Zheng et al. (2019) cite a study that found that among Chinese doctors, one-third were found to have experienced conflict with patients, and that there were “high incidence rates of depressive symptoms and suicide attempts” (p. 2). Burnout impacts everyone—physicians, their family members, colleagues, and of course, their patients. Physicians who experience burnout are more prone to medical errors, professionalism lapses, and treating their patients callously in an objectified manner. Recognizing the extreme conditions of a pandemic, how can the health and well-being of HCWs be supported to help ensure their resilience given personal risk of infection, heavy workloads, physical fatigue, emotional stress, isolation, and when resource shortages are experienced, distressing moral dilemmas?

In the West, burnout has traditionally been conceptualized more as an individual, rather than a systems-based problem, although there has been a recent shift toward a more encompassing view (Card, 2018; Montgomery, 2014; *The Lancet*, 2019b). Western strategies for helping reduce physician burnout include individual, physician-directed measures (personal coping and work-life balance, connecting with supportive colleagues to discuss patients and stressors, mindfulness courses, etc.), and organizational-level interventions (reduction of workload, better team functioning, etc.)—benefits are associated with both, although organizational initiatives have been identified as having greater impact (Panagioti et al., 2017). Cultural norms and workplace ethics vary across countries. Although many Chinese physicians may sense they are experiencing overload or burnout, the Chinese work culture of withstanding hardship without complaint likely has contributed to high burnout rates. What can be done? From a Chinese cultural perspective, Lo et al. (2018) suggest a renaissance of medical humanities, and efforts to strengthen the primary healthcare system, as promising directions for addressing the problem of physician burnout in China.

Medical humanistic competency is not a technical skill that can be obtained through attending lectures or passing examinations. It involves an array of processes including reflection and sense-making supported by M/HH, leading to ongoing personal and professional development, as well as job-related gratifications, such as authentic connections with patients and colleagues, and enhanced resiliency supported by realistic, proactive, and positive attitudes and perspectives (Zwack & Schweitzer, 2013). Recognition of the importance of supporting development of humanistic attributes through integration of arts, humanities, and social sciences in medical education has led to global expansion of M/HH (Wei, Goetz, Hillier, & Brett-MacLean, 2020). Evidence supports the benefits of active involvement in the arts (visual art, music, literature, theatre, etc.) and humanities in medical school. Mangione et al. (2018) found that exposure to the arts and humanities was correlated with positive qualities such as emotional intelligence, empathy, and observational skills, among medical students, as well as reduced burnout, pointing to the importance of self-care in caring well for others. Embracing arts and humanities offers a means of hope and support for healthcare professionals at any time, but especially so during extremely challenging periods such as a pandemic when other sources of support and sustenance may be disrupted given the need for physical distancing and quarantine. Reading, drawing or making crafts, listening to music, watching films, exploring different culinary creations, all provide a moment of pause or escape from stressful circumstances, offering an open, imaginative space for self-reflection and adjusting to a new normal (see Cénat et al., 2020).

Appreciating resiliency as a dynamic or creative process, M/HH can contribute to medical humanistic competency. Internalized humanistic competency is important not only for the personal well-being of HCWs but also patients' well-being. Chinese physicians shared that during the early months of the pandemic, many patients diagnosed with COVID-19 were particularly struck hard, both physically and mentally. Some refused to eat, drink, talk, or follow prescribed treatment. They felt hopeless to live any more. However, HCWs did not give up on them. They spent time talking with them, and sang songs for them, they danced for them, and shared jokes. Gradually patients began to feel more hopeful and began to cooperate with their treatment plans which helped them to recover. The humanistic care they received helped to improve the health outcomes of patients. Recognizing that frontline HCWs will inevitably experience stress and anxiety through healthcare crises, we can imagine connecting emotionally with patients in different ways is also beneficial to them (Wald, 2020). M/HH can also provide insights and perspectives that can help develop organizational approaches to addressing burnout among HCWs. For example, Adams and Walls (2020) emphasize the importance of transparent and thoughtful communication, and encouraging and supporting self-care as central to promoting organizational trust and a sense of control

among HCWs (also see Wu et al., 2020). We need to proactively create a healthcare culture that supports wellness and resiliency, and can quickly respond to the needs of frontline HCWs, including medical educators and learners during emergent challenging periods.

2.4. Build Adaptive Leadership Ability for a Changing World

Early on many did not take the threat of COVID-19 seriously. Dr. Li Wenliang who warned colleagues about a potential new virus was initially reproached for spreading false rumours. After he died of COVID-19 an official inquiry later found he was a professional leader who had fought bravely and made sacrifices. The contributions of trusted medical leaders such as Professors Zhong Nanshan, Li Lanjuan, and Zhang Wenhong who helped communicate the threat of COVID-19 to the public also needs to be recognized. On January 20, 2020, Zhong, who helped isolate the SARS virus during the SARS epidemic in 2002-2004, announced on state television human-to-human transmission of the virus had been confirmed, making clear the gravity of the situation. Authorities and medical leaders communicated with the public through many channels and encouraged preventive behaviours. Chinese people, from government leaders to the public masses, worked together to reduce the numbers of those infected and control the pandemic. At the age of 83, Professor Zhong, who has argued M/HH education should be directed to ensuring the essential nature of medicine as a healing profession (Li, 2016), went to Wuhan when it was in lockdown during the first wave of the pandemic to help manage and lead the response.

Public health crises like the COVID-19 pandemic create opportunities for leadership across all levels (Van Bavel et al., 2020). In their 2010 report, Frenk et al. emphasize the importance of leadership in ensuring effectiveness of complex healthcare systems globally. Beyond management and governance, an emphasis on leadership competency emphasizes the need to adaptively improve increasingly complex, interconnected healthcare systems to advance patient care, and overall population and global health. There is a need to shift from individual leadership competency to capability development of individuals across organizations and systems that helps prepare everyone to contribute ‘knotworking’, a term coined by Engeström (2012, 2018) to describe the improvisational, goal-focused activity connections of fluidly emergent, distributed teams (also see Bleakley, 2013). Developing leaders is not just about training, but requires opportunities for personal development and leadership across the learning continuum. Medical universities, hospitals and healthcare clinics offer ideal environments for developing adaptive leadership competencies such as systems thinking, managing complexity, fostering organizational resiliency, and responsive creation of new collaborative practices. In addition, Yang et al. (2020) point to the opportunity for medical education in China to capitalize on double-degree programs such as MD/MPH and MD/MBA degrees “to secure interdisciplinary leadership of the future for challenging times like this” (p. 789; also see Crites, Ebert, & Schuster, 2008). Recognizing the need for transformative education to support the development of leadership attributes needed in the 21st century, Frenk et al. (2010) encouraged shifting from “non-critical adoption of educational models to ... (global flows) of pedagogical resources, and innovations” (p. 2). A group of Canadian and US medical students and educators developed a curriculum for advocacy and leadership which they suggest can be adapted and used elsewhere (Benrimoh et al., 2016). Grounded in complexity science, an international group is collaborating on a CBME-based model of leadership development for all physicians (Matlow et al., 2016). Lobdell et al. (2020) encourage adoption of leadership models that prioritize a “team-oriented approach to care delivery and collaboration across institutions” (p. 2) to help catalyze both short- and long-term improvements needed across many interconnected, networked systems currently impacting healthcare around the globe to help

prevent future pandemics, and also promote health and well-being before, during, and after health crises.

To optimize preparedness and effectiveness of responding to future healthcare challenges, Mangrulkar et al. (2020) propose required leadership curriculum for medical students guided by three core principles: 1) leadership is about values and understanding yourself, 2) leadership is about change, and 3) leadership is about teams and accountability to one another. Reconnecting with ideas regarding being, becoming, and relationally-oriented identity formation seems appropriate here. As argued by Hafferty (2016), “fundamental uncertainties ... (and) ambiguities that permeate medical practice, require a professional presence that is best grounded in who one is rather than what one does” (p. 55). Research on optimal teaching and assessment methods directed to helping prepare HCWs to lead through healthcare crises, and then later apply their knowledge and experience to ensure healthcare system change and transformation is needed to improve prospects for human health. As medicine becomes more and more interprofessional and team-based, it is crucial to teach future physicians how to work collaboratively with others, and contribute to needed changes and transformation of healthcare systems, instead of just being informed, and formed. Further, given our deeply interconnected world it is important to encourage development of engaged leadership throughout healthcare organizations and systems.

3. SUMMARY AND CONCLUSIONS

The medical students we teach today will become the physicians of tomorrow, informed by all we have taught them, as they develop new understandings, approaches, and hopes for global health guided by a longer connection into the future than we have access to. How successfully they adapt and respond to the complex health challenges we face will depend on how well we will have prepared them. In this chapter, we have proposed a number of curricular emphases we believe will help prepare our learners to respond to complex, changing global circumstances. We have proposed promotion of relationally-oriented identity formation that includes preparing our learners to be “global citizens”. Last century’s idealized vision of physicians was the individual superstar, or heroic expert, who focused on biomedical knowledge and technical skills. Lucey (2013) imagined a “collaboratively effective systems physician” identity for the 21st century (p. 1640). Given COVID-19, we propose amending this to a ‘collaboratively effective, relationally- and globally-oriented systems physician’ identity. We need physicians who are self-, other- and globally-aware, who are caring and committed, creatively adaptive collaborators who inspire teams of all kinds to improve the health of patients, global populations, and the world. Recognizing that people from all walks of life have contributed to the containment of multiple waves of COVID-19 in China and elsewhere, from the beginning of the pandemic through to the present day, we should ensure our communities are also engaged in these collaborative efforts.

Among others, Frenk et al. (2010) have encouraged international competency-based learning efforts, emphasizing the need for transformative learning, and timely development and introduction of curricula to respond to rapidly changing local and societal needs. We believe the curricular emphases we have proposed are aligned with the learner-centred focus of CBME—ideally, students are supported in exploring a range of active, self-directed learning paths (Frost & Regehr, 2013). However, while CBME is effective in assessing technical skills, it is challenging to translate these more complex, adaptive competencies into measurable, behaviourally-based anchors. As noted by Cruess et al. (2016), assessment becomes increasingly difficult at higher levels of Miller’s pyramid, with “Is” being most challenging. Given this, they recommend assessment of identity formation be primarily

formative. With respect to M/HH that aims to introduce nuanced perspectives to help learners “query their own attitudes and behaviors” (p. 192), and develop new responsive understanding and insights, Shapiro et al. (2009) caution that M/HH teaching and learning cannot be assessed by applying checklists and algorithms used to evaluate more technical competencies. With respect to adaptive leadership, health systems, and complexity science, Woodruff (2019) recommends “assessing adaptive competence separate from technical competence” (p. 867) noting this would help “avoid incentivizing rigid maladaptive behaviors when more flexible and responsive approaches are in order”, and would offer more meaningful directions for ongoing mentorship. Recognizing that narrow, behavioral competency measures can serve to limit or frustrate more fully integrated assessment of progress, Ginsburg, McIlroy, Oulanova, Eva, K., and Regehr (2010) argue “holistic impressions should not be considered invalid simply because they are subjective. Instead, assessment methods should consider novel ways of accommodating these impressions to improve evaluation” (p. 780).

What to do? There is a need for research on systems/complexity-focused approaches to preparing learners to effectively respond to the myriad global health challenges we face. Given widespread adoption of CBME, a pressing question that also needs to be explored is how to best assess adaptive relational, collectivist competencies and capabilities. To bridge the gap between the theory and practice of CBME, and potential overemphasis of measurable technical skills, entrustable professional activities (EPAs) have been proposed as a complement to CBME, offering a more comprehensive approach to assessing complex competencies (ten Cate, 2005, 2013; Englander et al., 2017). Recognizing an increasing emphasis on interprofessional, team-based practice and broader practice contexts, the ICBME Collaborators have identified a need for research that contributes to understanding, enhancement, and assessment of “collective competencies” (Gruppen et al., 2017). Hodges (2013) has argued for inclusion of subjective and collective approaches to assessment methods. Whitehead, Kuper, Hodges, and Ellaway (2015) have proposed the use of social science-based approaches, such as realist and ethnographic methods, to assess socially and culturally-referenced physician competencies. It is expected that over time, increasing effort will be focused on this area. Schuwirth and van der Vleuten (2020) report that exercises that have considered future scenarios in which “healthcare providers are increasingly technology supported and or even technology substituted” suggest that health professionals will need to have “different skills, abilities and competencies, most likely in the humanistic domain” (p. 1053).

In the midst, and wake, of the COVID-19 pandemic there is much we need to learn. We need to do so to best guide and support our learners through their journey to becoming and being humane and effective practitioners and global collaborators, facing a future we can only begin to imagine. We have written this article to contribute to a beginning conversation, recognizing that while complexity and systems approaches may expand possibilities for medical education, these will also undoubtedly introduce limits through what is hidden from view (see Vogt, Ulvestad, Eriksen, & Getz, 2014). Observing the “epistemological narrowing” introduced by biomedical thinking, Squier (2007) has argued M/HH can help remedy resulting medical *nescience*, or “lack of knowledge or awareness” (p. 334) that serves to impede healing, by recognizing complexity and possibilities beyond positivist, biomedical understanding. We characterize this as the ‘ontological thrust’ of the M/HH, occurring through recognition of dynamic socio-cultural realities, perspective framing, reflexive criticality, catalyzed meaning-making, and other dimensions of human experience, leading to new perceptions and understandings, and ongoing questioning. We believe that innovative, imaginative approaches to learning and assessment directed to fostering integration of our learners’ personal and professional growth, medical knowledge, clinical skills, health

systems understanding, and medical humanistic competency will help them courageously navigate their way, led by both their hearts and minds, committed to improving the health of patients and our communities in support of a better future for the world.

REFERENCES

- Adams, J. G., & Walls, R. M. (2020). Supporting the health care workforce during the COVID-19 global epidemic. *Journal of the American Medical Association*, 323(15), 1439-1440. <https://doi.org/10.1001/jama.2020.3972>
- Bateson, N. (Director/Producer). (2011). *An ecology of mind: A daughter's portrait of Gregory Bateson* [Motion Picture]. The Impact Media Group.
- Benrimoh, D., Warsi, N., Hodgson, E., Demko, N., Chen, B. Y., Habte, R., Dandurand-Bolduc, C., Silverberg, S., Xia, S., Chu, L., & Ruiz-Casares, M. (2016). An advocacy and leadership curriculum to train socially responsible medical learners. *MedEdPublish*, 5, 62. <http://doi.org/10.15694/mep.2016.000062>
- Biancolella, M., Colona, V. L., Mehrian-Shai, R., Watt, J. L., Luzzatto, L., Novelli, G., & Reichardt, J. K. V. (2022). COVID-19 2022 update: transition of the pandemic to the endemic phase. *Human Genomics*, 16(1), 19. <https://doi.org/10.1186/s40246-022-00392-1>
- Bleakley, A. (2010). Blunting Occam's razor: Aligning medical education with studies of complexity. *Journal of Evaluation in Clinical Practice*, 16(4), 849-855. <https://doi.org/10.1111/j.1365-2753.2010.01498.x>
- Bleakley, A. (2013). Working in "teams" in an era of "liquid" healthcare: What is the use of theory? *Journal of Interprofessional Care*, 27(1), 18-26. <https://doi.org/10.3109/13561820.2012.699479>
- Bleakley, A. (2017). The perils and rewards of critical consciousness raising in medical education. *Academic Medicine: Journal of the Association of American Medical Colleges*, 92(3), 289-291. <https://doi.org/10.1097/ACM.0000000000001426>
- Bleakley, A., Marshall, R., & Brömer, R. (2006). Toward an aesthetic medicine: Developing a core medical humanities undergraduate curriculum. *Journal of Medical Humanities*, 27(4), 197-213. <https://doi.org/10.1007/s10912-006-9018-5>
- Boudreau, J. D., & Fuks, A. (2015). The humanities in medical education: Ways of knowing, doing and being. *Journal of Medical Humanities*, 36(4), 321-336. <https://doi.org/10.1007/s10912-014-9285-5>
- Card, A. J. (2018). Physician burnout: Resilience training is only part of the solution. *Annals of Family Medicine*, 16(3), 267-270. <https://doi.org/10.1370/afm.2223>
- Casey, S., Watts, A., Frost, M., Kedmy, A., & Brett-MacLean, P. (2020). Building dialogues between medical students and autistic patients: Reflections on the MD Program's Patient Immersion Experience. *Spectrum*, 5. <https://doi.org/10.29173/spectrum83>
- Cénat, J. M., Noorishad, P. G., Blais-Rochette, C., McIntee, S. E., Mukunzi, J. N., Darius, W.P., Broussard, C., Morse, C., Ukwu, G., Auguste, E., & Menelas, K. (2020). Together for hope and resilience: A humanistic experience by the Vulnerability, Trauma, Resilience and Culture Lab Members during the COVID-19 pandemic. *Journal of Loss & Trauma*, 25(8), 643-648. <https://doi.org/10.1080/15325024.2020.1774704>
- Cristancho, S., Field, E., & Lingard, L. (2019). What is the state of complexity science in medical education research? *Medical Education*, 53(1), 95-104. <https://doi.org/10.1111/medu.13651>
- Crites, G. E., Ebert, J. R., & Schuster, R. J. (2008). Beyond the dual degree: Development of a five-year program in leadership for medical undergraduates. *Academic Medicine: Journal of the Association of American Medical Colleges*, 83(1), 52-58. <https://doi.org/10.1097/acm.0b013e31815c63b6>
- Cruess, R. L., Cruess, S. R., Boudreau, J. D., Snell, L., & Steinert, Y. (2015). A schematic representation of the professional identity formation and socialization of medical students and residents: A guide for medical educators. *Academic Medicine: Journal of the Association of American Medical Colleges*, 90(6), 718-725. <https://doi.org/10.1097/acm.0000000000000700>

- Cruess, R.L., Cruess, S.R., & Steinert, Y. (2016). Amending Miller's pyramid to include professional identity formation. *Academic Medicine: Journal of the Association of American Medical Colleges*, 91(2), 180-185. <https://doi.org/10.1097/ACM.0000000000000913>
- D'Eon, M. (2017). Systems thinking and structural competence in and for medical education. *Canadian Medical Education Journal*, 8(1), e1-e5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5344060/>
- Dilnot, C. (2017). 'Care' as a problem: How to begin to create, for design, an adequate theory of model of care. In P. Rodgers, C. Bremner, G. Innella, & I. Coxon (Eds.), *Proceedings of "Does Design Care? An International Workshop of Design Thought and Action"* (pp. 1-6). Lancaster University: Lancashire, UK. Retrieved from: <https://doi.org/10.13140/RG.2.2.24043.64805>
- Du, J., Dong, L., Wang, T., Yuan, C., Fu, R., Zhang, L., Liu, B., Zhang, M., Yin, Y., Qin, J. W., Bouey, J., Zhao, M., & Li, X. (2020). Psychological symptoms among frontline healthcare workers during COVID-19 outbreak in Wuhan. *General Hospital Psychiatry*, 67, 144-145. <https://doi.org/10.1016/j.genhosppsych.2020.03.011>
- Duan, Z. G. (2017). 大健康人文：医学人文与健康人文的未来 [Great health humanities: The future of medical humanities and health humanities]. *Medicine and Philosophy*, 38(6A), 6-9. (In Chinese) Retrieved from: <https://yizhe.dmu.edu.cn/article/id/6412e677fa89b2af1f8754d9>
- Eichbaum, Q. (2015). The problem with competencies in global health education. *Academic Medicine: Journal of the Association of American Medical Colleges*, 90(4), 414-417. <https://doi.org/10.1097/ACM.0000000000000665>
- Eichbaum, Q. (2017). Acquired and participatory competencies in health professions education: Definition and assessment in global health. *Academic Medicine: Journal of the Association of American Medical Colleges*, 92(4), 468-474. <https://doi.org/10.1097/ACM.0000000000001382>
- Eichbaum, Q., Reid, S., Coly, A., Naidu, T., & Omaswa F. (2019). Conceptualizing medical humanities programs in low-resource settings in Africa. *Academic Medicine: Journal of the Association of American Medical Colleges*, 94(8), 1108-1114. <https://doi.org/10.1097/ACM.00000000000002789>
- Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. *Science*, 196(4286), 129-136. <https://doi.org/10.1126/science.847460>
- Englander, R., Frank, J. R., Carraccio, C., Sherbino, J., Ross, S., Snell, L., & ICBME Collaborators (2017). Toward a shared language for competency-based medical education. *Medical Teacher*, 39(6), 582-587. <https://doi.org/10.1080/0142159X.2017.1315066>
- Engeström, Y. (2012). *From teams to knots: Activity-theoretical studies of learning at work*. Cambridge, UK: Cambridge University Press. <https://doi.org/10.1017/CBO9780511619847>
- Engeström, Y. (2018). *Expertise in transition: Expansive learning in medical work*. Cambridge, UK: Cambridge University Press. <https://doi.org/10.1017/9781139023009>
- Frank, J. R., Snell, L. S., ten Cate, O., Holmboe, E. S., Carraccio C., Swing, S.R., Harris, P., Glasgow, N. J., Campbell, C., Dath, D., Harden, R. M., Iobst, W., Long, D. M., Mungroo, R., Richardson, D., Sherbino, J., Silver, I., Taber, S., Talbot, M., & Harris, K. A. (2010). Competency-based medical education: Theory to practice. *Medical Teacher*, 32(8), 638-645. <https://doi.org/10.3109/0142159X.2010.501190>
- Frank, J. R., Snell, L. S., Englander, R., Holmboe, E. S., & ICBME Collaborators. (2017). Implementing competency-based medical education: Moving forward. *Medical Teacher*, 39(6), 568-573. <https://doi.org/10.1080/0142159X.2017.1315069>
- Frank, J. R., Snell, L. S., & Sherbino, J. (Eds). (2015). *CanMEDS 2015 Physician Competency Framework*. Ottawa, ON (Canada): Royal College of Physicians & Surgeons of Canada: http://canmeds.royalcollege.ca/uploads/en/framework/CanMEDS%202015%20Framework_EN_Reduced.pdf
- Frenk, J., Chen, L., Bhutta, Z. A., Cohen, J., Crisp, N., Evans, T., Fineberg, H., Garcia, P., Ke, Y., Kelley, P., Kistnasamy, B., Meleis, A., Naylor, D., Pablos-Mendez, A., Reddy, S., Scrimshaw, S., Sepulveda, J., Serwadda, D., & Zurayk, H. (2010). Health professionals for a new century: Transforming education to strengthen health systems in an interdependent world. *The Lancet*, 376(9756), 1923-1958. [https://doi.org/10.1016/S0140-6736\(10\)61854-5](https://doi.org/10.1016/S0140-6736(10)61854-5)

- Frost, H. D., & Regehr, G. (2013). "I am a doctor": Negotiating the discourses of standardization and diversity in professional identity construction. *Academic Medicine: Journal of the Association of American Medical Colleges*, 88(10), 1570-1577. <https://doi.org/10.1097/ACM.0b013e3182a34b05>
- General Medical Council. (2013). *Good medical practice*. Manchester, UK: General Medical Council. https://www.gmc-uk.org/guidance/good_medical_practice.asp
- Gibbs, T. (2020). The Covid-19 pandemic: Provoking thought and encouraging change. *Medical Teacher*, 42(7), 738-740. <https://doi.org/10.1080/0142159X.2020.1775967>
- Ginsburg, S., McIlroy, J., Oulanova, O., Eva, K., & Regehr, G. (2010). Toward authentic clinical evaluation: Pitfalls in the pursuit of competency. *Academic Medicine: Journal of the Association of American Medical Colleges*, 85(5), 780-786. <https://doi.org/10.1097/ACM.0b013e3181d73fb6>
- Goldie, J. (2012). The formation of professional identity in medical students: Considerations for educators. *Medical Teacher*, 34(9), e641-e648. <https://doi.org/10.3109/0142159X.2012.687476>
- Gonzalo, J. D., Davis, C., Thompson, B. M., & Haidet, P. (2020). Unpacking medical students' mixed engagement in health systems science education. *Teaching & Learning in Medicine*, 32(3), 250-258. <https://doi.org/10.1080/10401334.2019.1704765>
- Gruppen, L., Frank, J. R., Lockyer, J., Ross, S., Bould, M. D., Harris, P., Bhanji, F., Hodges, B. D., Snell, L., ten Cate, O., & ICBME Collaborators. (2017). Toward a research agenda for competency-based medical education. *Medical Teacher*, 39(6), 623-630. <https://doi.org/10.1080/0142159X.2017.1315065>
- Guo, L., Wei, L., Li, Y., & Li, H. (2016). Medical humanities and empathy: An experimental study. In D. Vuillermin & L. Guo (Eds.), *Chinese medical humanities review* (pp. 29-35). Beijing, China: Peking University Medical Press. <https://www.purpleculture.net/chinese-medical-humanities-review-2016-p-25198/>
- Hafferty, F. W. (2016). Professionalism and the socialization of medical students. In R. L. Cruess, S. R. Cruess & Y. Steinert (Eds.), *Teaching medical professionalism* (2nd ed., pp. 53-73). New York, NY: Cambridge University Press. <https://doi.org/10.1017/CBO9781316178485>
- Hall, A. K., Nousiainen, M. T., Campisi, P., Dagnone, J. D., Frank, J. R., Kroeker, K. I., Brzezina, S., Purdy, E., & Oswald, A. (2020). Training disrupted: Practical tips for supporting competency-based medical education during the COVID-19 pandemic. *Medical Teacher*, 42(7), 756-761. <https://doi.org/10.1080/0142159X.2020.1766669>
- Hawkins, R. E., Welcher, C. M., Holmboe, E. S., Kirk, L. M., Norcini, J. J., Simons, K. B., & Skochelak, S. E. (2015). Implementation of competency-based medical education: Are we addressing the concerns and challenges? *Medical Education*, 49(11), 1086-1102. <https://doi.org/10.1111/medu.12831>
- Hodges, B. (2013). Assessment in the post-psychometric era: Learning to love the subjective and collective. *Medical Teacher*, 35(7), 564-568. <https://doi.org/10.3109/0142159X.2013.789134>
- Holden, M. D., Buck, E., Luk, J., Ambriz, F., Boisabuin, E. V., Clark, M. A., Mihalic, A. P., Sadler J. Z., Sapphire, K. J., Spike, J. P., Vince, A., & Dalrymple, J. L. (2015). Professional identity formation: Creating a longitudinal framework through TIME (transformation in medical education). *Academic Medicine: Journal of the Association of American Medical Colleges*, 90, 761-767. <https://doi.org/10.1097/ACM.0000000000000719>
- Holmboe, E. S., Sherbino, J., Englander, R., Snell, L., Frank, J. R., & ICBME Collaborators. (2017). A call to action: The controversy of and rationale for competency-based medical education. *Medical Teacher*, 39(6), 574-581. <https://doi.org/10.1080/0142159X.2017.1315067>
- Irby, D. M., Cooke, M., & O'Brien, B. C. (2010). Calls for reform of medical education by the Carnegie Foundation for the Advancement of Teaching: 1910 and 2010. *Academic Medicine: Journal of the Association of American Medical Colleges*, 85(2), 220-227. <https://doi.org/10.1097/ACM.0b013e3181c88449>
- Jarvis-Selinger, S., Pratt, D. D., & Regehr, G. (2012). Competency is not enough: Integrating identity formation into the medical education discourse. *Academic Medicine: Journal of the Association of American Medical Colleges*, 87(9), 1185-1190. <https://doi.org/10.1097/ACM.0b013e3182604968>

- Jin, P. (2015). The physician charter on medical professionalism from the Chinese perspective: A comparative analysis. *Journal of Medical Ethics*, 41(7), 511-514. <https://doi.org/10.1136/medethics-2014-102318>
- Jones, D. S. (2020). History in a crisis—lessons for Covid-19. *New England Journal of Medicine*, 382(18), 1681-1683. <https://doi.org/10.1056/NEJMp2004361>
- Jones, T., Blackie, M., Garden, R., & Wear, D. (2017). The almost right word: The move from medical to health humanities. *Academic Medicine: Journal of the Association of American Medical Colleges*, 92(7), 932-935. <https://doi.org/10.1097/ACM.0000000000001518>
- Li, E. (2016). From medical humanities to humanistic medicine: An interview with academician Zhong Nanshan. *Chinese Medical Ethics*, 3, 369-371. (In Chinese) Retrieved from: <https://www.fx361.com/page/2016/1116/16577256.shtml>
- Lingard, L. (2016). Paradoxical truths and persistent myths: Reframing the team competence conversation. *Journal of Continuing Education in the Health Professions*, 36(Supp 1.), S19-S21. <https://doi.org/10.1097/CEH.0000000000000078>
- Lio, J., Ye, Y., Reddy, S., Dong, H., & Sherer, R. (2016). Developing a competency framework for medical education in China: A qualitative study. *Medical Science Educator*, 26, 743-748. <https://doi.org/10.1007/s40670-016-0287-y>
- Liu, Z., Tian, L., Chang, Q., Sun, B., & Zhao, Y. H. (2016). A competency model for clinical physicians in China: A cross-sectional survey. *PLoS One*, 11(12), e0166252. <https://doi.org/10.1371/journal.pone.0166252>
- Lo, D., Wu, F., Chan, M., Chu, R., & Li, D. (2018). A systematic review of burnout among doctors in China: A cultural perspective. *Asia Pacific Family Medicine*, 17(1), 1-13. <https://doi.org/10.1186/s12930-018-0040-3>
- Lobdell, K. W., Hariharan, S., Smith, W., Rose, G. A., Ferguson, B., & Fussell, C. (2020). Improving health care leadership in the Covid-19 era. *NEJM Catalyst: Innovations in Care Delivery*. <https://catalyst.nejm.org/doi/full/10.1056/CAT.20.0225>
- Lucey, C. R. (2013). Medical education: Part of the problem and part of the solution. *JAMA Internal Medicine*, 173(17), 1639-1643. <https://doi.org/10.1001/jamainternmed.2013.9074>
- Lurie, S. J. (2012). History and practice of competency-based assessment. *Medical Education*, 46(1), 49-57. <https://doi.org/10.1111/j.1365-2923.2011.04142.x>
- Madhav, N., Oppenheim, B., Gallivan, M., Mulembakani, P., Rubin, E., & Wolfe, N. (2017). Pandemics: Risks, impacts, and mitigation. In D. T. Jamison, H. Gelband, S. Horton, P. Jha & R. Laxminarayan (Eds.), *Disease control priorities: Improving health and reducing poverty* (3rd ed.), pp. 315-345. Washington, DC: The International Bank for Reconstruction and Development. Retrieved from: https://doi.org/10.1596/978-1-4648-0527-1_ch17
- Mangione, S., Chakraborti, C., Staltari, G., Harrison, R., Tunkel, A. R., Liou, K. T., Cerceo, E., Voeller, M., Bedwell, W. L., Fletcher, K., & Kahn, M. J. (2018). Medical students' exposure to the humanities correlates with positive personal qualities and reduced burnout: A multi-institutional US survey. *Journal of General Internal Medicine*, 33(5), 628-634. <https://doi.org/10.1007/s11606-017-4275-8>
- Mangrulkar, R. S., Tsai, A., Cox, S. M., Halaas, G. W., Nelson, E. A., Nesse, R. E., Silvestri, R. C., Radabaugh, C. L., Skochelak, S., Beck Dallaghan, G. L., & Steiner, B. (2020). A proposed shared vision for leadership development for all medical students: A call from a coalition of diverse medical schools. *Teaching & Learning in Medicine*, 32(5), 561-568. <https://doi.org/10.1080/10401334.2020.1754835>
- Matlow, A., Chan, M. K., Bohnen, J. D., Blumenthal, D. M., Sanchez-Mendiola, M., de Camps Meschino, D., Samson, L. M., & Busari, J. (2016). Collaborating internationally on physician leadership education: First steps. *Leadership Health Services*, 29(3), 220-230. <https://doi.org/10.1108/LHS-12-2015-0049>
- Medical Professionalism Project. (2002). Medical professionalism in the new millennium: A physicians' charter. *The Lancet*, 359(9305), 520-522. [https://doi.org/10.1016/S0140-6736\(02\)07684-5](https://doi.org/10.1016/S0140-6736(02)07684-5)

- Miller, G. E. (1990). The assessment of clinical skills/competence/performance. *Academic Medicine: Journal of the Association of American Medical Colleges*, 65(9), S63-S67. <https://doi.org/10.1097/00001888-199009000-00045>
- Montgomery, A. (2014). The inevitability of physician burnout: Implications for interventions. *Burnout Research*, 1(1), 50-56. <https://doi.org/10.1016/j.burn.2014.04.002>
- Montgomery, K. (2006). *How doctors think: Clinical judgment and the practice of medicine*. New York, NY: Oxford University Press.
- New York University School of Medicine (NYUSOM). (1993). *Literature, arts and medicine (Litmed) database*. <http://medhum.med.nyu.edu/about>
- Norman, G., Norcini, J., & Bordage, G. (2014). Competency-based education: Milestones or millstones? *Journal of Graduate Medical Education*, 6(1), 1-6. <https://doi.org/10.4300/JGME-D-13-00445.1>
- O'Byrne, L., Gavin, B., & McNicholas, F. (2020). Medical students and COVID-19: The need for pandemic preparedness. *Journal of Medical Ethics*, 46(9), 623-626. <https://doi.org/10.1136/medethics-2020-106353>
- Pan, A., Liu, L., Wang, C., Guo, H., Hao, X., Wang, Q., Huang, J., He, N., Yu, H., Lin, X., Wei, S., & Wu, T. (2020). Association of public health interventions with the epidemiology of the COVID-19 outbreak in Wuhan, China. *Journal of the American Medical Association*, 323(19), 1915-1923. <https://doi.org/10.1001/jama.2020.6130>
- Panagioti, M., Panagopoulou, E., Bower, P., Lewith, G., Kontopantelis, E., Chew-Graham, C., Dawson S., van Marwijk, H., Geraghty, K., & Esmail, A. (2017). Controlled interventions to reduce burnout in physicians: A systematic review and meta-analysis. *JAMA Internal Medicine*, 177(2), 195-205. <https://doi.org/10.1001/jamainternmed.2016.7674>
- Reyna, J. (2020). Twelve tips for COVID-19 friendly learning design in medical education. *MedEdPublish*, 9, 103. <https://doi.org/10.15694/mep.2020.000103.1>
- Robinson, C., Goldsmith, A., Merkt, P., Edmier, A., Stanford, K., Hellman, N., & Spiegel, P. (2019). *Training for infectious disease outbreaks and other emergencies in low and middle income country settings: A systematic literature review*. Baltimore, MD: Center for Humanitarian Health, Johns Hopkins Bloomberg School of Public Health. Retrieved from: http://hopkinshumanitarianhealth.org/assets/documents/RRTLit_Review_Final_Draft_6.25.19.pdf
- Rutberg, P. C., King, B., Gaufberg, E., Brett-MacLean, P., Dinardo, P., & Frankel, R. M. (2017). Do medical students' narrative representations of "The Good Doctor" change over time? Comparing humanism essays from a national contest in 1999 and 2013. *Academic Medicine: Journal of the Association of American Medical Colleges*, 92(4), 537-543. <https://doi.org/10.1097/ACM.0000000000001531>
- Santen, S. A., Ryan, M. S., & Coates, W. C. (2020). What can a pandemic teach us about competency-based medical education? *AEM Education & Training: A Global Journal of Emergency Care*, 4(3), 301-305. <https://doi.org/10.1002/aet2.10473>
- Schuwirth, L. W., & van der Vleuten, C. P. (2020). A history of assessment in medical education. *Advances in Health Sciences Education*, 25(5), 1045-1056. <https://doi.org/10.1007/s10459-020-10003-0>
- Shapiro, J., Coulehan, J., Wear, D., & Montello, M. (2009). Medical humanities and their discontents: Definitions, critiques, and implications. *Academic Medicine: Journal of the Association of American Medical Colleges*, 84(2), 192-198. <https://doi.org/10.1097/ACM.0b013e3181938bca>
- Shi, W., & Jiao, Y. (2020). The COVID-19 pandemic: A live class on medical professionalism. *QJM: An International Journal of Medicine*, 114(9), 677-678. <https://doi.org/10.1093/qjmed/hcaa157>
- Shotter, J. (1999, September). *At the boundaries of being: Re-figuring intellectual life*. Paper presented at the Social Construction and Relational Practices Conference, University of New Hampshire, Durham, NH. Retrieved from: https://www.researchgate.net/profile/John_Shotter2/publication/261250839_Shotter_Boundaries_of_being_UNH_1999/links/569b857908aeeea985a555fdf/Shotter-Boundaries-of-being-UNH-1999.pdf

- Shotter, J. (2016). *Speaking, actually: Towards a new "fluid" common-sense understanding of relational becomings*. Farnhill, UK: Everything is Connected Press. <https://eicpress.com/speakact.htm>
- Song, X. N., Shen, J., Ling, W., Ling, H. B., Huang, Y. M., Zhu, M. H., Yang, K. K., Wang, M., & Zhao, H. L. (2015). Sudden deaths among Chinese physicians. *Chinese Medical Journal*, *128*(23), 3251-3253. <https://doi.org/10.4103/0366-6999.170263>
- Squier, S. M. (2007). Beyond nescience: The intersectional insights of health humanities. *Perspectives in Biology & Medicine*, *50*(3), 334-347. <https://doi.org/10.1353/pbm.2007.0039>
- Sturmberg, J. P., & Martin, C. M. (2009). Complexity and health—yesterday’s traditions, tomorrow’s future. *Journal of Evaluation in Clinical Practice*, *15*(3), 543-548. <https://doi.org/10.1111/j.1365-2753.2009.01163.x>
- Swing, S. R. (2007). The ACGME outcome project: Retrospective and prospective. *Medical Teacher*, *29*(7), 648–654. <https://doi.org/10.1080/01421590701392903>
- Tan, X., Liu, X., & Shao, H. (2017). Healthy China 2030: A vision for health care. *Value in Health Regional Issues*, *12*, 112-114. <https://doi.org/10.1016/j.vhri.2017.04.001>
- ten Cate, O. (2005). Entrustability of professional activities and competency-based training. *Medical Education*, *39*(12), 1176–1177. <https://doi.org/10.1111/j.1365-2929.2005.02341.x>
- ten Cate, O. (2013). Nuts and bolts of entrustable professional activities. *Journal of Graduate Medical Education*, *5*(1), 157–158. <https://doi.org/10.4300/JGME-D-12-00380.1>
- ten Cate, O., & Billett, S. (2014). Competency-based medical education: Origins, perspectives, and potentialities. *Medical Education*, *48*(3), 325-332. <https://doi.org/10.1111/medu.12355>
- The Lancet*. 2019a. Physician burnout: A global crisis. *The Lancet*, *394*(10193), 93. [https://doi.org/10.1016/S0140-6736\(19\)31573-9](https://doi.org/10.1016/S0140-6736(19)31573-9)
- The Lancet*. 2019b. Physician burnout: The need to rehumanise health systems. *The Lancet*, *394*(10209), 1591. [https://doi.org/10.1016/S0140-6736\(19\)32669-8](https://doi.org/10.1016/S0140-6736(19)32669-8)
- US Department of Health & Human Services. (2017). *Pandemic influenza plan: 2017 update*. Washington, DC: US Dept. of Health & Human Services. Retrieved from: <https://www.cdc.gov/flu/pandemic-resources/pdf/pan-flu-report-2017v2.pdf>
- Van Bavel, J. J., Baicker, K., Boggio, P. S., Capraro, V., Cichocka, A., Cikara, M., Crockett, M. J., Crum, A. J., Douglas, K. M., Druckman, J. N., Drury, J., Dube, O., Ellemers, N., Finkel, E. J., Fowler, J. H., Gelfand, M., Han, S., Haslam, S. A., Jetten, J., ... Willer, R. (2020). Using social and behavioural science to support COVID-19 pandemic response. *Nature: Human Behaviour*, *4*(5), 460-471. <https://doi.org/10.1038/s41562-020-0884-z>
- Vogt, H., Ulvestad, E., Eriksen, T. E., & Getz, L. (2014). Getting personal: Can systems medicine integrate scientific and humanistic conceptions of the patient? *Journal of Evaluation in Clinical Practice*, *20*(6), 942-952. <https://doi.org/10.1111/jep.12251>
- von Bertalanffy, L. (1969). *General systems theory: Foundations, development, applications*. New York, NY: George Braziller.
- Vuillermin, D. (2016). Introduction. In D. Vuillermin & L. Guo (Eds.), *Chinese medical humanities review* (pp. 1-8). Beijing, China: Peking University Medical Press. <https://www.purpleculture.net/chinese-medical-humanities-review-2016-p-25198/>
- Wald, H. S. (2015). Professional identity (trans)formation in medical education: Reflection, relationship, resilience. *Academic Medicine: Journal of the Association of American Medical Colleges*, *90*(6), 701-706. <https://doi.org/10.1097/ACM.0000000000000731>
- Wald, H. S. (2020). Optimizing resilience and wellbeing for healthcare professions trainees and healthcare professionals during public health crises: Practical tips for an ‘integrative resilience’ approach. *Medical Teacher*, *42*(7), 744-755. <https://doi.org/10.1080/0142159X.2020.1768230>
- Wald, H. S., Anthony, D., Hutchinson, T. A., Liben, S., Smilovitch, M., & Donato, A. A. (2015). Professional identity formation in medical education for humanistic, resilient physicians: Pedagogic strategies for bridging theory to practice. *Academic Medicine: Journal of the Association of American Medical Colleges*, *90*(6), 753-760. <https://doi.org/10.1097/ACM.0000000000000725>

- Watts, N., Amann, M., Arnell, N., Ayeb-Karlsson, S., Belesova, K., Berry, H., Bouley, T., Boykoff, M., Byass, P., Cai, W., & Campbell-Lendrum, D. (2018). The 2018 report of the Lancet Countdown on health and climate change: Shaping the health of nations for centuries to come. *The Lancet*, 392(10163), 2479-2514. [https://doi.org/10.1016/S0140-6736\(18\)32594-7](https://doi.org/10.1016/S0140-6736(18)32594-7)
- Wei, L., Goez, H., Hillier, T., & Brett-MacLean, P. (2020). A visiting professorship in undergraduate medical education at the University of Alberta: Reflections on possibilities for medical humanities in China, and elsewhere. *MedEdPublish*, 9(190). <https://doi.org/10.15694/mep.2020.000190.1>
- Whitehead, C. R., Kuper, A., Hodges, B., & Ellaway, R. (2015). Conceptual and practical challenges in the assessment of physician competencies. *Medical Teacher*, 37(3), 245-251. <https://doi.org/10.3109/0142159X.2014.993599>
- Woodruff, J. N. (2019). Accounting for complexity in medical education: A model of adaptive behaviour in medicine. *Medical Education*, 53(9), 861-873. <https://doi.org/10.1111/medu.13905>
- World Health Organization (WHO). (2019). Burn-out an 'occupational phenomenon': International Classification of Diseases. Retrieved from: https://www.who.int/mental_health/evidence/burn-out/en
- Wu, A., & Noel, G. (2020). How to internationalize medical education using concepts in internationalization of higher education. *MedEdPublish*, 9(151). <https://doi.org/10.15694/mep.2020.000151.1>
- Wu, W., Zhang, Y., Wang, P., Zhang, L., Wang, G., Lei, G., Xiao, Q., Cao, X., Bian, Y., Xie, S., Huang, F., Luo, N., Zhang, J., & Luo, M. (2020). Psychological stress of medical staff during outbreak of COVID-19 and adjustment strategy. *Journal of Medical Virology*, 92(10), 1962-1970. <https://doi.org/10.1002/jmv.25914>
- Wu, Z., & McGoogan, J. M. (2020). Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: Summary of a report of 72,314 cases from the Chinese Center for Disease Control and Prevention. *Journal of the American Medical Association*, 323(13), 1239-1242. <https://doi.org/10.1001/jama.2020.2648>
- Yang, D-Y., Cheng, S-Y., Wang S-Z., Wang J-S., Kuang M., Wang T-H., & Xiao H-P. (2020). Preparedness of medical education in China: Lessons from the COVID-19 outbreak. *Medical Teacher*, 42(7), 787-790. <https://doi.org/10.1080/0142159X.2020.1770713>
- Zheng, Q., Yang, K., Wang, X., Ou, Z., Su, X., Zhang, J., & Qu, M. (2019). Burnout among doctors in China through 2018: A protocol of systematic review and meta-analysis. *Medicine*, 98(37), e17117. <https://doi.org/10.1097/MD.00000000000017117>
- Zwack, J., & Schweitzer, J. (2013). If every fifth physician is affected by burnout, what about the other four? Resilience strategies of experienced physicians. *Academic Medicine: Journal of the Association of American Medical Colleges*, 88(3), 382-389. <https://doi.org/10.1097/ACM.0b013e318281696b>

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Chapter # 23

IDENTIFYING THE Ph.D. STUDENTS' NEEDS FOR CAREER ENHANCEMENT SKILLS

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ABSTRACT

To date, it is observed that an increasing number of Ph.D. graduates follow a career outside academia. The EU-funded CHAMELEONS project aimed to identify and fulfill the needs of Ph.D. students towards pursuing a career in digital and connected health industry. The CHAMELEONS overall goal was to develop innovative educational interventions offered by higher education to build more adaptable, entrepreneurial and employable graduates in both academic and non-academic environments. Thus, a range of courses or educational material provided by CHAMELEONS consortium members, or available in open platforms were identified, organized and offered to 15 students, of diverse background, enrolled in the program through a State-of-the-Art (SotA) toolkit. Two questionnaires were provided to attain information on: (i) background and skills the students recognized as underdeveloped, (ii) students' preferences in terms of interest, reasons, and motivation of selection and skills they aim to acquire using SotA toolkit. Students selected courses not actually improving hard skills needed for their research, but soft skills in the business and career management direction, focusing mostly on creativity, innovation, and communication. Finally, the students mentioned that the drive for their selection was based on self-awareness tools which identified the underdeveloped skills required for a successful career.

Keywords: PhD courses, extra-curricular activities, career enhancement, ESCO classification.

1. INTRODUCTION

The globalization and the advances in the technology sector have modified substantially modern life. The labour market requires new types of skills since jobs are becoming more knowledge- and skills-intensive. According to European Commission, by 2020 35% of all jobs would require high-level qualifications in the European Union (MEMO/11/615). This observation denotes that more jobs for those with higher academic qualifications, such as PhDs, will be involved in industry. Indeed, to date, less than 15% of doctoral graduates achieve a long-term academic career, with the remaining seeking employment in governmental or industry settings. This transition requires the restructuring of training programs in order to improve interdisciplinarity but also to enhance 'sophisticated skills useful in the workplace' (Roberts, 2018). As mentioned by (Bogle, Michel, Eggermont, & Willem van Henten, 2011), the skills researchers need are similar both inside and outside academia, and may include creative thinking, planning the implementation and verification of ideas in teamwork and communicating research. These skills will not only open up and maximize employment outside academia, but they will also address the EU's societal challenges. Moreover, diverse and interdisciplinary activities qualify students with such skills and experiences needed for their future careers (Patricio, & Santos, 2019). However,

while Europe has high-level skills needs, in many EU Member States there is an unmet demand for graduates in a number of areas including science, technology, engineering, and the medical professions (Relevant and high-quality higher education, 2023).

According to the (European qualifications framework (EQF), 2018), doctoral graduates should have “*knowledge at the most advanced frontier of a field of work or study and at the interface between field and the most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice*”. However, one major question remains and must be addressed: “Which PhD program characteristics are capable to improve employability for the PhD graduates, while also leading them to become big thinkers?”

1.1. Connected Health and the CHAMELEONS approach

As life expectancy has grown through the last decades, a need for more efficient healthcare systems has risen to support the increasing number of patients’ care needs. Introducing state-of-the-art technology in healthcare has become essential in healthcare delivery and a wide range of disciplines, such as computer science, engineering, health and information technology (IT) design, can contribute to the improvement of patient management. This intersection of disciplines, known as Connected Health (CH) (Caulfield, & Donnelly, 2013), introduces the need to overcome disciplinary barriers and achieve inter-disciplinary interaction (Chouvarda, Mountford, Traikovik, Loncar-Turukalo, & Cusak, 2019). And thus, to achieve innovative creative CH solutions, not only several disciplines must work together in a more cohesive and meaningful way but also intersectoral cooperation is needed, by bringing together actors from universities, market and civil society sectors, to achieve efficient solutions in healthcare.

Highly skilled ambitious researchers who can address the most urgent and complex societal challenges in the CH domain are among Europe’s emerging needs. However, PhD programs do not include activities to serve this purpose (Bosch, 2018) and broaden students’ opportunities in various sectors, especially in Engineering and medicine domains (Lieu Tran et al., 2019; Cui, & Harshman, 2020). To achieve this, educational methods need to be introduced, empowering graduates to develop interdisciplinary, and intersectoral knowledge is crucial if we are to address current and future healthcare needs. (Mountford et al., 2018)

CHAMELEONS was a two-year research project (www.chameleonsproject.eu/) that received funding from the European Union’s Horizon 2020 research and innovation program under grant agreement No 873105. CHAMELEONS was organized by an intersectoral and international consortium including five universities around Europe, namely (1) Aristotle University of Thessaloniki (AUTH) in Greece, (2) University College Dublin (UCD) and (3) Maynooth University (MU) in Ireland, (4) University of Porto (UP) in Portugal and (5) University of Oulu (OULU) in Finland. The objective of CHAMELEONS project was to design, deliver, and evaluate a range of interdisciplinary, intersectoral and international courses and educational material that will broaden PhD graduate skills, improve their employability in both academic and non-academic environments and equip them to solve societal challenges in the area of CH.

CHAMELEONS project focused on training 15 PhD students, through: (i) identifying and making available courses and educational material and (ii) co-design and deliver interdisciplinary, inter-sectoral, and international courses to improve their skills and employability, in a wide range of sectors, including academia, industry and entrepreneurship.

1.2. The CHAMELEONS State-of-the Art Toolkit for PhD Training

During the initial stage of the project, a screening phase in the five universities involved in the CHAMELEONS projects started in order to collect the views of those who attend interdisciplinary, inter-sectoral and international courses (young researchers) and those who design and implement such courses (Program Directors or equivalent). Interestingly, in those universities, it was revealed the limited availability of courses that are provided as part of PhD programs with the aim to broaden the career prospect outside academia. For this limited number of courses, the main characteristics were identified and used to inform the CHAMELEONS design requirements (Kosvyra et al., 2021).

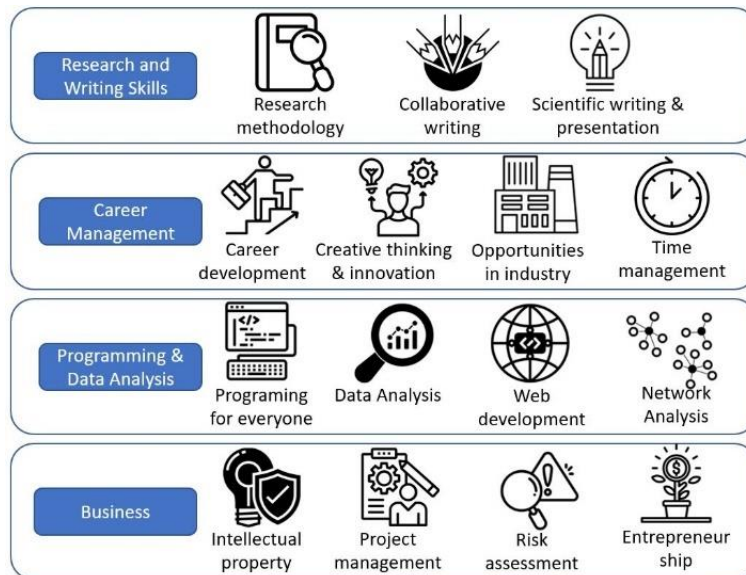
Afterward, this list of courses was made available to the students participating in the project and were asked to choose up to three courses, based on their needs and interests, that they were willing to attend.

In addition, apart from the list of courses that are provided by the universities involved in the CHAMELEONS, a list of publicly available online courses or educational material that can improve future career opportunities, based on (Kosvyra et al., 2021), was created. In this respect, numerous platforms providing online courses were investigated (such as Coursera - <https://www.coursera.org>, udacity - <https://www.udacity.com>, FutureLearn - <https://www.futurelearn.com> etc.) as well as YouTube channels or IEEETv (<https://ieeetv.ieee.org/>) were investigated.

Following, the list of courses provided either by the CHAMELEONS universities or online platforms was divided into four categories, based on the: (1) the knowledge/skills they are providing and (2) the thematic area. In addition, each of the categories were further divided into sub-categories (Figure 1).

Figure 1.

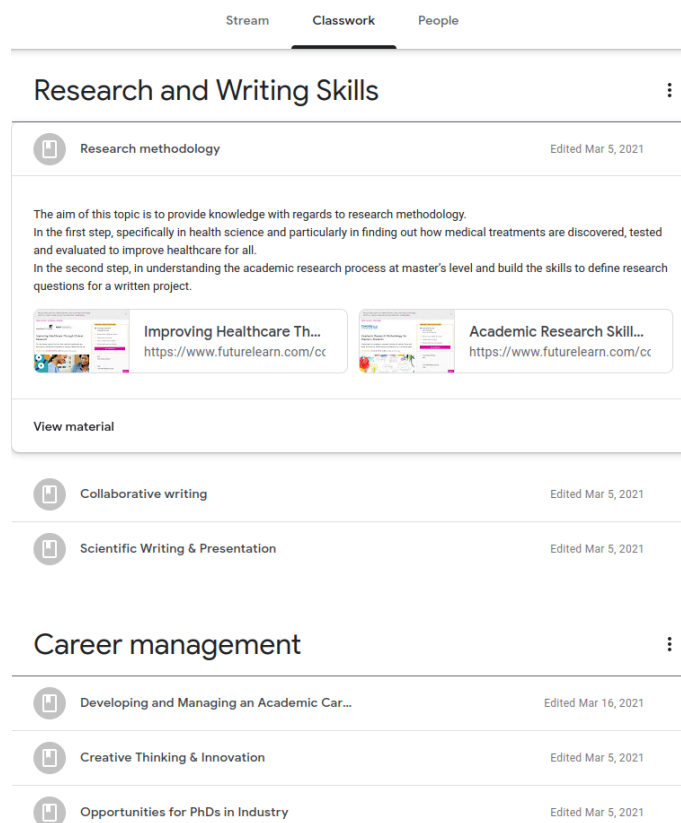
The courses provided by the universities involved in CHAMELEONS project and the educational material that is available on the online platforms are divided into four categories, with each of them to be further divided into sub-categories. The icons of the figure were downloaded from the <https://thenounproject.com/>



The list of courses was included in a State-of-the-Art (SotA) toolkit, which was implemented using google classroom and is accessible through the CHAMELEONS website. The goal of the SotA toolkit was to provide any information for the courses or any educational material to the students in a condensed and detailed way. The structure of the classroom was based on the identified categories of courses, offering the user access to more information and details on the content and scope of each course, as depicted in Figure 2. The SotA toolkit was advertised through the communications channels of the consortium members.

Figure 2.

Implementation of the questionnaire in Google Classroom. The list of courses is organized into distinct categories according to the thematic area and the targeted skills. The general description of each category is provided, whereas the list of the courses is also available.



The goal of this chapter is to present the main motivation of the PhD students behind the selection of the courses or the educational material they prefer to attend during their PhD and associate them with the skills they aim to develop. A distinct analysis was made to investigate any differences in students' perspectives regarding the courses provided by the universities involved in CHAMELEONS and the courses or the educational material provided from open platforms. To this end, two questionnaires were developed aiming to identify how students recognize their needs and how they address them using these types of resources.

This book chapter attempts to identify the needs of PhD students towards preparing for their careers, by assessing their preferences for courses or activities outside their curriculum.

2. DESIGN & IMPLEMENTATION

To capture students' needs and their perspectives regarding the selection of the courses already provided by CHAMELEONS consortium, but also the courses or educational material that are provided through online platforms, two distinct questionnaires were designed and implemented as part of the SotA toolkit, in Google Forms. The answers were completely anonymous and no personal information was requested by the students.

2.1. Courses provided by the consortium members

The first questionnaire focuses on the courses provided by the universities involved in CHAMELEONS and it was organized into two parts. The first part of the questionnaire attempts to obtain more general information about the background of each student, the skills that they recognized as underdeveloped and the tools they used to identify them. Moreover, students were asked which of those courses they found interesting or useful for their career development during the first screening and considered them as potential candidates for attending.

The second part of the questions aims to attain information about the specific preferences of students for the courses made available to them, meaning how many and which courses they finally decided to attend. Since the period that students could attend a course did not overlap with the lockdown period due to the COVID-19 pandemic, face-to-face attendance was also possible, in addition to completely online provision. Moreover, students were asked to provide information about these specific courses in terms of interest, reasons, and motivation for selection and the skills they aim to acquire through these courses. With respect to the skills, students were called to identify them from a list of skills provided by the European classification of Skills, Competences and Occupation - ESCO (<https://esco.ec.europa.eu/>). This was adopted to enable linking these identified needed skills with other relevant resources developed at EU level.

2.2. Courses and educational material provided by online platforms

Similarly to the aforementioned questionnaire, a dedicated one was developed focusing on the courses and educational material provided via online platforms. Through this questionnaire, the users were asked to provide more details regarding the most interesting online material they attended, and the skills they aimed to improve through the specific material. The classification of the skills was also based on the ESCO categorization.

Finally, the experience of the students from the overall SotA toolkit use was also captured through those two questionnaires. In this respect, the users were prompted to provide their expectations from a tool like the SoTA and also their overall perception regarding the actual use of the tool.

3. RESULTS

This section presents the results of the questionnaires reflecting the choices of the students, as regards both the courses provided by the CHAMELEONS consortiums, and the educational material offered by the online platforms.

3.1. Students’ Choices for synchronous Courses provided by the consortium

The results presented in this section include (i) the attributes of the courses and (ii) the skills that the students intend to improve by attending them. The questionnaire was answered by 13 students coming from diverse backgrounds. Specifically, 7 of them come from a technical/engineering background, 2 of them from the Business field, 3 of them from Education (Physical/Health) and 1 from a Healthcare background.

Among the 15 students that participated in the CHAMELEONS project, only 10 decided to attend courses with two of them selecting three courses, two students selected two courses, and six students decided to attend one course. For the remaining student, one student chose not to attend a course but used this opportunity for a short-term placement in another university to perform part of his/her research. As concerns the four that opted out, the reasons were mostly the limited time to offer in an activity outside their PhD program and the fact that they already have fulfilled the number of ECTS required to complete their studies. Thus, 10 different courses were selected and counted for the analysis as 16 individual selections representing all ten students' preferences (Table 1). Table 1 depicts the selected courses’ titles, the duration of the course, the university that delivers each course, the number of students that selected it and the delivery mean. As observed, most of the students selected to attend courses of short duration (1 week) with the way of provision to be face-to-face.

Table 1.
Overview of the Selected Courses. Popularity is measured in terms of the number of students who selected the course.

Course	Length	Location	Popularity	Accessibility	ECTS
Creative Thinking & innovation	1 week	UCD	6	Face-to-face	5
Communication for Impact	1 week	UCD	2	Face-to-face	5
Social Entrepreneurship	8 hours	MU	1	Face-to-face	5
Design your Purposeful Life	1 week	UCD	1	Face-to-face	5
Basics in eHealth	5 weeks	OULU	1	online	5
Computational medical research	6 weeks	AUTH	1	online	4
Scientific Writing and Publication	81 hours	UP	1	Blended	7.5
Data mining	6 weeks	AUTH	1	online	4
Entrepreneurship: application and mindset	1 week	UCD	1	Blended	5
Exploring Intellectual Property	1 week	UCD	1	online	5

In order to understand better how the students identified their underdeveloped skills, 12 students used one or more SWOT analysis tools when deciding on the course to attend, while the 13th did not use such a tool. Most students used MyIDP tool (<https://myidp.sciencecareers.org>), while other choices included a self SWOT Analysis (Addams, & Allred, 2013), use of the PhD competencies model (phdcompetencemodel.nl)

(Stouthard, & Cohen, 2016), an inhouse Career Goal Setting Tool, and Career Development Toolkit for Researchers (Jones). Mentoring and discussion of options with CHAMELEONS academic and non-academic partners was an additional optional step to facilitate decisions.

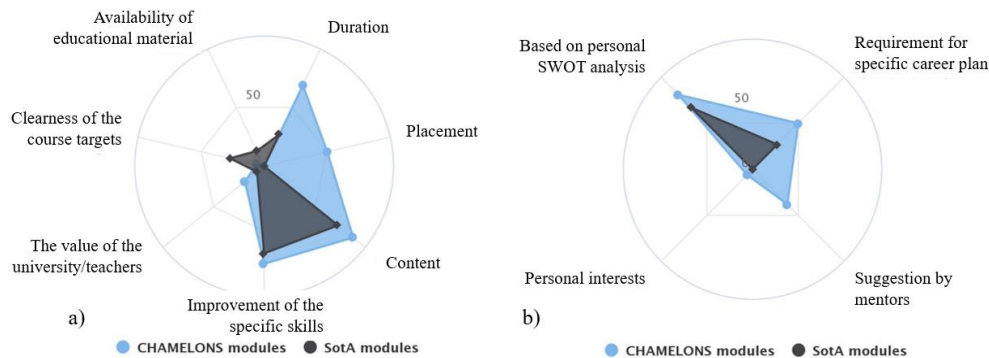
The underdeveloped skills identified belong to a wide range of skills, including mostly communication and creativity/innovation skills, and many others as business, presenting, research, teaching, time & project management, teamwork, data analysis and interpretation, and academic publishing skills. The courses from the Career Management and Business categories were identified by the students as the most interesting. The most popular course was 'Creative Thinking and Innovation', followed by 'Communication for Impact,' 'Creative Thinking & Problem Solving' and 'Design Thinking for Innovation'.

Table 1 With regards to their categorization, 9 of them belong to the Business category, while 5 are in Career Management and 2 are in Programming and Data Analysis. The most voted reason for selecting a course, by taking into consideration the attributes of the specific course, was the content of the course (14 selections), followed by the specific skills' improvement with 12 selections, the course duration and the placement collected 11 and 8 selections accordingly. On the other hand, attributes like the value of the institution, the clearness of the objective and the available material appeared less important Figure 3a.

Regarding the motivator to identify the underdeveloped skills that affected their choice on course, 13 selections were based on students' swot analysis, 8 made the selection because specific skills were required for their career plan, while for 6 of them it was suggested by their mentoring panel. Only one student considered personal interests as a motive Figure 3b.

Figure 3.

Comprehensive view of students' reasoning for their choices for course selection regarding (a) its attributes (b) and their motivation, for the courses provided by CHAMELEONS consortium members (blue) and by SotA toolkit (black). The values are expressed as percentage of students that answered the specific option.



The specific skills that students aim to improve by the courses that they selected belong to 3 categories, 31 in Communication, 22 in Information and 26 in Management skills, while no student considered that the selected course will improve Computer Use related skills. Although 2 courses in Programming and Data analysis were selected, students aim to achieve Information Management and computer skills. Figure 4 provides an intuitive way to depict these skills in detail, capturing which of them were the most popular. As observed, students are heading in two directions, one is more practical and focused on developing plans to solve problems and create new products, while the other is more personalized including skills as processing and presenting information or making decisions.

Figure 4.
Popularity of skills that students intend to acquire.

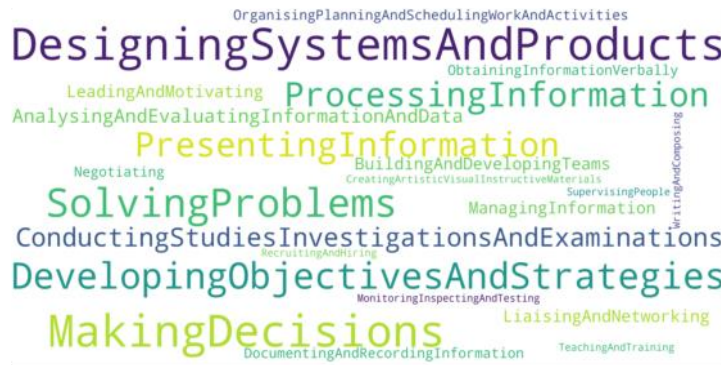
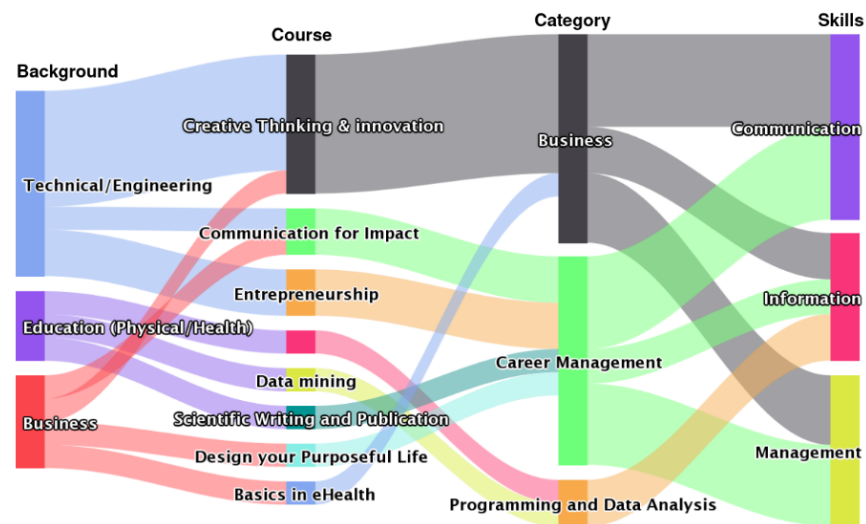


Figure 5 presents a comprehensive view about which course each student selected and from which category, in relation to their background and the skills they aim to acquire from attending the course. It is noticeable that students from a technical background are moving towards enhancing their business skills, while some of them, along with the students from a business background, are focusing on career management.

Figure 5.
Comprehensive view of student's choices and expectations. The four columns in the graph represent: (i) Background: the educational background of the student, (ii) Course: The course selected, (iii) Category; The category the course belongs to, as it was defined in the google classroom, (iv) Skills: the ESCO category in which the skill that the student aims to improve belong.



3.2. Students' Choices for Courses or educational material provided by online platforms

In total, 10 users answered the questionnaire, most of which (5) declared technical background (engineering/informatics), three had clinical background, one had expertise in business, and one in project management.

According to the results, the material included in the Career management category was studied more by the users (7 selections), highlighting their anxiety for their life after the completion of their studies. In addition, 5 students attended material related to “research and writing skills” while two users declared that they attended material related to programming and data analysis.

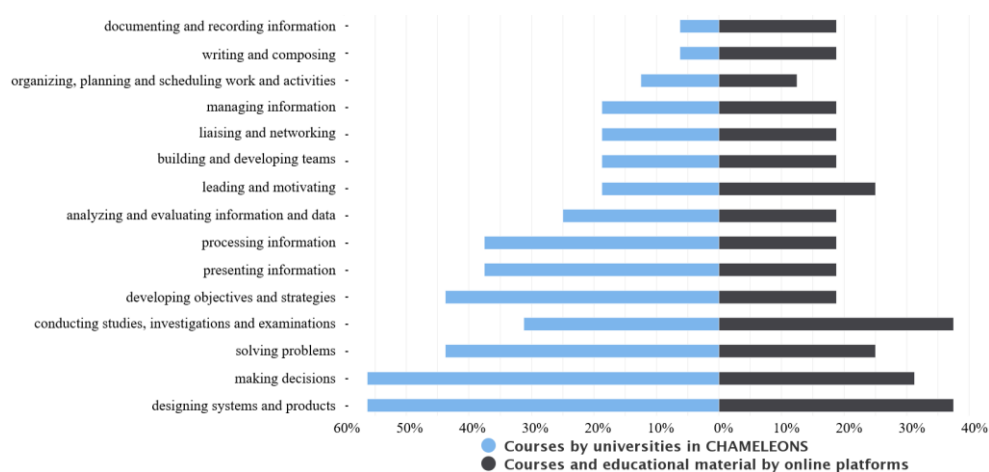
Regarding the motivation behind the attendance of the material, 8 students answered that the main motivation behind the selection of a material was that they had experience on the topic, but they wanted to improve the skills that were covered by the topic while 6 students reported that the personal improvement and career enhancement guide their actions. In addition, the fact that they wanted to improve underdeveloped soft skills was mentioned by three users, while the duration of the material was also mentioned by 2 users.

In addition, most of the users (7) answered that under these circumstances they prefer the online material to be provided in the form of online courses, 6 users answered that they prefer to study a book while three users (3) prefer to watch training videos.

From the analysis of the ESCO skills that were expected to be improved after the attendance of the courses through the SotA toolkit (

Figure 6), it was found that design thinking is the most targeted skill followed by the conduction of studies. Problem-solving and making decisions were also found to attract students' attention, similarly to the skills that are provided by CHAMELEONS consortium. Finally, the skills related to the processing and the presentation of information are also important for the students.

Figure 6. Comparison of the main ESCO skills that are expected to be improved by selecting material provided by online platforms (black) and from CHAMELEONS consortium (blue). The skills are ordered based on their cumulative popularity in both approaches of course provision. The results are presented as percentages of the number of courses attended.



As observed, the main skills that the users expected to improve with the material they selected to attend, are related to the design of systems and products and conducting studies, investigations and examinations, while skills closely related to project management, such as decision-making, problem-solving, leading and motivating, were also considered crucial.

3.3. Overall SotA toolkit evaluation

A positive evaluation of the SotA toolkit was revealed since the students responded that they found it interesting while in general it was stated that the toolkit meets users' expectations with 6 users answering positively to the question "*Do you envisage a role for the learning you experienced through the SoTA toolkit in your own PhD?*", three users answered maybe while only one answered negatively.

When the users were asked to provide more details on the role that the SotA is envisioned to play in their PhD studies, one student, coming from business background, stated that the toolkit "*gave me clear focus on how best to maximize my networking and ensure I can work effective in teams in academia and practice*". In addition, most students mentioned that the specific learning could impact users' career with one student from informatics area of expertise writing that "*Yes, it could help me gain knowledge and experience in fields that are related to my career*" or another from engineering background to answer that "*I think that every additional skill that a person is obtaining is useful*".

4. DISCUSSION

The self-assessment of student's needs, the identification of the underdeveloped skills and taking actions can be considered necessary steps for career development. ESCO classification aims to provide a clear definition of the skills and several frameworks have been developed to support candidates to understand their needs (Fernández-Sanz, Gómez-Pérez, & Castillo-Martínez, 2017). In the context of CHAMELEONS project, a SotA toolkit was developed to support PhD students to develop their skills, by providing information for courses or educational material in a condensed and detailed way. Two questionnaires were designed to capture students' needs and expectations.

Taking into consideration students' responses, most of them considered it essential to use a self-awareness/self-assessment tool to identify the skills that they need to improve and help them make their selection in this direction. This fact proves that students are aware that they need to improve some skills that are not included in the narrow curriculum of a Ph.D. program and are willing to investigate their deficiencies and take actions to improve their competence in these fields.

It is important also that students seem to look to the future, since they selected courses that do not actually improve a hard skill needed for their current research, but soft skills in the business and career management direction, focusing mostly on creativity, innovation, and communication. Only students coming from an educational background were interested in developing a more practical skill from the Programming and Data Analysis category. It is worth mentioning that students with Business background were mostly interested in career management opportunities, while students with a technical background focused mainly on the business field.

Moreover, students are willing to attain skills such as designing systems and products, developing objectives, strategies, and decision-making, and processing information, skills that are needed for building a successful career in every sector. Students need to develop a multitude of skills providing knowledge on a variety of fields and learning to overcome the

cognitive, normative, and regulatory barriers so they can be a part of the CH system (Leniston, & Mountford, 2021).

Regarding the complementarity between synchronous (f2f) courses and asynchronous online material it was found that in most cases the ESCO skills sought to be covered by both options. For example, designing systems and products skill was a preference for both synchronous and asynchronous. On the other hand, skills like documenting and composing information, or writing and composing were more linked to asynchronous training, potentially due to the offline effort required.

With regards to the skills that the students are expected to acquire, it was found that skills related to communication are the most mentioned skills

Figure

6.

Interestingly,

as mentioned by (Mantai, & Marrone, 2022), communication was the most desired skill mentioned in PhD advertisements that were posted in Euraxess (<https://euraxess.ec.europa.eu/>), after the Degree and Achievements. Additionally, the ESCO skills that were expected to be improved after the attendance of the courses are also closely related to the most frequent skills shown in PhD admissions across several European countries, such as communication, interpersonal skills, and personal attributes.

Finally, we need to highlight that, while the students that answered the questionnaires come from different disciplines and countries, the number of CHAMELEONS students that provided the data used in this work is small. The results described above provide a descriptive overview of the identified trends. The findings can guide further surveys in different universities and programs and more extensive research must be performed to quantify the results towards evidence representative of the whole PhD population in Europe.

5. CONCLUSION

To conclude, PhD students in the wider domain of CH Technologies (Chouvarda et al., 2019), appear to have a need for developing skills beyond their basic scientific education, while also deepening their knowledge within the PhD. These skills are related mostly to creative and innovative thinking to create new products and provide solutions to the public. These choices are made based on the perspective of developing a successful career plan and being competitive in the occupational arena, taking also into account that Digital Health requires innovative and robust solutions. This study offers evidence and insights that can form the basis for the enrichment of future PhD programs in Europe.

REFERENCES

- Addams, L., & Allred, A. T. (2013). "The first step in proactively managing students' careers: teaching self-swot analysis". *Academy of Educational Leadership Journal*, 17, 43–51.
- Bogle, D., Dron, M., Eggermont, J., & Willem van Henten, J. (2011). Doctoral Degrees Beyond 2010: Training Talented Researchers for Society. *Procedia - Social and Behavioral Sciences* 13, 35–49. <https://doi.org/10.1016/j.sbspro.2011.03.003>
- Bosch, G. (2018). Train PhD students to be thinkers not just specialists. *Nature*, 554(7692), 277. <https://doi.org/10.1038/d41586-018-01853-1>
- Caulfield, B. M., & Donnelly, S. C. (2013). What is connected health and why will it change your practice? *Qjm* 106(8), 703–707. <https://doi.org/10.1093/qjmed/hct114>
- Chouvarda, I., Mountford, N., Trajkovic, V., Loncar-Turukalo, T., & Cusack, T. (2019). Leveraging interdisciplinary education toward securing the future of connected health research in Europe: Qualitative study. *Journal of Medical Internet Research*, 21(11). <https://doi.org/10.2196/14020>

- Cui, Q., & Harshman, J. (2020). Qualitative Investigation to Identify the Knowledge and Skills That U.S.-Trained Doctoral Chemists Require in Typical Chemistry Positions. *Journal of Chemical Education*, 97(5), 1247–1255. <https://doi.org/10.1021/acs.jchemed.9b01027>
- European qualifications framework (EQF). (2018). Retrieved April 7, 2023, from <http://www.cedefop.europa.eu/en/events-and-projects/projects/european-qualifications-framework-eqf>
- Fernández-Sanz, L., Gómez-Pérez, J., & Castillo-Martínez, A. (2017). e-Skills Match: A framework for mapping and integrating the main skills, knowledge and competence standards and models for ICT occupations. *Computer Standards & Interfaces*, 51, 30–42. <https://doi.org/10.1016/j.csi.2016.11.004>
- Jones, C. (2023) Career Development Toolkit for Researchers. Retrieved April 7, 2023 from <https://www.jobs.ac.uk/media/pdf/careers/resources/career-development-toolkit-for-researchers.pdf>
- Kosvyra, A., Filos, D., Mountford, N., Cusack, T., Isomursu, M., & Chouvarda, I. (2021). PhD courses and the intersectoral experience: A comprehensive survey. *International Conference on Higher Education Advances*, 1131–1139. <https://doi.org/10.4995/HEAD21.2021.12978>
- Leniston, N., & Mountford, N. (2021). Born or made - Can interdisciplinary and intersectoral doctorate education create institutional entrepreneurs? A systematic review. *International Conference on Higher Education Advances*, 791–798. <https://doi.org/10.4995/HEAD21.2021.12960>
- Lieu Tran, T. B., Törngren, M., Nguyen, H. D., Paulen, R., Gleason, N. W., & Duong, T. H. (2019). Trends in preparing cyber-physical systems engineers. *Cyber-Physical Systems* 5(2), 65–91. <https://doi.org/10.1080/23335777.2019.1600034>
- Mantai, L., & Marrone, M. (2022). Identifying skills, qualifications, and attributes expected to do a PhD. *Studies in Higher Education*, 47(11), 2273–2286. <https://doi.org/10.1080/03075079.2022.2061444>
- MEMO/11/615 An EU strategy for modernising higher education – Questions and Answers (2011). Retrieved April 7, 2023, from https://ec.europa.eu/commission/presscorner/detail/en/MEMO_11_615
- Mountford, N., Zubiete, E. D., Kessie, T., Garcia-Zapirain, B., Nuño-Solinís, R., Coyle, D., et al. (2018). Activating Technology for Connected Health in Cancer: Protocol for a Research and Training Program. *JMIR Research Protocol*, 7(1), e14. <https://doi.org/10.2196/resprot.8900>
- Patricio, M. T., & Santos, P. (2019). Collaborative research projects in doctoral programs: a case study in Portugal. *Studies in Higher Education*, 45(11), 2311–2323. <https://doi.org/10.1080/03075079.2019.1607282>
- Relevant and high-quality higher education. (2023). Retrieved April 7, 2023, from <https://education.ec.europa.eu/education-levels/higher-education/relevant-and-high-quality-higher-education>.
- Roberts, A. G. (2018). Industry and PhD engagement programs: inspiring collaboration and driving knowledge exchange. *Perspectives: Policy and Practice in Higher Education*, 22(4), 115–123. <https://doi.org/10.1080/13603108.2018.1456492>
- Stouthard, M., & Cohen, A. (2016). PhD Competence Model. *Intrinsic Activity*, 4(1): A3.5. <https://doi.org/10.25006/IA.4.S1-A3.5>

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Chapter # 24

SCHOOL SOCIAL WORK INTERVENTION WITH STUDENTS AT SOCIO-EDUCATIONAL RISK: PRACTICES TO PROMOTE EQUITY IN TIMES OF COVID 19

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ABSTRACT

The Covid 19 pandemic, by electing distance learning, intensified the risks of dropout and failure of students with a more fragile relationship with the school, accentuating social inequalities and other inequalities and not allowing the multiplicity of their needs to be satisfied, in the sense of its integral development. The Portuguese government wanted to respond to the problems of absenteeism and school dropout, child poverty, intra-family violence, and mental illness, which were aggravated by the pandemic, giving guidance to managers, teachers, and technicians to reinvent the role of the school in times of physical distance, quarantine, and isolation. In this reinvention, the intervention strategies of the social workers were highlighted in the identification, and monitoring of risk/danger situations to which children and young people were subject and, in the articulation with the competent authorities and the community institutions, in promoting the right to education and social protection. Focusing on a qualitative approach, through interviews with social workers who are part of multidisciplinary teams in school clusters, in the metropolitan area of Porto in northern Portugal, we sought to know how they perceive their functions and professional practices, and their potential in making the right to education effective for combating inequalities.

Keywords: students at socio-educational risk, professional practices, school social workers, covid 19 pandemic, social inequalities, equity.

1. INTRODUCTION

Ensuring access to inclusive, quality, and equitable education and promoting lifelong learning opportunities for all, is an objective outlined by the UN for the sustainable development agenda 2016-2030 and which has been committed to the emergence and expansion of the Covid 19 pandemic. To mitigate the negative effects of the pandemic, on the realization of the right to education, educational policy measures were implemented that have required educational systems to pay special attention to the increase in social inequalities resulting from different learning conditions in the various social categories of students. Such teaching-learning conditions accentuated the differences in student performance resulting from factors related to social, economic, and cultural contexts. In this pandemic period, the risk of school dropout and failure, to which certain categories of students are subject, is associated with their family capital for learning, which leads these students to situations of greater school and social exclusion. Socio-economic, cultural, and personal conditions cannot prevent access to education and qualifications. Guaranteeing all children and young people the right to a quality education that fights social inequalities, that promotes inclusion and social justice, is the challenge of the educational system, namely to consolidate the school as a place that provides for all, without exception, opportunities to

learn, full integration into the school environment and the creation of conditions for personal fulfillment. Such educational measures sought to make the school promote the process of equity and school and social inclusion. Social justice is a guarantee that personal and social circumstances, such as socioeconomic status and ethnic origin, are not an obstacle to the development of educational and social inclusion potential as a guarantee of achieving a minimum level of skills for all, sufficient to the continuation of training in the sense of a satisfactory integration into society and the labor market, were seriously compromised in times of the Covid19 pandemic. All the more so since equity in education is a fundamental instrument of social equity and inequality in school results has social and economic costs: school failure and dropout increase the risk of unemployment, juvenile delinquency, and criminality. Equity is a central issue of education policies and is considered the condition through which individuals can take advantage of education and training, in terms of opportunities, access, attendance, and results. An education and training system is equitable when “its results are independent of socio-economic background and other factors leading to educational disadvantages” and when “attendance takes into account specific individual learning needs” (Lemos, 2013, p. 162). International studies that measure equity in education systems and that allow the collection of relevant information on student performance and teaching and learning contexts have concluded that, despite a significant improvement in education indicators, social inequalities persisted and, in the period of pandemic crisis, they increased (CNE, 2020). There is still no accurate and comprehensive assessment of the effects of the Covid-19 pandemic on education. But, as the report on the state of education (CNE, 2021) and the report on the National Commission for the Promotion of the Rights and Protection of Children and Young People) (CNPDPJCJ, 2021) advances, there is already a consensus, worldwide, that social inequalities have worsened, that the learning done by students was harmed, and that there was an increase in school dropout and failure. The closure of schools led to an unequal situation of access to technological equipment, the internet network, and digital training that allowed students from groups placed at a social disadvantage, even at a distance, to continue learning and maintain contact with their teachers and pairs. No less important is the reference to the low level of schooling achieved that the system allowed families to obtain, who did not have the knowledge or skills that would allow them to monitor their children's schooling, as well as the non-existence of conditions for access to food and other essential goods, namely health. Confined in often overcrowded housing, without living conditions and without a quiet space to study, children and young people had a significant increase in levels of anxiety and mood swings, as well as a greater number of conflicts and disagreements at home, signs of depression and irritability and feelings of loneliness. These factors had a major impact on the worsening of learning inequalities. Thus, following the guidelines of the ecological approach, in the pandemic period, it is necessary to pay special attention to factors related to different learning contexts: in particular, the family context and resources for families earning (family capital for learning) and the social composition of schools (Diogo, 2010). The well-being of children and families has become increasingly urgent, given the public health crisis and the resulting greater social inequalities that significantly affect vulnerable groups of the population in terms of access to education and social protection. In a comprehensive approach centered on the professional practices of school social workers, recreated in the period of the Covid 19 pandemic, it is our purpose to identify how the reinvented practices of these professionals allow them to mitigate social inequalities in the realization of the right to education and other human rights, guaranteeing conditions of equity and social justice, and to intervene in the socio-educational risk and danger to which children and young people were exposed.

2. ECOLOGICAL MODEL AND SCHOOL SOCIAL WORK INTERVENTION WITH STUDENTS AT SOCIO-EDUCATIONAL RISK

In a situation where children and young people are exposed to risk/danger of having their right to education and other human rights guaranteed, the school social worker should intervene with the child, the family, and, all the local entities present in their social care, in elaborate a social diagnosis and the respective intervention plan. This diagnostic assessment and the design and implementation of the intervention plan of school social work should be based on theoretical and methodological references such as The Assessment Framework for Children in Need and their Families - Ecological Model for Assessment and Intervention in Situations of Risk and Danger for Children, which adopts an ecological perspective, placing the child/young person and the family in their multiple social life contexts. The ecological views students as part of a larger system of interactions and relationships beyond selves (Bronfenbrenner, 1979; Siporin, 1980). This ecological approach allows school social workers to intervene at various levels of the "system" to address how the interactions of different contexts may be impacting student well-being (Clancy, 1995).

This model integrates four fundamental components: the process, the person (developing), the context (immediate or not), and time (Bronfenbrenner, 1979; Bronfenbrenner & Morris, 2006; Canhão, 2007):

- The first dimension is the process which involves the different forms of interaction that occur between the person and his/her environment (proximal process);

- The second component is the person and this dimension includes not only the person's biopsychological characteristics but also the characteristics developed/acquired based on interaction with the immediate environment(s). The characteristics of the person that influence proximal processes are dispositions, resources, and demands;

- The third dimension refers to context and encompasses the interaction between four different environmental levels or contexts: the microsystem, mesosystem, exosystem, and macrosystem. The microsystem, "is a pattern of activities, roles and interpersonal relationships experienced by the developing child/youth in a given environment with specific physical and material characteristics." (Bronfenbrenner, 1979, p. 18) Therefore, environments such as the home, daycare center, or school in which the child/youth is involved in face-to-face interactions are part of the microsystem. The mesosystem concerns the interrelations between two or more environments in which a child/youth actively participates, and can be formed or expanded whenever he becomes part of new environments. For example, this system includes the relationships a child maintains at home, at school, at the club, and with neighborhood friends. In an exosystem, unlike the mesosystem, the child/youth in development is not an active participant, but there may be events that affect them or vice versa, they may be affected by events in the immediate environment where the child is. These types of environments that consist of exosystems can be for example the parents' place, the sibling's school, or the parents' friends network. Finally, the macrosystem includes the cultural values, beliefs, situations, and historical events that define the community in which one lives and which may affect the remaining ecological systems. (Bronfenbrenner, 1979)

- The fourth dimension is time. Importance is attributed to the concept of chronosystem which encompasses changes or consistencies over time, not only in the characteristics of the person but also in the environment in which the person lives. For example, changes over a lifetime in family structure, socioeconomic status, employment, or where one lives.

In the intervention process, the social worker should analyze the needs of the child/youth - in education, health, emotional and behavior development, identity, family and

social relationships, social presentation, and autonomy capacity. The analysis should also focus on the respective capacity of parents/caregivers to respond to these needs, referring to basic care provision, safety, effectiveness, stimulation, the establishment of rules and limits and stability, and in family and ecological factors, namely family history and functioning, extended family, housing conditions, employment situation, family income, social integration of the family and existing community resources.

School social workers should therefore focus on the child/youth, on his/her developmental, protective and well-being needs, measured against his/her stage of development, but also against his/her school, training, and life project. As children are not only individuals with their bio-psychological specificity but also social beings who develop in the structural spaces they inhabit and are conditioned by, it is crucial to take into account their social class, ethnicity, gender, the local community they live in, etc. The development of children/young people has to be understood as a continuous and interdependent process of multiple factors (biological, psychological, social, and cultural), which influence each other, either positively or negatively, constituting protective or risk factors.

From a bio-ecological perspective, emotional, social, and cognitive development occurs through the complex process of interaction between the child/young person and the different microsystems in which he/she moves. This process occurs in a reciprocal and bidirectional way, in which the child exchanges with the elements (e.g. parents, teachers, and peers) that compose the microsystems.

These multiple contexts include characteristics related to the child, the family, and the school (peer group and teachers), that may constitute risk or protection factors. Risk factors are interpreted in terms of vulnerability and are often associated with a lack of adaptation. The protective factors or mechanisms are analyzed as risk mediators, as they allow modifying the individual's response to danger, thus reducing the possibility of negative development. Risk and/or protective factors interact with each other, by integrating the ecosystem of the developing person and may originate from different microsystems (e.g. family, school, peer group) that are not independent of each other, which necessarily implies in the intervention process, analyzing the links established between these different microsystems in which the child is involved and participates.

3. RESEARCH: METHODOLOGY, DESIGN, METHODS

The research work developed aimed to know the representations of social workers working in a school context about their professional practices and the reinvention of intervention in the context of a pandemic crisis. It fits into the qualitative research strategy and has given special focus to the words and speeches of social workers, in the construction of the subjective reality of social actors. The study had an exploratory character, constituting the first stage of more comprehensive, methodological, and territorial research, which is in progress. For data collection, a semi-structured interview was used with a script composed of six main themes (academic path; professional path; work developed as a social worker at school; social work and school mediation; intervention in a school context during the Covid 19 Pandemic; the role of the Social Worker in Schools). Given the impossibility of conducting the interviews in person due to the pandemic situation, and taking into account the availability of the interviewees, it was decided to send the interview guide by email. The interviews were conducted during the 2020/21 school year. Ten social workers who are part of multidisciplinary teams in School Groups in the Porto Metropolitan Area participated in the research. The sample was non-probabilistic, built intentionally and for convenience. We intentionally selected the sample because we already had contacts with social workers

who supervised the internship of students of the degree in social work, which made the process of collecting information faster and more operational, in times of a pandemic. We concluded conducting interviews when the information provided by school social workers added little or nothing to the material already obtained, not contributing significantly to the improvement of the reflection. To read the interviews, thematic content analysis was used. The answers to open questions allowed us to obtain the perceptions of social workers on the effects of the Covid 19 pandemic on their professional practices. These raw data were subject to the categorization process by us. To this end, we cut the text of the responses into comparable categorization recording units for thematic analysis. Coding is the process by which raw data are systematically transformed and aggregated into units, which allow for an accurate description of relevant content characteristics. We chose, as categories, the themes that we consider to be our registration units, that is, the unit of meaning to be coded and which corresponds to the content segment to be considered as a base unit, aiming at categorization. To define the categories, we used the context units that serve as comprehend units to encode record units and correspond to the message segment, whose dimensions are optimal so that the exact meaning of the recording unit can be understood. It should also be noted that the definition of the categories was carried out in a mixed way, in which part of the categories is derived from theory and another part is induced during the course of the analysis. To understand the work of social workers, a content analysis of legal documents was also carried out, which enunciated emergency measures in the context of education and the action of these specialized technicians in the school context.

4. DISCUSSION: THE PROFESSIONAL PRACTICES OF SCHOOL SOCIAL WORKERS IN SOCIO-EDUCATIONAL RISK IN TIMES OF COVID 19

As previously mentioned, ten social workers participated in the research, who are integrated into clusters of schools in the Porto metropolitan area and have professional experience mostly for more than 10 years. However, as professionals integrated into the school context performing functions in the area of Social Work, the experience of fewer than 10 years predominated. With two exceptions, the others joined the school through public measures to promote educational success: Educational Territories of Priority Intervention (TEIP); Integrated and Innovative Plan to Combat School Failure (PICIE); National Program for Promoting School Success (PNPSE). In addition to their basic training in Social Work, most of the interviewees had specific training, either at post-graduate or Master's level, in the area of childhood (e.g. Sociology of Childhood), intervention with children and young people (e.g. Social Intervention in Children and Youth at Risk of Exclusion) or mediation (e.g. Family Mediation).

From the analysis of the interviews, for this article, we highlight the theme of professional practices and the reinvention of intervention in the context of pandemic crises.

In this line, it was important to know not only what challenges the interviewees faced in the performance of their professional activity, but also what strategies they developed to overcome them (see figures 1 and figure 2). To learn about the changes in their professional practices during the pandemic, we asked the following questions:

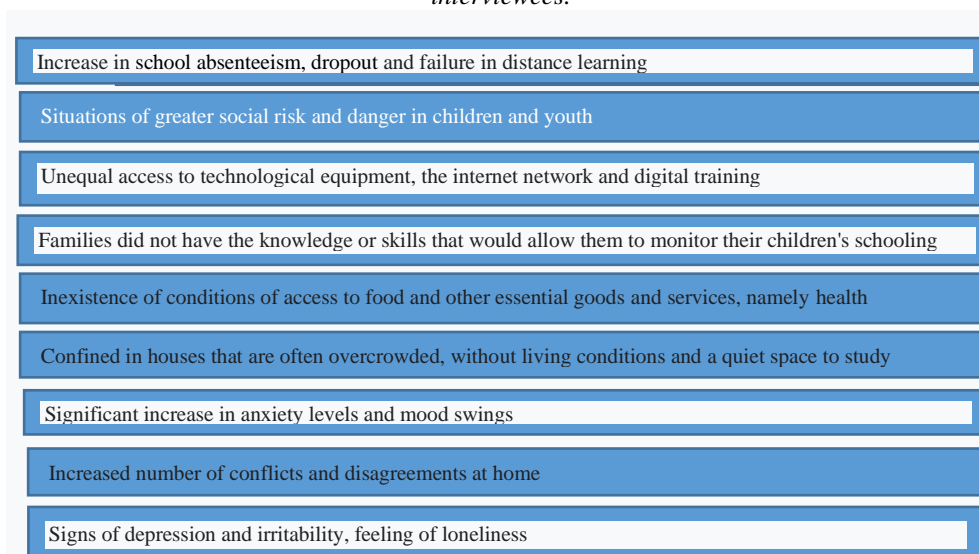
- How do you define the intervention of Social Work in schools in times of a pandemic?
- What has changed in intervention in times of a pandemic?

In times of a pandemic, psychosocial support for students and families has become even more central in the work of social workers. This individualized intervention with students and families followed an intervention procedure consisting of the following phases: signage;

diagnostic evaluation; intervention planning; social follow-the-up, which involves establishing an intervention agreement and negotiating and monitoring it; and evaluation.

The diagnostic evaluation identified the following problems (see figure 1):

*Figure 1.
Effects of COVID-19 on education and other rights: problems identified by the interviewees.*



First of all, their confinement forced students to use technology to carry out the follow-ups, i.e. the intervention started to be done at a distance through digital platforms and telephone contact. But home visits were necessary, and the reception of children and young people at risk/danger at the school was important (see figure 2).

“As we know, on March 13, 2020, schools close until September 2020 and the work on the ground was at serious risk of being compromised. However, this did not happen”. (Int. 1, a social worker for 13 years)

“The social worker continued to provide psychosocial support to students and families through the TEAMS Platform or over the phone. The technologies made it possible to continue with the contact and proximity with the families, but some constraints were evident as not all students were able to talk about their problems from a distance”. (Int. 2, a social worker for 8 years).

In situations of greater social risk, all maintained the field work with students and families through, mostly, home visits. But the most substantive change was related, above all, to a reorientation of action: the closure of schools has forced a greater focus on situations of risk of absenteeism and school dropout. The school as a first-line entity plays an important role in preventive and protective intervention in situations of risk and danger.

“The secondary school, the headquarters of the group, now welcomes students from all schools in the same area who are unable to follow virtual teaching at home, because their parents are essential workers, or because they do not have the material conditions, or because are at risk or in danger, among other reasons. Some of them are students who

have no interest in classes, which has become worse with distance learning. These are students who do not carry out the tasks given by the teachers and who are undisciplined”. (Int. 7, a social worker for 22 years).

Social workers have played an important role in their psychosocial follow-up. It was the principals, teachers, and families themselves who asked for the intervention of the social worker.

“It only confirmed once again the essential role of the social worker with students and families, as they were the ones who sought help from the technician”. (Int. 9, a social worker for 18 years)

“The signals came mostly not from the class directors but from the families themselves who contacted the GAAF social worker directly”. (Int. 2, a social worker for 8 years)

“Requests for support from families increased, so responses had to improve and increase. In times of a pandemic, in a school context, intervention requires a non-conformist and creative attitude”. (Int.10, a social worker for 3 years).

Figure 2.
Knowledge, skills, and acts of professional activity of social workers who intervene at school.

<p>Interactive relationships: active listening, empathy, neutrality, and impartiality.</p>	<p>Act of relationship building Alternative and more personalized forms of articulation between school, students, a family</p>	<p>“There was a strengthening of communication with families”. (Int. 4, a social worker for 13 years) “The intervention of Social Work always excelled at proximity to those with whom it works. Social work in schools has two factors that I consider highly positive, proximity and direct contact with the context. We project our eyes onto others. Therefore, it has been possible to carry out the intervention, transmitting confidence to those with whom one works, feeling that they are not alone”. (Int. 1, a social worker for 13 years)</p>
<p>Professional mediations and articulations”: permanent institutional interaction; mediation between services and citizens</p>	<p>Act of informing Mediations and articulations with directors, teachers, and specialized technicians - collaborating with the entire social network - partnerships with local community entities: CPCJ, EMAT, Municipalities, ISS, IPSS</p>	<p>“Social work in times of a pandemic is possible because relationships have already been established, intervention networks have been built, partnerships have been established, relationships have been created in the community”. (Int. 1, a social worker for 13 years) “A reinvention was necessary with working and the research of different social responses capable of responding to the demands and difficulties that occur with the pandemic that we are experiencing.” (Int.3, social worker for 14 years) “Despite the physical distance, I believe that the pandemic brought the technicians closer to each other, which led to an effective articulation of the different needs of each family. That is, the pandemic allows organizations to work effectively in a network to leverage different resources and thus better serve the needs of each family accompanied. (Int.1, social worker for 13 years) “Advice to class directors.” (Int. 4, social worker for 13 years)</p>

<p>Know the social phenomena: understand the situations of people, families, and groups; the environmental factors that condition and influence them</p>	<p>Problem definition act Knowledge of the rules and social and family contexts that condition the performance of students in school spaces</p>	<p><i>“The social worker has to be able to know the different life contexts of students and families. He must know very well the rules that regulate his school grouping, know the intermediate and superior leadership, but he must also know and characterize the social and family contexts that condition the performance of students in school spaces.” (Int. 4, social worker for 13 years)</i></p>
<p>Methods and techniques for planning and organizing resources and providing psychosocial care and development of citizens' living conditions</p>	<p>Professional act of help Psychosocial support and social monitoring of students' families - plan and organize resources so they are available to support distance learning methodologies, the dissemination of diversified support documents, to support situations of privation and poverty through some work to meet basic needs, particularly at the food level, and to make the follow-up of children and young people at risk/danger</p>	<p><i>“The social worker proved to be essential to keep students in contact with the school. Using all the surrounding means and collaborating with the entire social network, barriers and constraints that prevented access to education were broken”. (Int. 4, a social worker for 13 years)</i></p> <p><i>“Social work at school is very important during the pandemic, especially during the suspension of teaching activities, as it allowed students and families to be monitored to different needs (school, social, and family). The social worker maintained an essential function with regard about served by the group's canteens. Daily, he contacted class directors, guardians, and students, via email and by telephone, also communicating daily to the Director of the School Grouping, the update of the number of cases for school lunches.” (Int. 2, social worker for 8 years)</i></p> <p><i>“As there was an increase in the needs felt by many families in terms of food, the GAAF proposed a more comprehensive measure to the direction of the Grouping, which was not limited to responding only to students with grade A. The response was positive, which is why, with the collaboration of the management, the GAAF social worker also flagged and monitored cases for school reinforcement, similar to what was already established before the period of distance learning”. (Int. 2, social worker for 8 years)</i></p> <p><i>“To intervene with students who have problems at school, social, family and relational level; intervene with the respective families and promote parental training”. (Ent. 5, social work for 21 years)</i></p>

Source: Adapted from Granja, 2011

In Portugal, of the 41337 dangerous situations reported in 2020 to CPCJ, 6232 are related to the non-fulfillment of the right to education: the highest values relate to reports of school absenteeism, with 60% of the situations reported, followed by school dropout (30%). The intervention to combat absenteeism and school dropout was carried out by social workers to support children in need and with resources to keep up with distance learning, and also to support situations of privation and poverty through some work to meet basic needs, particularly at the food level.

Thus, in the context of the crisis intervention, the efforts made by schools to ensure the continuity of learning and minimize the effects of social inequalities were perceptible. There was the reinforcement of intervention by social work technicians and other specialized technicians in social monitoring of children and young people and their families, the reception of children and young people at school, the provision of meals, the availability of resources to support distance learning methodologies, the dissemination of diversified support documents and alternative and more personalized forms of articulation between school and family. In addition to the realization of the right to education, the pandemic has

made it clear that the school is an important space for the promotion of the personal, social and emotional well-being of children and young people, and that special attention must be paid to the most vulnerable students, to provide the necessary conditions for their safety, training, education, well-being, and full development.

The pandemic brought a worsening of social inequalities that, in turn, became more visible and affected more students and families. The most vulnerable were the most affected, becoming even more vulnerable, and this implied the implementation of monitoring and evaluation responses in an educational ecosystem that involved the various actors, and among them, the specialized technicians of the multidisciplinary teams, so that inclusion and social justice could continue to be developed and guaranteed. It was also very clear that the effectiveness of educational measures implies intervention in other social, economic and cultural areas, to promote skills and qualifications and improve conditions of children and young people and their families. These measures implemented in a pandemic period increased during the growing emphasis on ecological systems theory and related practice models.

Social workers identify risk and protective factors affecting students that are understood to be part of a system of interactions and relationships beyond individual beings, and systems theory requires school social workers to intervene at various levels of the "system" (e.g., microsystem, mesosystem, and macrosystem) to address how the interactions of these different systems can affect a student's relationship with the school and school knowledge. Placing the child/young in their multiple social life contexts, the school social worker should intervene in the elaboration of a social diagnosis and the respective intervention plan which should consider three main domains: the child's developmental needs, the parental competencies, and the family and ecological factors, and should analyze the reciprocal interaction between the three domains and how they influence each other. Ecological theory suggests that practice be carried out from a more ecological system's structure (Frey & Dupper, 2005; Frey, Lingo, & Nelson, 2008; Kelly, 2008). Contemporary school social work practice reflects the growing emphasis on ecological systems theory and related models of practice. The focus of practical activities of social workers should be environmental and not merely individual and the level of their intervention should be primary prevention and not just secondary and tertiary prevention (Kelly, Berzin & Frey, 2010). In school social work the emphasis on interventions that focus on change at the child level is inconsistent with an intervention with the ecological framework or with the person in the environment (Alderson, 1972; Allen-Meares, 2006; Costin, 1973; Dupper, 2002; Frey & Dupper, 2005). The focus should broaden to address conditions within the classroom, school, family, and community contexts, as well as interactions between school stakeholders and community service providers. The Alderson (1972) and Costin (1973) models pioneered research on intervention effectiveness by validating this approach, while the Frey and Dupper (2005) model drew largely on this knowledge. New, emerging, and more comprehensive programs and strategies targeting other systems such as the peer group and the school are evolving. The ecosystem perspective argues that the problem or need, rather than individual risk factors, should be centered on those related to peer, school, family, or community systems (Butcher, Kelly, & Frey, 2010)

The intervention that the social worker developed in times of a pandemic, was focused on students and families, always taking into account their biopsychosocial and cultural whole. The ecological perspective postulates that students and families and their environment must be understood in the context of their mutual relationship. This relationship is characterized by continuous reciprocal exchanges, whereby students and families, and environments are constantly influencing each other. An ecological perspective provides

a framework for understanding the nature of transactions between people and different institutions and/or systems. This perspective helps the social worker to identify and take into account all the systems that contribute to the situation of students and families and the existing difficulties. Thus, social workers understood each student as an inseparable part of the various social systems (i.e., school, home, neighborhood, peer group) in which he moves (Dupper, 2002, p. 5). Furthermore, it recognizes that resolution can be more effective when the intervention takes place in more than one system. In social work, schools have worked to create increased calls by school social work scholars to think and practice from a more ecological systems framework within their schools (Dupper, 2002; Frey & Dupper, 2005; Frey, Lingo, & Nelson, 2008; Kelly, 2008). In educational practice in times of pandemic, specialized technicians from the school and local teams, teachers, and parents must maintain effective communication and work together to benefit the development of children and young people. Teachers must also understand the situations that their students' families are experiencing, including knowledge of the social and economic factors that are part of the various systems that affect them and that can put children and young people at risk/danger. According to the ecological approach, if parents and school professionals have a close relationship and effective communication, this should shape the development of the child and youth in a positive way. In positive relationships and communication processes, social workers, having cultural competence played a key role during the pandemic time.

This orientation for intervention anchored in the ecological approach is used by social workers in making the diagnostic assessment and defining and implementing social intervention plans, which always consider the child and young person and their families in transformation, their changing context, and mutual influence reciprocally. We must analyze and reflect on the various phases of the intervention process in the context of social accompaniment, as mentioned by the interviewees.

In practice these phases are confused and often appear simultaneously, although here they are presented sequentially (see figure 3):

- The request, as most of the referrals are made by teachers, especially by class principals and head teachers, leaders, local partners, the team of specialized technicians, educational assistants, families, peers, students themselves, and the Social Worker herself who ends up identifying situations through informal contacts established with students in various activities at school. Thus, the implementation of activities in which he has direct contact with students can make him a signaling agent;

- After the request, the social worker in conjunction with other technicians and teachers diagnoses the situation. Social diagnostic assessment is the process of gathering and processing information to identify the full development needs of children and young people, the problems and their causalities, but also the potentialities to be developed in the social intervention plan. Identify problems and needs in the school, socio-family, and individual domains, which facilitates knowledge of the ecological context and the identification of protection and risk factors for each child and young person flagged. It should make it possible to verify the assumptions of integration, identify school capacities and interests and identify local resources likely to form partnerships within the scope of the intervention. The diagnosis is the basis for defining an intervention plan, appropriate to the problems and needs identified and the existing resources, which should be built together with students and families who should commit to the actions to be developed, committing to change;

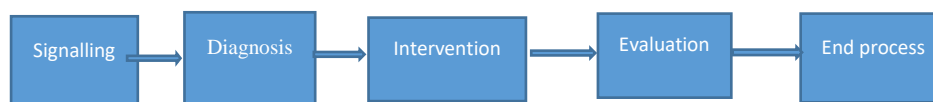
- Following the principles of the construction process of the helping relationship, the social worker does the monitoring at the individual, socio-family, and school levels, articulating information and intervention from local public administration services and civil society partners, that support and accompany students at risk of social exclusion and their

families, promoting activities that guarantee the integration of each child or young person in the school and the local community. That is, the follow-up, to support the student and the family in the actions and check what has been defined is effectively being carried out. Such monitoring should involve several players in the educational community who should be attentive and available to collaborate. Based on the diagnosis, the process of social intervention presupposes a negotiation where the process and the social worker assume the role of mediator between institutions and actors to act in the various social factors that influence the intervention in the school system and with the students and their families, developing close monitoring through regular contact with the students and strategies to approach the families, calling them for appointments, making phone calls and home visits;

- The evaluation of the intervention process should be systematic and continuous, to review, whenever necessary, the diagnoses and expected results in the implementation of the action plan. This allows us not only to know the results and effects of intervention but also to correct trajectories if they are undesirable;

- To end the process, the ideal will be closure because the child, youth, and family have reached the established goals and have become autonomous. However, it can occur on the initiative of the targets themselves, by referral to another institution, or for different reasons.

Figure 3.
Stages of intervention process of social workers.



According to the school social workers, the absence of parental and family support is a risk factor for children/young people already exposed to other risk factors, such as low economic, social, and cultural resources. During the pandemic period, children/young people at risk had no parental involvement or support in school and out-of-school activities, and were subject to the absence or reduced support and monitoring of school tasks, lack of openness to communication about the school, learning, and other themes, absence or lack of family activities and low expectations regarding school success. These are children who, during the pandemic period, had relationship problems with teachers and peers who often gave them even more negative feedback regarding their performance as students, becoming a precursor factor for their disaffection with school and their school dropout.

It is also important, according to the school social workers, to highlight the relevant role that the school has, as an institution whose purpose is to promote learning and, ultimately, the student's success, with a view to the student's integration into society. The pandemic period accentuated the negative and distant relationship of the school towards these students. Although being monitored by the school, the absence of effective support and the teachers' low expectations towards these students, contribute to low school performance. The importance of the relationship with the peer group, colleagues, and friends, who are important agents of socialization, is also highlighted. It is necessary to consider their degree of motivation toward learning and the type of pedagogy toward playful activities they develop.

These risk factors do not occur in isolation, but simultaneously, forming chain reactions of events that increase the likelihood of the child achieving negative outcomes, including failure and dropping out of school and other types of risk.

This theoretical proposal is fundamental for those social workers to understand the development of children/young people through the interdependence of multiple processes,

i.e., through the analysis of systems of interaction between individuals and the different environments in which they move throughout time, of continuities and social changes throughout time, through the life course and the historical period.

When this analysis is made one realizes that risk/danger are the consequence of social organization modes generating inequalities, with repercussions on the different operational groups, and with more repercussive and continuous individual and generational effects regarding children and the childhood/youth generational group who are left in a situation of poverty and social exclusion.

In this way, technical intervention in situations of risk and danger aims not only at eliminating or minimizing these situations, but also at promoting the access of children people, and families to a set of goods and services of an educational, economic, health, social, environmental and technological nature, in a true perspective of inclusion, equal opportunities, and citizenship.

This will only be possible because that social worker relies on real teamwork and partnership with other professionals at the school and with professionals from institutions who accompany the child/young and the family, through an interdisciplinary and inter-institutional approach in the diagnostic evaluation of the situation and the respective intervention project. The importance of a collaborative perspective between the various services and institutions, professionals, and disciplinary knowledge is thus lighted, starting from the case coordination by an entity/professional, to make the best use of resources overlapping responses and to find non-fragmented responses.

The intervention practices of those social workers should rethink the relationship between school and family and develop in this educational institution a space for reflection on the role each one of these elements has in meeting the multiple needs, of the student's well-being and academic performance student's promoting a closer relationship between school and family, with the ultimate purpose of providing children/young people with better conditions to achieve success at school and protection at different levels. It should also be noted that these family-centered intervention practices, besides the identification of their needs and problems, should elect to locate formal and informal resources and empower families to mobilize them. Direct intervention with families should be carried out so that there is active participation of these families in the assessment of the situation and the intervention plan so that they feel respected, valued, and involved. It should also involve the child/young person in the whole process, in a systematic and organized way, based on his/her needs, wishes, and participatory skills. All families have positive factors which should always be the starting point for any intervention. Diagnostic assessment is therefore not just a 'problem list', but rather the identification of protective and risk factors, needs, and concerns in the various contexts relevant to the child's development.

It was possible to understand that the risk or danger to which children and young people were subjected, results from the interaction that occurs between the different elements that make up the different systems and the accumulation of factors such as lack of parental support, lack of social support, low educational level and unemployment of parents, lack or insufficient participation and involvement of parents in the personal and school development of their children, schools in poor neighborhoods, etc. These factors are directly related. The family context and in particular their socio-economic and cultural status exerts its action on the child's well-being and school achievement. The Covid 19 pandemic caused increased exposure to certain conditions or risk factors in the family microsystem that increased the likelihood of the child or youth experiencing social, emotional, or physical problems.

However, the interviewees did not forget that the risk factors for school failure are also in the school context. Regarding school, it should be noted the experiences lived by children

and young people in the interaction with the different elements that make up this school context, namely teachers and peers, the relationship, support, and expectations of teachers, and the relationship/support of peers, their level of motivation towards learning and the type of recreational/pedagogical activities developed, etc. The articulation of the family with the school and the school with the entities of the promotion and protection system for children at risk/danger, such as the CPCJ, is essential in the individualized response to be built for each case of risk/danger. Mobilizing the data from the National Commission for Protection and Promotion, there has been less visibility and increasing complexity in the access to children, youth, and their families in the community at the beginning of the pandemic. In several cases, the action of the schools' multidisciplinary teams is highlighted in the support and social monitoring of children and youth at risk/in danger, which allowed the local CPCJ to overcome any difficulties. When CPCJ did not even make home visits, the schools' social workers made home visits that served to understand what was going on, why they were not attending classes 'online', and why parents did not answer the phones and did not respond to emails sent.

5. CONCLUSIONS

The pandemic context experienced since 2020 came, suddenly and unexpectedly, to confront social workers with new challenges in the work they develop in schools. When everyone is confined, how can we guarantee the necessary support for students at socio-educational risk/danger? Confinement and the need for physical distancing, therefore, required a reinvention of performance. In this line, it was important to know not only what challenges the interviewees faced in the performance of their professional activity, but also the strategies developed to overcome them. From the outset, the confinement forced the use of technologies to carry out follow-ups, that is, the intervention began to be carried out at a distance through digital platforms and telephone contact. However, in situations of greater social risk, fieldwork was maintained with students and families through home visits, above all, a reorientation of action: the closure of schools forced a greater focus on situations of socio-educational risk, namely through support for children in need and without resources to accompany distance learning, and also in supporting situations of need and poverty to satisfy basic needs, particularly in terms of food. Also highlighted in the speeches was the work with children and young people at risk/danger, carrying out their psychosocial follow-up in the host schools in close articulation with the institutions in the area of promotion and protection (Commission for the Protection of Children and Young People and Multidisciplinary Teams for the Support of Courts, in particular) and social support (municipalities and Private Institutions of Social Solidarity).

Improving relationships and communication between the various actors on the educational scene, implementing the role of mediator, is possible because the social worker in the school context is specialized in making social diagnoses and intervention plans focused on the child/young person who is the student, that is in continuous interaction with its environments. At the methodological level, it is the social diagnosis that will underpin the entire intervention plan at the level of psychosocial support focused on the child/youth who is the student, in the group, in the family, in the local community, and in the school. It is the professional with knowledge and skills to understand and work with what is in the school organization and "on the other side of the school". It is the child and the young person who are at the center of their intervention, understood in their uniqueness, getting to know them at school and also in what is on the other side of the school. The social worker has the knowledge and skills to understand the social reality, identify the needs and problems that

affect children and young people, as well as their causalities, and define pertinent paths of intervention. With an integral look, the social worker perceives the multiplicity of development needs of the child/youth. Is a professional who allows the school to understand the environment where each student is inserted, and share it with other specialized technicians and with teachers. To this end, it is crucial to carry out a social diagnosis capable of grasping the complexity and multidimensionality of the problems affecting children and young people, their families, and local communities, highlighting the diversity of factors that lie at their genesis. Furthermore, the social worker knows and can mobilize the local community's resources better respond to the multiple needs of children/youth, families, territories, and the school organization, and, because she/he uses the potential of networking, she/he designs and implements intervention projects in partnership with various entities of the municipal social network and the local social action commissions of the parishes. The local development projects in which they operate, the articulation with different services in the fields of promotion and protection of minors, social action, employment, and health, and the participation in working groups are just examples of the various responsibilities assumed by social workers in their daily professional life in a work of opening the school to families and the local community.

REFERENCES

- Alderson, J. J. (1972). Models of school social work practice. In R. Sarri & F. Maple (Eds.), *The school in the community* (pp. 151–160). Washington, DC: NASW. <https://doi.org/10.1093/acrefore/9780199975839.013.351>
- Allen-Meares, P. (2006). One Hundred Years: A Historical Analysis of Social Work Services in Schools. *School Social Work Journal, Special Issue, 30*, 24–43. <http://dx.doi.org/10.3989/arbor.2015.771n1003>
- Butcher, A. Kelly, M., & Frey, A. (2010) School Social Work Practice: Future Directions Based on Present Conditions. *Children & Schools, 32*(4), 195-199. <https://doi.org/10.1093/cs/32.4.195>.
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press.
- Bronfenbrenner, U., & Morris, P. (2006). The Bioecological Model of Human Development. In R. Lerner & W. Damon (Eds.), *Handbook of child psychology: Theoretical models of human development* (pp. 793–828). John Wiley & Sons Inc.
- Canhão, A. M. (2007) Modelo Ecológico de Avaliação e Intervenção nas situações de Risco e Perigo para a Infância. [Ecological Model of Assessment and Intervention in situations of Risk and Danger for Children]. *Revista Pretextos*. nº 28, 10-12.
- Clancy, J. (1995). Ecological school social work: The reality and the vision. *Social Work in Education, 17*(1), 40–47.
- Comissão Nacional de Promoção dos Direitos e Proteção das Crianças e Jovens. (CNPDPJC) (2021) *Relatório Anual de Avaliação da Atividade das CPCJ 2020*. [CPCJ Activity Evaluation Annual Report 2020]. Retrieved from <https://www.cnpdpjc.gov.pt>
- Conselho Nacional de Educação (2020) *Desempenho e Equidade: uma análise comparada a partir dos estudos internacionais TIMSS e PIRLS* [Performance and Equity: a comparative analysis based on international studies TIMSS e PIRLS]. Retrieved from <https://www.cnedu.pt/pt/noticias/cne/1572-analise-timss-pirls>
- Conselho Nacional de Educação (2021) *Efeitos da pandemia COVID-19 na educação: Desigualdades e medidas de equidade*. [Effects of the COVID-19 pandemic on education: Inequalities and equity measures]. Retrieved from https://www.cnedu.pt/content/noticias/estudos/Estudo_AssembleiaRepublica
- Costin, L. B. (1973). School social work practice: A new model. *Social Work, 20*(2), 135–139.

- Diogo, A. (2010). Estratégias de famílias e escolas [Family and school strategies]. *Sociologia: Revista do Departamento de Sociologia da FLUP*, Vol. XX, 425-442
- Dupper, D. R. (2002). *School social work: Skills and interventions for effective practice*. Hoboken, NJ: Wiley.
- Frey, A. J., Lingo, A., & Nelson, C. M. (2008). Positive behavior support: A call for leadership. *Children & Schools*, 30(1), 5–14. <https://doi.org/10.1093/cs/30.1.5>
- Frey, A. J., & Dupper, D. R. (2005). A broader conceptual approach to clinical practice for the 21st Century. *Children & Schools*, 27(1), 33–44. <https://doi.org/10.1093/cs/27.1.33>
- Granja, B. (2011) A Competência Reflexiva Processual em Serviço Social na Ação Profissional Junto às Populações. [Procedural Reflective Competence in Social Work in Professional Action with Populations]. *Cadernos de Pesquisa*, 41, 143, maio/agosto.
- Kelly, M. S. (2008). *The Domains and Demands of School Social Work Practice: A Guide to Working Effectively with Students, Families, and Schools*. New York: Oxford University Press.
- Kelly, M. S., Berzin, S., Frey, A. J., Alvarez, M., Shaffer, G., & O'Brien, K. (2010) The State of School Social Work: Findings from the National School Social Work Survey, Springer Science Business Media, LLC; *School Mental Health* 2, 132–141. <https://doi.org/10.1093/sw/swv044>
- Kelly, M. S., Thompson, A- M., Frey. A., Klemp, H., Alvarez, M., & Berzin, S. C. (2015) The State of School Social Work: Revisited. *School Mental Health*, 7, 174-183. <https://doi.org/10.1007/s12310-015-9149-9>
- Lemos, V. (2013). Políticas públicas de Educação. Equidade e sucesso escolar. [Education public policies. Equity and school success]. *Sociologia, Problemas e Práticas*, [Online], 73, 151-169. <https://doi.org/10.7458/SPP2013732812>
- Siporin, M. (1980). Ecological systems theory in social work. *Journal of Sociology and Social Welfare*, 7(4), 507–532.

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Chapter # 25

USES OF ARTIFICIAL INTELLIGENCE IN INTELLIGENT TUTORING SYSTEM

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ABSTRACT

This article aims to present the operation of an Intelligent Tutoring System exploiting artificial intelligence to personalize the learning of the learner and to automate certain tasks of the teacher. All the resources consulted and the educational objectives achieved by the learner will be processed using the TinCan API and the limitation of the amount of sensitive data sent to the cloud will be ensured by the use of peripheral artificial intelligence. We start by defining the concepts of artificial intelligence and Intelligent Tutoring System, then we focus on the implementation of machine learning in such a system and the advantages that this technique brings. Finally, we describe the limits of such a technology and the possible solutions to it.

Keywords: intelligent tutoring system, edge computing, Artificial Intelligence, pedagogical resources, semantic technologies.

1. INTRODUCTION

For several years, the increase in the volume of data produced and progress in understanding the human brain have enabled engineers to create machines capable of simulating certain aspects of human intelligence. One of these aspects, the simulation of learning, has allowed the birth of machines capable of perceiving, learning and optimizing: this is machine learning, also called artificial intelligence (Hofstadter, 1979). This technological evolution is perceived as a disruptive innovation that will upset our society, due to its possibility of interacting and helping humans in high-level tasks. However, the appearance of a powerful tool for processing information does not induce profound changes in learning practices: the practices of teachers and learners must evolve in order to use technology in an optimal in view of the targeted objectives (Dai et al., 2020). This tool, which is extremely powerful in certain tasks, however comes up against limits intrinsic to human intelligence such as its ability to adapt to the unexpected or its ability to generalize from an extremely small set of data: it can therefore not replace human decision-making capacity and must remain a tool. Loeckx (2016) maintains that artificial intelligence can prove to be an effective device for learning through its ability to personalize the learner's learning experience but also through the possibilities of automating tasks and summary of the results for the teacher. The increase in resources available online, the democratization of online learning and the development of this technology have allowed the development of tools allowing the construction of personalized learning environments: the Intelligent Tutoring System (ITS). These systems make it possible to personalize the learning on several axes such as the follow-up of the evolution of the learner and the achievement of his objectives, the adaptation of the educational resources proposed according to his style of learning or even the generation of personalized feedback in different formats (e.g., alerts,

graphs, report). Some fear full automation of the teacher's role, but numerous studies show that human intervention cannot be completely replaced. On the other hand, IA and ITS will change the existing pedagogical relationship between knowledge, teacher and learner by adding an aspect of mediation between these entities, leading de facto to profound organizational changes in traditional teaching, both in terms of teaching and student practices: while teachers will see their roles and practices evolve, students will have to learn how to make optimal use of AI to enhance their learning outcomes (Seldon & Abidoeye, 2018). However, it will be necessary to ensure that students are educated on the use of such a tool, because even if the mathematical concepts underlying AI begin to be integrated into school curricula, a poor understanding of this technology will inevitably lead to a decline of the effectiveness of the tool, or even a negative effect on the quality of learning (Ijaz, Bogdanovych, & Trescak, 2017). In addition, other problems must also be studied upstream such as learning biases or the management of sensitive data. In summary, this chapter will focus on the representation of a field of knowledge and the modeling of a student, on the various opportunities linked to this technology but also on its limits and the means of overcome them. The research questions we will try to answer are the following:

- How does artificial intelligence serve the personalization of learning?
- What are the intrinsic limits of this type of technology?

2. METHODS

This article is a literature review aiming to analyze the design and impact of an ITS on the learner and the teacher with a view to creating an intelligent semantic learning support system. Searches on ResearchGate, ScienceDirect, arXiv and Google were made using the keywords “artificial intelligence”, “education” and “intelligent tutoring system”. This research includes questions about learning and these cognitive mechanisms, skill-based learning, e-learning, AI and its techniques, semantic technologies and standardized object descriptions, the functioning of intelligent tutors in the education, the technical and ethical limits of these tools. Other topics were also discussed such as the use of Natural Language Processing, recommendation systems, computational thinking, logic programming, theories of brain processes of information processing or even reflections and debates on the evolution of technology, education and society. For all searches, the keywords were searched in the titles and abstracts of the articles present in the aforementioned databases. The research protocol has been restricted to articles meeting various inclusion criteria: the article must be published in a peer-reviewed journal between January 2010 and December 2021 and must report on at least one analytical or empirical study. Dissertations and secondary data analyze were excluded. Study observations must be based on students in grades K-12 and must include a control group in order to be able to make a comparison (e.g., teacher-led class, human tutoring). The measure of the effectiveness of the system must be measured using standardized tests, and the study must provide the information necessary to consider the effect size. Finally, duplicate studies were excluded, and a review of the references used in the selected articles was made, but no further publications were added during the process.

3. DISCUSSION

3.1. Architecture of an ITS

Even if ITS have different approach models, they all share a common architecture by having three main types of knowledge: knowledge related to the domain to be studied (stored in the domain model), knowledge about each learner in order to personalize the transmission of knowledge (stored in the student's model) and pedagogical knowledge allowing the tutor to make decisions on the resources to be offered and on the help to be provided to the learner (stored in the tutor's model). According to Vanlehn (2006), there are two main loops in the latter, where one aims to determine the order of future tasks to be given to the learner according to the knowledge acquired (outer loop) and the other aims to follow the learning of the live student to bring him help in case of blockage (inner loop). This help can take different forms, depending on the type of model chosen during the designs. This system can be enriched using a Learning Record Store (LRS), which allows the storage and manipulation of data of the learner's learning experiences on different types of web resources.

3.1.1. Knowledge Model

The knowledge model, also called expert model or knowledge expert, contains the concepts, facts and rules of the domain targeted by the learner. Typically produced using the knowledge of experts in the field, it provides the ITS with a source of knowledge to present to the learner while serving as an assessment tool by comparing the learner's responses to their own. domain knowledge model. Among the most common knowledge base design approaches, we can cite the Cognitive Model which is based on the ACT-R theory of cognition and learning (Desmarais & Baker, 2012), a cognitive architecture aimed at defining the bases cognitive and perceptual operations governing human thought. In this vision of cognition, knowledge can be declarative (composed of facts) or procedural (composed of actions). These two types of knowledge are only accessible through the use of buffers, the content of which varies depending on the moment and represents the state of the rational thought controller. We can also cite the constraint-based model, where domain knowledge is represented in the form of rules not to be broken (e.g., "If the relevance of the answer is true, then the answer must be correct"). According to Mitrovic (2012), this approach, more mathematical than the previous one, maintains that each decision is made according to a certain number of limits not to be crossed while having to have solutions respecting the constraints posed. More easily implementable by computer, this vision of cognition is however defined as a vision not guided by the emission of hypotheses, which prevents the prediction of the entire model in advance: a solution allowing complete modeling tends to show that the system is not entirely constraint based. Concerning the modeling of knowledge, we observe two major forms which are inspired by semantic technologies by their capacities to offer an ontological language operable by humans and machines (Héon, 2016). The first is based on ontologies, allowing the description of a structured set of concepts representing a field of information as well as the relationships between these concepts. Mainly used in the semantic web, ontologies make it possible to create taxonomic links and semantic links in order to connect knowledge by their meanings and their hierarchies in this field. This representation can take the form of a heuristic tree, which is a diagram intended to reflect the path of thought and the associative nature of it by visually presenting the existing links between concepts. The second form is based on the Knowledge Graph, and represents a network of concepts linked together by descriptive verbs. This representation adds an additional dimension by clarifying the

relationships between concepts: using the Subject-Verb-Predicate triplet, it facilitates the creation of data models representative of a set of additional concepts. to explain the relationships between these concepts, which allows an intelligent processing of these resources in addition to facilitating the inference capacity of the system (du Château, Mercier-Laurent, Bricault, & Boulanger, 2020).

3.1.2. Learner Model

The student model represents their characteristics, knowledge, and skills to provide the ITS with a source of information about it, allowing it to infer aspects of the learner's behavior. The system will then be able to compare the state of the learner's knowledge with that of the field in order to identify possible misconceptions and adapt the exercises in order to work on the weaknesses of student's skills. Two types of information must be processed to have a relevant model of the learner: their fixed characteristics (e.g., gender, mother tongue, level of study) and their dynamic characteristics (e.g., knowledge, emotional state, level of attention, problem-solving skills). This information allows the knowledge modeling of the learner on a domain, which can take different forms. Among the most frequent, we find the Overlay type modeling, where the knowledge of the learner is a subset of the knowledge of the expert system. The goal of the system is then to broaden the set of knowledge of the learner so that it completely covers all the expert knowledge. Its main weakness lies in the fact that each knowledge of the learner different from the expert is considered as a strategic error, while the error can also be in the operational domain (e.g., the learner may have understood the rule but mislead in the execution thereof). To overcome this problem, there is another more complex model to implement: the disturbance model, which consists of defining the knowledge that the learner has, and that the system does not have as errors. The goal of the tutor is then to reduce the scope of the learner's knowledge so that it no longer exceeds this expert knowledge. However, this system requires much more design time, insofar as it uses a library of erroneous rules which must be considered upstream by the designers. We can also cite the model based on stereotypes, where learners are grouped into pre-constructed archetypes, quick to set up but whose representation of knowledge is partial and dependent on the richness of the archetypes constructed. We can also cite the fuzzy modeling where subjective variables of the good or bad type are used to define the student, which allows greater flexibility of the system to the detriment of a share of precision in the measurement of knowledge. Finally, there are forms of modeling using Artificial Intelligence techniques to describe the learner's knowledge, through the use of Bayesian Neural Networks using Hidden Markov Model or Recurrent Neural Networks boosted via the use of LongShortTermMemory (LSTM) for better efficiency: we are talking here about Learner Knowledge Diagnosis (LKD). All these types of student models can be enriched by using a Learning Record Store (LRS), which makes it possible to precisely follow the progress of learners on various educational supports by storing data on the learning experiences emitted by them. This technique makes it possible to capture the informal aspect of the flow of learning and to formalize this data in the form of xApi instructions adopting the form "User + Verb + Object" (e.g., User read this article, User played this game, User participated in such activity). In addition to allowing the storage of less formal learning data, LRS allow data analysis and exchange with other systems: this is valuable information for ITS because it provides additional for monitoring learner learning (Bealink.io, 2020).

3.1.3. Pedagogical Model

The tutor model, also called the pedagogical module, is the engine of the system. He acts as a tutor in charge of choosing “what to teach, how and when”, evaluating the learner's knowledge and adapting the proposed content to his preferences, answering questions or even generating feedback. in case of error or misunderstanding (Bourdeau & Grandbastien, 2010). These actions are based on the pedagogical content stored in the domain knowledge model and the characteristics of the learner stored in the learner model, and are intended to encourage the learner to build himself even knowing her rather than following chain instructions. There are already semantic active learning systems (e.g., SASA) capable of enriching and personalizing the learner's experience, by exploiting a reasoner using the calculation of first-order predicates and ontologies modeling the entities participating in the process learning (Szilagyí & Roxin, 2012). The addition of artificial intelligence in such a semantic system allows the realization of a personal intelligent learning agent, which will aim to optimize the learning of each learner according to the model drawn up of this one and the knowledge to be transmitted through of the various educational resources available. To do this, the intelligent tutor must be able to answer three questions: Who, What and How. The first question concerns the learner and his characteristics (e.g., age, level of study, knowledge acquired, objectives, motivation). This information is essential in order to personalize the learning path, but also makes it possible to adapt the pedagogical choices inducing the cognitive states sought in the learner. These states bring together different cognitive processes, such as attention and reasoning, requiring cerebral resources in the learner in order to learn new knowledge or solve a complex task. The second question (What?) concerns the area of knowledge to be transmitted. Using the domain knowledge model, the tutor must be able to navigate between the characteristics of the domain to be learned (e.g., geography, history, foreign language), the subjects of the domain (e.g., concepts, rules) as well as the skills to be learned. work (e.g., communication, comprehension, writing, problem solving). The last question concerns the pedagogical aspect of tutoring, by understanding the strategies for approaching the subjects to be studied (e.g., reading, writing, arithmetic) as well as the effectiveness of these approaches according to the situations, the subjects to be studied, the profile of the learner and his motivation or of the context of use. To answer these questions, the paradigm of procedural programming, whose belonging to the field of Artificial Intelligence, allows the creation of a computer tutor capable of following and/or changing routines. This style of programming offers the program better efficiency and increased modularity compared to sequential programming, due to the division of the program into sub-parts thus limiting the side effects between the functions. These functional units, similar to small modules, each fulfill a specific task and can then be assembled together to form libraries. These libraries then fulfill a defined role (e.g., the cross product of 4 variables) and can be called at appropriate times in the learner's learning path. Since the tutor makes the link between the learner and the system, the use of Natural Language Processing (NLP) makes it possible to improve the construction of the learner's knowledge through a more natural dialogue as well as clearer and clearer indications and relevant aids (Rus, Niraula, & Banjade, 2015)

3.2. Advantages and limits of AI in an ITS

From a learner's point of view, AI acts as an intelligent tutor in a virtual environment to personalize the educational resources offered according to its learning style (Messika, 2019). All the data transmitted will be stored, analyzed and processed in order to improve the representation of the learner's knowledge and skills. This precise representation

improves the system's ability to infer the pedagogical content to be favored according to the profile of the learner and allows the personalization of his learning path through the choice of different pedagogical strategies according to each profile. The precise monitoring of the evolution of the learner's knowledge facilitates the production of feedback to be provided to him, through the synthesis of his progress and the achievement of the set educational objectives (Alkhatlan & Kalita, 2019). In addition, the use of artificial intelligence facilitates the processing of information by allowing the highlighting of the different ways in which learners interact with resources and the effect that these have on the quality of learning, data who then assist the teacher in making decisions about the usefulness and impact of the educational objects used. The ability to extract statistical regularity and synthesize the system also allows the teacher to have a summary of the evolution of each learner, both on the achievement of educational objectives and on the evolution of the style of teaching, learning or motivation (Franzoni, Milani, Mengoni, & Piccinato, 2020). This analysis makes it possible to detect the difficulties specific to each learner but can also infer potential dropouts, reducing the digital divide linked to the use of a virtual tutoring system (Pitchforth, 2021). Finally, this technology offers the possibility of aggregating educational objects from a domain through the use of semantic technologies and metadata. Properly described pedagogical resources make it possible to drastically increase the amount of relevant pedagogical resources available to the teacher because they are processable and categorizable by machines, which facilitates interoperability between different learning systems (Apoki, 2021). One of the standards that can be used is LOM (Learning Object Metadata), which is a description scheme for digital or non-digital educational resources using several categories (e.g., general, life cycle, rights, relationship, classification) to describe a resource. However, the use of AI in a tutoring system brings several constraints to take into account. The first notable problem concerns learning biases during the training phase of the pedagogical model. This bias, coming from a biased data set, introduces a distortion in the training process which results in a systematic deviation of the model results. This bias can come from a confirmation bias, i.e., from cognitive biases of the designer, but can also be a statistical bias, i.e., from non-representative training data or statistical algorithms used inconsistent with the objective of the system (Mélot, Ris, & Briganti, 2021). To limit them, it is necessary to define upstream the precise needs of the users, to control the coherence of the methods used according to the desired results and to surround oneself with experts of the subject to be treated to limit the impact of one's own cognitive biases. Another problem is that of poor understanding of the technology, which can occur on the designer and user side. The main problem for the designer is the systemic problem of the black box: we know the input data; we observe an output result, but it is complex to explain what is happening between the two. This problem sometimes makes it difficult to explain on what elements the model is based to produce the result, which de facto complicates the explanation of the feedback produced, the debugging of the system in the event of inconsistent output or the granting of confidence to a system whose operation escapes human comprehension. There is currently no universal answer to this problem, with easily explainable algorithms having lower performance than algorithms using multiple layers of learning (Villani, 2018). Research continues to improve the transparency of these algorithms, even if this problem of algorithmic decisions may be more about the contestability of the results than the explainability (Abiteboul, 2017). On the user side, the poor understanding of technology is rooted in the lack of education on this subject. Currently, at a low level of study, IT is only office automation. We must demystify this technology by learning the basic algorithms and techniques for the operation of artificial intelligence (e.g., linear regression, decision tree, deep learning). The population must also

be accustomed to using this tool in order to reduce use bias, better collect data and better understand the limits of the technology (O'Neil, 2016). Finally, it may be more appropriate to speak of machine learning than artificial intelligence because intelligence is a fairly strong term and ultimately quite incorrect in view of the degree of intelligence that AI really demonstrates. Finally, one of the last important points is that of the processing of sensitive data. The Internet of Things makes it possible to use several different connected objects as learning media, which involves data transfers between devices. In addition, collecting as much information about the learner as possible is necessary to design a model of their knowledge and skills, which involves collecting all the data they emit in addition to pre-filled information (e.g., sex, age, level of education). All these data are essential to have an accurate and relevant model of the learner but are extremely sensitive. One of the solutions to avoid having them transit through the cloud is to use peripheral artificial intelligence, a method combining machine learning and cloud computing to process the data as close as possible to the source of transmission in order to avoid the transmission large amounts of data in clouds. Peripheral computing is a technique aimed at synchronizing on a server only relevant and pre-processed data (Ismael, 2018). This technique applied to artificial intelligence works in two stages: first a local learning where each device adjusts its learning model, followed by a global aggregation where the main server defines the weights of the new model and updates it on the various connected objects (Li, Zhao, Lu, Liu, & Shen, 2019). Data are not transferred between devices, only models are transferred. Thus, time and bandwidth are saved and the private aspect of the data is protected (Hosseinipour, Brinton, Aggarwal, Dai, & Chiang, 2020). This technique also has its limits but remains a feasible and relevant solution for the processing of sensitive data.

4. FUTURE RESEARCH DIRECTIONS

This bibliographical review presented only part of the concepts related to intelligent tutoring systems. Certain cognitive theories, learning theories, IT development possibilities or even the use of big data and learning analytics have not been addressed for the sake of non-exhaustiveness. Many areas still remain to be explored, and field experiments are necessary to confirm or invalidate the different ideas defended in this article. These experiments are planned for the near future and will be the subject of another publication.

5. CONCLUSION

Given the constant evolution of AI, it is important that students and teachers learn to master the technology in order to maximize its positive impact. ITS possible contributions are not negligible: better personalization of learning, better generation of feedback, powerful tool for statistical inference and aggregation of relevant content. Like any technology, however, AI has limitations such as learning biases, usage biases or securing the large amount of sensitive data retrieved. We must continue to work on these risks in order to avoid falling into a technological dictatorship where the tool becomes a constant monitoring instrument whose operation escapes the understanding of its users. It is certainly a powerful tool, but to be handled with care due to its various ethical and technological implications. Finally, it is important to say that Artificial Intelligence will never completely replace human decisions because certain characteristics of human intelligence (e.g., empathy, adaptation to the unexpected, data-efficient learning) cannot be transposed to the machine. In the history of human communication, evolution has perfected the

transmission of information through the analysis of the face, the appreciation of attention or the consideration of emotions and other external parameters. Since humans are social animals who learn better from their peers, it is essential to retain humanity in one of the greatest strengths of our species: the ability to learn. Through an individualization of the learning path and associated with the look and decisions of the teacher, the smart tutor therefore seems to be a promising tool combining personalization and automation in order to support (and not replace) the teacher in his work, which remains and will remain essential due to our biological evolutions with regard to learning efficiency and transmission of information from human to human.)

REFERENCES

- Abiteboul, S. & Dowek, G. (2017). *Le temps des algorithmes* [Time of algorithms]. Paris, Le Pommier.
- Alkhatlan, A. & Kalita, J. (2019). Intelligent Tutoring Systems: A Comprehensive Historical Survey with Recent Developments. *International Journal of Computer Applications*, 181(43), 1-20. <https://doi.org/10.5120/ijca2019918451>
- Apoki, U. (2021). The Design of WASPEC: A Fully Personalised Moodle System Using Semantic Web Technologies. *Computers*, 10(5), 59. <https://doi.org/10.3390/computers10050059>
- Bourdeau, J. & Grandbastien, M. (2010). Modeling tutoring knowledge. In R. Nkambou, J. Bourdeau, & R. Mizoguchi (Eds.), *Advances in Intelligent Tutoring Systems* (vol. 308, pp. 123-143). Berlin, Heidelberg: Springer. https://doi.org/10.1007/978-3-642-14363-2_7
- Dai, Y., Chai, C., Lin, P., Jong, M. S., Guo, Y., & Qin, J. (2020). Promoting students' wellbeing by developing their readiness for the artificial intelligence age. *Sustainability*, 12(16), 1–15. <https://doi.org/10.3390/su12166597>
- Desmarais, M.C., & Baker, R.S. (2012). A review of recent advances in learner and skill modeling in intelligent learning environments. *User Modeling and User-Adapted Interaction*, 22(1-2), 9–38. <https://doi.org/10.1007/s11257-011-9106-8>
- du Château, S., Mercier-Laurent, E., Bricault, L. & Boulanger, D. (2020). Modélisation des connaissances et technologies du Web sémantique: deux applications au patrimoine culturel [Modeling knowledge and technologies of the Semantic Web: two applications to cultural heritage]. *Humanités numériques*. <https://doi.org/10.4000/revuehn.510>
- Franzoni, V., Milani, A., Mengoni, P. & Piccinato, F. (2020). Artificial Intelligence Visual Metaphors in E-Learning Interfaces for Learning Analytics. *Applied Sciences*, 10(20). <https://doi.org/10.3390/app10207195>
- Héon, M. (2016). *Le web Sémantique en 10 minutes* [Semantic Web in 10 minutes]. Retrieved from <https://www.youtube.com/watch?v=r795n3AffgA>
- Hofstadter, D. (1979). *Gödel, Escher, Bach: An Eternal Golden Braid*. Basic Books.
- Hosseinalipour, S., Brinton, C. G., Aggarwal, V., Dai, H., & Chiang, M. (2020). From Federated to Fog Learning: Distributed Machine Learning over Heterogeneous Wireless Networks. *IEEE Communications Magazine*, 58(12), 41-47. <https://doi.org/10.48550/arXiv.2006.03594>
- Ijaz, K., Bogdanovych, A. & Trescak, T. (2017). Virtual worlds vs books and videos in history education. *Interactive Learning Environments*, 25(7), 904–929. <https://doi.org/10.1080/10494820.2016.1225099>
- Ismael, K. (2018, August 14). Edge Computing vs. Fog Computing: What's the Difference? *CMSWire*. Retrieved April 13, 2023, from <https://www.cmswire.com/information-management/edge-computing-vs-fog-computing-whats-the-difference/>
- Li, G., Zhao, P., Lu, X., Liu, J. & Shen, Y. (2019). Data Analytics for Fog Computing by Distributed Online Learning with Asynchronous Update. In *ICC 2019 - 2019 IEEE International Conference on Communications* (pp. 1-6). Shanghai, China. <https://doi.org/10.1109/ICC.2019.8761303>

- Loeckx, J. (2016). Blurring boundaries in education: context and impact of MOOCs. *The International Review of Research in Open and Distributed Learning*, 17(3), 92–121.
- Mélot, H., Ris, L. & Briganti, G. (2021). *De l'intelligence humaine à l'intelligence artificielle?* [From human intelligence to artificial intelligence?]. Retrieved from https://www.youtube.com/watch?v=t2_poAVaiQ0
- Messika, E. (2019). L'Enseignement Supérieur a L'Ere De L'Intelligence Artificielle [Higher Education in the Age of Artificial Intelligence]. *Forbes*. Retrieved April 13, 2023, from <https://www.forbes.fr/technologie/7-recommandations-pour-l-enseignement-superieur-a-lerede-lintelligence-artificielle/>
- Mitrovic, A. (2012). Fifteen years of constraint-based tutors: what we have achieved and where we are going. *User Modeling and User-Adapted Interaction*, 22(1-2), 39–72. <https://doi.org/10.1007/s11257-011-9105-9>
- O'Neil, C. (2016). *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy*. Crown Publishing Group, USA.
- Pitchforth, J. (2021) Et si l'Intelligence Artificielle était source d'égalité dans l'enseignement supérieur? [What if Artificial Intelligence was a source of equality in higher education?] *Actua.com*. Retrieved May 3, from <https://www.actua.com/contribution/jamiepitchforth/et-si-lintelligence-artificielle-etaitsource-degalite-dans-lenseignement-superieur/>
- Qu'est-ce qu'un Learning Record Store (LRS)? [What is a Learning Record Store?] (2021). Retrieved April 13, 2023, from <https://bealink.io/a-quoi-sert-un-learning-record-store-lrs>
- Rus, V., Niraula, N., & Banjade, R. (2015). DeepTutor: An Effective, Online Intelligent Tutoring System That Promotes Deep Learning. *Proceedings of the AAAI Conference on Artificial Intelligence*, 29(1). <https://doi.org/10.1609/aaai.v29i1.9269>
- Seldon, A. & Abido, O. (2018). *The Fourth Education Revolution, will Artificial Intelligence Liberate or Infantilise Humanity*. London, UK: University of Buckingham Press.
- Szilagyi, I. & Roxin, I. (2012). Learner Ontology for the Active Semantic Learning System. In I. Aedo, R. M. Bottino, N.-S. Chen, C. Giovannella, Kinshuk, & D. G. Sampson (Eds.), *Proceedings of the 12th IEEE International Conference on Advanced Learning Technologies* (pp. 393-394). Rome, Italy. <https://doi.org/10.1109/ICALT.2012.162>
- Vanlehn, K. (2006). The behavior of tutoring systems. *International journal of artificial intelligence in education*, 16(3), 227–265.
- Villani, C. (2018). Donner un sens à l'intelligence artificielle [Make sense of artificial intelligence]. *AI for Humanity Rapport*. Retrieved from <https://www.aiforhumanity.fr>

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Chapter # 26

WHAT PHD STUDENTS WANT FROM CAREER-RELATED MODULES: THE CHAMELEONS PROJECT

An evaluation of three interdisciplinary, inter-sectoral and international modules

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ABSTRACT

CHAMELEONS (Championing A Multi-Sectoral Education and Learning Experience to Open New Pathways for Doctoral Students, H2020-SwafS-2018-2020), is a programme of 3 EU-funded interdisciplinary, inter-sectoral and international modules that aimed to broaden the skills of PhD graduates improving their employability in academic and non-academic environments. Fifteen doctoral students from five European universities were recruited. This chapter represents evaluation conducted on all 3 modules. In terms of programme content, students perceived that real-time assessment, reflective learning, engagement with course coordinators and the opportunity to engage with practical research tools (Photovoice, Ecosystem Mapping and Walk My ID) all enhanced their learning. They suggested more group activities to enable them to better network with their doctoral colleagues as well as more practical activities. In terms of programme delivery students expressed a desire to have more physical face-to-face engagements while understanding the Covid-19 constraints. When given the opportunity to add freeform and unprompted comments, students almost without exception expressed their satisfaction with and appreciation for the modules. In terms of programme outcomes one student expressed an aspiration to be “more sure” of their skill set and marketability complimenting the focus on practical learning in the programme content review.

Keywords: doctoral education, programme evaluation, stakeholder design, interdisciplinarity, intersectorality.

1. INTRODUCTION

Collaborative doctoral programmes assist the knowledge society in finding innovative ways to address sustainable development goals by asking creative questions and finding creative solutions. The aim of CHAMELEONS (Championing A Multi-Sectoral Education and Learning Experience to Open New Pathways for Doctoral Students), was to develop interdisciplinary, inter-sectoral and international modules that broaden the skills of PhD graduates improving their employability in academic and non-academic environments. Chameleons was an EU H2020-SwafS Science with and for Society, Coordination and Support action (www.chameleonsproject.eu). The objective of this project was to develop new and innovative educational interventions to improve the learning experience offered by higher education with the intention of shaping more adaptable, entrepreneurial, and employable doctoral graduates, ready to meet the challenges of the future.

CHAMELEONS comprised a programme of 3 such modules. These modules were designed online through collaboration with stakeholders from industry, charitable

organisations, recent doctoral graduates, academics, patients, educational technologists, and librarians (Cusack et al., 2021). The themes set for the three CHAMELEONS co-designed modules were:

- Module 1: Forging relationships - Building and Sustaining your Doctoral Network
- Module 2: Managing the Project - Keeping on Track with an Eye to the future
- Module 3: Starting your Career - Future Proofing your Career and Getting a Job

These were designed to provide a continuum of learning objectives that use constructive learning methods to advance logically through the modules. Each module advanced the students' depth of knowledge and understanding. In each module the topics were organized within the four following learning threads:

- Build an understanding of yourself and others
- Develop networking and communication skills
- Understand ethical user centred design
- Market your research capacity and skills

2. BACKGROUND

Ten years from now, jobs will be more knowledge and skills-intensive than ever before, globalisation and technological advances indicate that there will be changes in sectoral structure and demand for new types of skills we are not even currently anticipating (EU strategy for modernising Higher Education, 2011). Typically, less than half of doctoral graduates will be employed in academia immediately after graduation, with less than 10% to 15% achieving a long-term academic career (Euraxind). Current doctoral curricula may not, however, nurture the big thinkers and creative problem-solvers that society needs (Bosch, 2018).

At a professional and research level, international, interdisciplinary and inter-sectoral networks are on the increase with established researchers collaborating within and across disciplines to increase and improve innovation, creativity and knowledge. More recently, this is being mirrored by the establishment of interdisciplinary and inter-sectoral doctoral research networks, the intention of which is to train PhD graduates for careers both within and outside academia and who are equipped to address societal challenges (see for example Mountford et al, 2018). Such collaborative doctoral programs can assist the knowledge society in finding innovative ways of approaching the world's problems by asking creative questions and finding creative solutions within multiple employment contexts.

Previous research has shown that key areas of focus for interdisciplinary PhD programmes should include the extraction of value from the interdisciplinarity; student motivation over the lifetime of the interdisciplinary programme, and relating to others both within and external to the programme (Mountford, Coleman, Kessie, & Cusack, 2020). Policy-makers and practitioners have highlighted the lack of transferable skills in doctoral graduates, but also emphasize attributes and experience (rather than specific technical skills) as key hiring factors (Leniston, Coughlan, Cusack, & Mountford, 2022). This study aimed to assess whether a particular programme of modules, designed to address these challenges raised in policy, practice, and academic circles, had in fact made a difference to the learning and development experiences of 15 PhD students.

3. METHODS

Fifteen doctoral students (Female=9, Male=6) from five European universities (Aristotle University of Thessaloniki, Greece; University of Oulu, Finland; University of

Porto, Portugal; Maynooth University, Ireland; University College Dublin, Ireland) were recruited. The students were all undertaking doctoral studies loosely linked to Connected Health. Their studies were in the following areas: Economics, Data Analysis, Biomedical and Chemical Engineering, Medical Informatics, Public Health, Sports Science, Digital Health, Obesity Prevention and Adopting Emerging ICT.

The Chameleons project commenced in March 2020 just as the world was in the grip of a global pandemic and as Europe completely locked down. We saw the closure of all sectors of society including education. The original intention of Chameleons was to design and deliver three in-person modules for doctoral students in the field of Connected Health, from five educational institutions across Europe. However, the pandemic required Chameleons to move on-line. Due to COVID-19 restrictions, the first two modules were delivered remotely via Zoom. Module 1 took place in the week of 21-28 of April 2021 and Module 2 between the 8th and the 14th of September 2021. With the gradual opening of the European society to mobility and reduction of the COVID control restrictions, it was possible to organize Module 3 to be delivered in-person in the week of 21 to 25 of February 2022. As each module was completed the evaluation and feedback from the students informed the development of the next module. The iterative design process used in this project ensured that the module designs were informed by key stakeholders including those who had experienced the curriculum itself.

One week after each module was completed the students were invited to complete an anonymous questionnaire. The questionnaire was hosted on Google forms. The questionnaire consisted of sixteen questions, comprising thirteen closed questions with a five-point scale Likert Scale, and three further open-ended questions. The use of the Likert Scale model for questions 1-13 aided in providing a quantitative evaluation of the module while the final three free text questions provided a qualitative insight into the participants' perceptions of the Chameleons modules.

Questions 1 and 2 asked students about the module objectives and whether they felt that they had achieved these objectives. Questions 3 to 5 related to the online context of module delivery and asked students whether they found the module to be inclusive and/or engaging both in terms of content and context. Question 6 asked students to reflect on whether they had benefitted from the module, with question 12 asking them to qualify this response. Question 7 asked for comment on whether the practical elements of the module had allowed them to link theory and practice. Question 8 and 9 enquired as to whether the assessment method had consolidated their learning and whether they saw this learning as relevant to their future career. Question 10 asked whether they would have enrolled in the module if they had had more prior information on its content, while question 11 asked how they now felt about enrolling having completed the module. Question 13 asked them if they intended to attend the next Chameleons module. Questions 14 and 15 were free text responses that asked students to identify three aspects of the module which assisted their learning and three changes they would suggest that would enhance their learning. Finally, question 16 offered students an opportunity to provide additional comments on the module in a free text format. In addition to the end of module questionnaire, each day of the module students were invited to submit a 100 word reflection on what they had learned and the experiences that they had gained that day. In doing so, students were asked to focus on the following three questions:

- a) Do you envisage a role for the learning you experienced today in your own PhD experience? If yes, what do you envisage this role might be and if not, why do you not think it is relevant?

b) Do you think this learning could impact your career? If yes, how and why and if not why not?

c) Give one example of where and how you might potentially use this learning.

The primary purpose of these reflective assignments was to reflect on the outcomes of the day, to promote teamwork, and to practice communication and discussion with their peers and speakers. Consent was, however, sought and received from each of the students to use these reflections to strengthen the assessment of the programme. These reflections were, therefore, anonymized and coded in a grounded theory process (Braun & Clarke, 2006). A total of 58 responses was collected over the week of module 1; 59 over module 2; and 42 responses in module 3.

4. FINDINGS

Fifteen doctoral students from across five European universities (University of Porto, Portugal; Oulu University, Finland; Aristotle University, Greece; Maynooth University Ireland; University College Dublin Ireland) were recruited to Chameleons. The findings from the evaluation questionnaires for both modules are presented in the following sections.

4.1. Programme Content

Participants were asked what had most enhanced their learning. Students identified real time assessments and reflective learning as particularly helpful, as outlined by the following participant free text comments:

“Allocated time for working alone on the first day. Having 15-20 minutes to reflect on an exercise alone was really helpful in digesting what we learned.” (Module 1, Respondent 12)
“Reflective learning was quite useful, because after a long day we were urged to remember what we learned and think of scenarios that it would be helpful, thus developing a stronger connection with the learning material.” (Module 1, Respondent 13)

“Reflective diaries, self-assessment assignments, refresher quizzes.” (Module 2, Respondent 3) were important components of learning.

The participants identified that they took inspiration from engagement with course coordinators and potential employers from academia and industry

“I think that the most valuable aspect was that we had the opportunity to freely chat with the speakers and ask them questions.” (Module 1, Respondent 7)

“Opportunities to speak to people working in industry, with a blended academic/industry approach who spoke candidly” (Module 1, Respondent 3)

The opportunity to engage with practical tools such as the Photovoice research methodology⁴ was also highlighted as important:

“Photovoice- learning a practical skill that we can use personally or for our research.” (Module 1, Respondent 12)

In relation to module 2, participants highlighted the opportunity to engage in practical activities as important, namely Walk My ID, this is illustrated as follows:

“Walking my ID activity allowed me to reflect on my personal motivations, worthwhile exercise...Checking in with the group again was a nice element for interaction and engagement with fellow students during a time when interactions have been limited” (Module 2, Respondent 2).

In relation to module 3, participants were particularly positive about the inclusion of mock interviews:

“the mock interviews were the best part of the module, which gave me not only the chance to practice the interview skills, but they also provided opportunities to meet and share

information and contacts with academic and non-academic staff. Invaluable! Giving students the opportunity to network with academic and non-academic staff was fantastic” (Module 3, respondent 5).

“I now know what I need to do prior a job interview and what I need to prepare, i.e., the potential questions that I might get asked and those that I might ask.” (Module 3, Respondent 5)

Other elements that were highlighted by smaller numbers of students included:

- a debate that saw industry-located PhD holders and academia-located PhD holders articulate their views and experiences of the two different sectors as PhD career targets.
- The development of a PhD career board game as a group project throughout the week.

4.2. Programme Delivery

There was a strong desire for more physical and face-to-face engagements. The participants acknowledged the complications of Covid-19 on having in-person sessions but expressed a strong interest in meeting face-to-face.

“I think mostly helpful for learning would be to get to meet everyone and collaborate face to face. Even though I think everything has worked well remotely.” (Module 2, Respondent 11) “Despite being held online, the module was interactive enough to facilitate the learning.” (Module 2, Respondent 15)

“..... I would probably like is having more time for the breakout sessions because it would enable participants to be more engaged with each other. Notwithstanding that the level of engagement was fantastic, I felt that during the main sessions, we could not really engage with other participants. We could only use the chat box. I know that this is a problem related to the distance learning and the module organization was excellent. In a face-to-face module, engagement between participants would have been assured by the coffee breaks.” (Module 1, Respondent 7)

A number of module participants indicated the need for more breaks in the timetable: *“A little more space in the timetable or bite sized learning. Regular breaks for zoom sessions I find are really helpful” (Module 1, Respondent 3).* Echoing this sentiment, another participant commented *“The overall schedule was too intense with very short breaks. I had expected to catch up on my own PhD work/emails in the morning and evening but this wasn't always possible as I was so exhausted from looking at the screen. I also did not expect that I would need to stay on Zoom longer in the evening for group work.” (Module 1, Respondent 12) “Face to face for module 3 will be great, I think zoom fatigue very difficult to avoid towards the end of the week.... “ (Module 2, Respondent 2).*

This was successfully addressed in module three with respondents across the board naming in-person interaction as one of the most beneficial elements of that module:

“The in-person activities and lectures were far better than the online ones.” (Module 3, Respondent 10)

“In-person element, hands-on and creative work like the board game made it feel less like a lecture” (Module 3, Respondent 6)

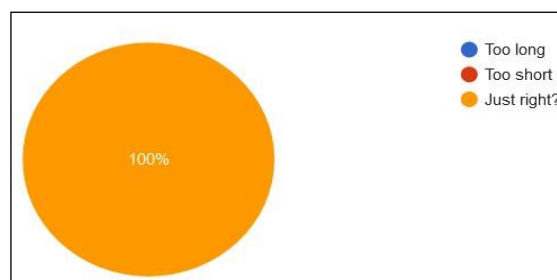
“Being together on spot interacting and participating live” (Module 3, Respondent 3).

“That we attended in person and got to know each other better” (Module 3, Respondent 9)

While all students felt that the time allocated to the module (1 week) was optimal (see Figure 1 below), a number of students did comment that not enough time was allocated to group project tasks.

“Probably, it would have been better to have more time allocated for the group works, or having less group works to do” (Module 3, Respondent 5)

Figure 1.
Response to Question: “Was the module length too long, too short, or just right?”



4.3. Programme Outcomes

One participant expressed an aspiration to be “more sure” of their skill set and marketability upon completion of Module Three, complimenting the focus on practical learning in the programme content review. They identified *“Building an understanding, research methods & design, marketing research capacity & skills” (Module 2, Respondent 11)* as important. This echoed a similar request in the review of the earlier Module 1 that suggested the need for *“more practical methodologies to build our career” (Module 1, Respondent 11)*. Another participant identified the need for *“more focus on how to communicate better my work, discuss the commercialization of research finding” (Module 2, Respondent 6)*.

While another participant commented *“I used the module to take some concrete career planning steps, I am more active on linked in and twitter and arranged a site visit to a research centre and met some new contacts” (Module 2, Respondent 2)*

Following the completion of module 3, a number of students reflected a desire to have produced something tangible, as a group, from the programme:

“One idea I did have was to use the work we competed towards some tangible research outputs. - considering the 2 year long duration it may have worked well for students to collaborate and work on a paper/poster together.” (Module 3, Respondent 2)

“I insist that we should have created something out of this wonderful experience, a booklet, a project, an article or any other initiative.” (Module 3, Respondent 3)

5. FUTURE RESEARCH DIRECTIONS

Students said they wanted face-to-face modules when evaluating modules 1 and 2 but when it came to a face-to-face module 3 there was initial reluctance amongst a small but significant portion of the students. Many of the students who were at first reluctant later rated module 3 extremely highly citing in person interaction as key to this experience. Future research might profitably explore the role of fear, inertia, perceived time savings, and other barriers to the uptake of face to face teaching at PhD level – particularly post Covid. Given the emphasis placed on the value of the face to face experience in our evaluated modules it seems particularly important that we identify ways to overcome such barriers to facilitate the types of learning and experience found in the CHAMELEONS modules.

6. CONCLUSION/DISCUSSION

Despite the need to pivot the delivery of Chameleons, from face to face to on-line, it is clear that the Chameleons doctoral students benefitted from engaging with the two modules already delivered. The iterative design process employed for these modules enabled the participant evaluation to inform the module design process swiftly and meaningfully. By default, the module designers also learned about online education delivery.

Participants valued the development of reflective skills (reflective writing, Walking my ID) and research methodologies (photovoice (Wang & Burris, 1997), ecosystem mapping). It is interesting to note that they highlighted the importance of 'protected' time within the module to develop these skills. All three modules were delivered over a five-day period - the first two online modules contained an intervening weekend while the third module ran Monday to Friday. While online, this weekend break proved to be important in order to give students an opportunity to reflect on their learning, to develop their skills (they undertook a photovoice project in module 1, and a Walking my ID project in module 2). However, the participants also stressed that engaging in online education is tiring and that regular breaks away from the screen are necessary. The evaluation of module 3 demonstrates that less breaks are necessary when students were engaging face-to-face over a five day period.

It was clear that participants would have preferred a face-to-face engagement from the beginning had the health situation permitted. The participants lost a number of elements of their education owing to the online environment. The 'hidden curriculum' (Giroux & Penna, 1979) which is not predetermined by educators is limited in the online context. Skills which are important for professional development such as networking, learning to make research links, disseminating your research, and socializing with peers were not available to the participants. The sensemaking and sense-giving activities (Leniston & Mountford, 2021) that take place in the informal spaces between the formal curriculum elements were more difficult to achieve in an online environment.

In relation to programme outcomes, this concept of enabling doctoral students to be "more sure" of their skill set and marketability was taken up in module 3. In order to build student confidence, while developing their skills, each student undertook 2 'mock' interviews. Each student was tasked with identifying three job opportunities. They were asked to apply, as part of the module task, for each of these jobs. The applications were submitted in advance of the module. The students were interviewed by a panel of 2 people who role played as interviewers for the companies/institutions represented in the job advertisements. The interviews were conducted in a close to authentic conditions as possible, mimicking a job interview. On completion of the interviews, the interviewers gave the student feedback. This task offered students the opportunity to market themselves to potential employers through a variety of communication channels. The feedback served to support them in this endeavor. This real-world experiential learning enabled them to apply what they had learned during the two modules.

The careful evaluation of module 1 and 2 guided the development of module 3 and led to a successful completion of the programme in the view of the students. The objectives of Chameleons were firstly to develop a range of interdisciplinary, inter-sectoral and international modules, designed to broaden the skills of PhD graduates, and secondly to improve their employability and to develop new and innovative educational interventions to improve the learning experience offered by higher education to shape more adaptable, entrepreneurial, and employable graduates. The way in which this was achieved within Chameleons could be easily adapted to broaden the development of employment skills in doctoral graduates beyond connected health.

REFERENCES

- Bosch, G. (2018). Train PhD Students to be Thinkers not specialists. *Nature*, 554(7692), 277.
- Braun, V. & Clarke, V. (2006). Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, 3(2), 77-101. Retrieved January 29, 2023 from <https://biotap.utk.edu/wp-content/uploads/2019/10/Using-thematic-analysis-in-psychology-1.pdf.pdf>
- Cusack, T., Mountford, N., Isomursu, M., Garcia, G.G., Filos, D. & Chouvarda, I. (2021), Interdisciplinary and Intersectoral Doctoral Education Designed to Improve Graduate Employability. In M. Carmo (Ed.), *Proceedings of the International Conference on Education and New Developments* (pp. 643- 645). Lisbon, Portugal: inScience Press.
- Euraxind: Project Background. Retrieved January 29, 2023 from <https://www.vitae.ac.uk/researcher-careers/euraxess-uk-career-development-centre/euraxind/euraxind-project-background>.
- EU Strategy for Modernising Higher Education (2011). Retrieved January 29, 2023 from https://ec.europa.eu/commission/presscorner/detail/en/MEMO_11_615
- Giroux, H. A. & Penna, A. N. (1979). Social education in the classroom: The dynamics of the hidden curriculum. *Theory & Research in Social Education*, 7(1), 21-42.
- Leniston, N., & Mountford, N. (2021). Born or made - Can interdisciplinary and intersectoral doctorate education create institutional entrepreneurs? A systematic review. In *Proceedings of International Conference on Higher Education Advances (HEA'd)*. Valencia, Spain. Retrieved January 29, from <http://ocs.editorial.upv.es/index.php/HEAD/HEAD21/paper/viewFile/12960/6185>.
- Leniston, N., Coughlan, J., Cusack, T., & Mountford, N. (2022) A Practice Perspective on Doctoral Education—Employer, Policy, and Industry Views. In M. Carmo (Ed.), *Proceedings of the International Conference on Education and New Developments* (187-191). Lisbon, Portugal: inScience Press.
- Mountford, N., Zubiete, E.D., Kessie, T., Garcia-Zapirain, B., Nuño-Solinís, R., Coyle, D., & Jimenez, P.V. (2018). Activating technology for connected health in cancer: protocol for a research and training program. *JMIR Research Protocols*, 7(1), e14. <https://doi.org/10.2196/resprot.8900>
- Mountford, N., Coleman, M., Kessie, T., & Cusack, T. (2020). Interdisciplinary doctoral research networks: enhancers and inhibitors of social capital development. *Studies in Higher Education*, 45(12), 2558-2573.
- Wang, C., & Burris, M.A., 1997. Photovoice: Concept, methodology, and use for participatory needs assessment. *Health education & behavior*, 24(3), 369-387.

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What PhD students want from career-related modules: the CHAMELEONS project - An evaluation of three interdisciplinary, inter-sectoral and international modules

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Chapter # 27

THE E-READINESS OF STUDENT TEACHERS FOR 21ST CENTURY TEACHING: SOME REFLECTIONS FROM A UNIVERSITY OF TECHNOLOGY IN SOUTH AFRICA

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ABSTRACT

The COVID-19 pandemic and the hygienic measures of social distance brought impasses to education. Face-to-face activities are suspended, and this accelerated the use of Information Communications Technology (ICT) in most schools. Based on these changes, teacher education and training at universities should prepare prospective teachers that are able to function within digital and virtual classrooms. This study investigates the level to which student teachers were exposed to Technological Pedagogical Content Knowledge (TPACK) needed by them to function within such classrooms during and post-COVID-19 times. The study analyses, the Central University of Technology's (CUT) final year Bachelor of Education student teachers' e-readiness to integrate ICT and present lessons in these classrooms. A total of 60 student teachers were purposively selected for this study. Data was collected using online questionnaires. A 5-point Likert scale questionnaire was used to collect data from student teachers. Subsequently, results revealed that student teachers are aware of the importance of ICT and e-learning in schools. However, they acknowledge that they have limitations, and they are not fully ready in implementing ICT in digital & virtual classrooms. The study concludes by offering several theoretical and practical recommendations for the e-readiness of student teachers in such environments.

Keywords: e-learning, e-readiness, information communications technology (ICT), teacher education.

1. INTRODUCTION

The COVID-19 pandemic is one of the eight declared pandemics since the beginning of the 21st century. It is among the six pandemics that directly damage the respiratory system in human beings (Guillén, Cuellar, & Alfaro, 2020). In preventing the spread of this pandemic, health authorities have recommended among other contagion-prevention measures, social distancing, wearing of masks, and social confinement. As a result of these measures, COVID-19 has streamlined the obligatory use of Information Communications technology (ICT) in most fields and services including education (Guillén et al., 2020, Lake & Dusseault, 2020).

Face-to-face teaching was interrupted in schools around the world from 2019 to 2020 academic years due to this pandemic (Lake & Dusseault, 2020). Remote teaching and learning were then encouraged by most education authorities around the world. Faced with this need for change, schools are challenged by this new normal because most teachers are not properly trained for these forms of teaching (Guillén et al., 2020). This is because remote teaching and learning required teachers to be skilled in, among others, online teaching, blended teaching, e-learning, m-learning, the use of Learner Management Systems (LMS), Open Education Resources (OER), the use of the Internet, etc.

In addition to teachers' challenges, many working parents, in general, were struggling to help with the education of their children (Department of Basic Education, 2018). This is because remote learning predominantly requires the assistance of parents at home. In essence, it requires a higher level of literacy and education from the side of parents, and this poses a challenge to illiterate parents, especially in third-world countries like South Africa.

Like many other countries, the South African government through the Department of Basic Education (DBE) encourages the introduction of remote teaching and learning during this period of the pandemic (Ndebele, 2020). Schools were encouraged to use online teaching and learning, blended learning, e-learning, m-learning, and many ICT-integrated strategies for teaching and learning (Ndebele, 2020). Noticing this global trend compelled teacher training institutions like universities to be serious about infusing the use of ICT in teacher training. The Central University of Technology (CUT) like most universities had to equip student teachers that are studying for the Bachelor of Education (B.Ed.) degree with ICT integration skills.

The purpose of this empirical research is to investigate the level to which student teachers at CUT are exposed to the integration of ICT in their teaching. This study focused only on teacher education as presented by one public university in South Africa (SA). There might be differing views about teacher education as presented by private universities in SA and/or in other countries. Again, because ICT integration is a broad concept, it can be viewed either as a goal or a process depending on the researcher's paradigm. This study focused on the training of pre-service teachers in how to use ICT to respond to the notion of equalizing educational opportunities in SA and to capacitate student teachers in the use of ICT in the classrooms. Also, to enable student teachers to respond to the demands of the 21st-century classrooms, the 4th industrial revolution, and to respond to the requirements of providing education during and post-COVID-19 era.

The organization and content of traditional pre-service teacher education programs around the world are changing quickly due to ICTs' quick development. Pre-service teacher education faces a challenging issue in attempting to integrate modern technologies with effective teaching (Jin & Harp, 2020). Regarding its functional relationship to a pedagogical and didactical philosophy, the use of technological affordances to support learning should be considered. The use of technology in the classroom has the potential to alter how people teach and learn (Jung & Ottenbreit-Leftwich, 2019). The ability of preservice teachers to integrate ICTs into their classroom practices and teaching strategies depends on their overarching approach to education, which derives from their implicitly or explicitly adopted learning theories' perspective, as pedagogy and didactics embed the methods and practices of teaching (Jin & Harp, 2020, Jung & Ottenbreit-Leftwich, 2019). The review of the literature shows that teachers' adoption of various philosophies derived from learning theories has a direct impact on (1) how they choose and employ ICTs, (2) how they perceive their role as teachers in the context of putting their adopted learning theory into practice, (3) as well as the perceived role of their learners in the teaching-learning process.

2. ICT INTEGRATION MODEL

According to Kimmons, Graham, and West (2020) the purposes and components of a model should be characterized by what, *how*, *why*, and *who/where/when*. The first component, i.e., what, requires the model to be comprehensive enough but adequately limited to allow for parsimony and to prevent overreaching. A model should include enough variables, and ideas and have detailed explanations (Kimmons et al., 2020). Second, the model should show the interrelatedness of the components it proposes. Its structure should

allow for the model to make sense of the world in different ways. Third, it must provide logic and rationale to support why components are related in the proposed form. Forth, a model must be bound by a context representing the who, where, and when of its application (Kimmons et al., 2020).

Currently, various models are used to train teachers on effective technological integration. These include among others the Levels of Technology Integration (LoTi), Technology Acceptance Model (TAM), Substitution – Augmentation – Modification – Redefinition (SAMR), Replacement – Amplification – Transformation (RAT), Technological Pedagogical Content Knowledge (TPACK), Technology Integration Planning (TIP), Technology Integration Matrix (TIM) and recently the Passive, Interactive, Creative, Replacement, Amplification, Transformation (PICRAT) (Kimmons et al., 2020, Karatza, 2019).

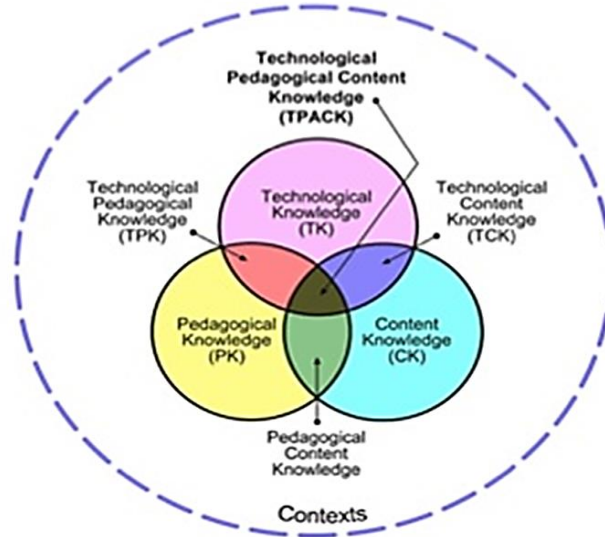
This study uses the TPACK model because according to the researcher, it is an appropriate model that is in line with the four components, what, how, why and who/where/when, as discussed above. Also, this study chooses this model because it is a model most referred to in several education policies of the South African education system, among others the Action plan to 2019: Towards the Realisation of Schooling 2030 (DBE, 2015), and the Professional Development Framework for Digital Learning: Building Educator Competencies in Facilitating Learning with Digital Tools and Resources (DBE, 2018).

Technological Pedagogical Content Knowledge (TPACK) is a teacher knowledge model aimed at enabling teachers to effectively teach with technology. It is an extension of Lee Shulman's framework of Pedagogical Content Knowledge (PCK) to include the use of technology in schools (Shulman, 1986, 1987; Mishra & Koehler, 2006). The TPACK framework was first presented by Punya Mishra and Matthew Koehler (2006) (Koehler, Mishra, & Cain, 2013).

Again, in answering the question, 'why this framework?', Mishra and Koehler (2006: p. 14) argue that "teaching is a complex domain. So successful teaching depends on flexible access to knowledge and the application and systematic organization of powerful knowledge in the classroom". Again, teaching takes place in a dynamic environment. Successful teachers need to understand learners' thinking and learning pathways, how learners acquire content knowledge, and learners' technical knowledge (Mishra & Koehler, 2006; Mishra & Koehler, 2008). This can be achieved by equipping learners with the necessary knowledge they need to master their subject content.

Integrating ICT in education requires knowledge of the three main domains of a learning environment, namely, content, pedagogy, and technology. Content, pedagogy, and technology are the three knowledge dimensions that form the bases of the TPACK framework. The TPACK framework is thus the interaction between and among the above-mentioned domains of knowledge in all forms of acquisition to formulate objective knowledge needed for 21st-century classrooms (Mishra & Koehler, 2006; Koehler et al., 2013). The TPACK model is diagrammatically represented as follows:

Figure 1.
Technological Pedagogical Content Knowledge Model.



Source: Mishra & Koehler, 2006

The TPACK framework and its seven knowledge domains. The three core components of this framework are content, pedagogy, and technology (Mishra & Koehler, 2006, 2008). In addition to these, the three components are combined in pairs. These combinations form another three components, namely, Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), and Technological Pedagogical Knowledge (TPK). The rest of the components combine to form the framework entitled Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006).

2.1. Content Knowledge (CK)

This domain refers to the outstanding knowledge of the subject matter that teachers must have to teach. A teacher must have a thorough understanding of the subject matter or content that they are going to teach (Shulman, 1987; Mishra & Koehler, 2006; Koehler et al., 2013). The teacher must have expertise in the subject level that he/she will be teaching; for instance, the subject knowledge of mathematics at primary school, high school, and university differs. According to Shulman (1987, p. 6), the teacher's "content knowledge should embrace subject concepts, theories used in the subject, relevant philosophies, organizational frameworks, evidence, and proof, as well as reputable tactics and ways of developing such knowledge".

Teachers must possess content knowledge, which calls for insight and in-depth knowledge of the subject matter they are teaching. (Koehler et al., 2013). Teachers who lack a thorough understanding of their subject matter run the risk of losing the respect and integrity of their students in this technologically advanced age where information is so readily available (Biggs & Tang, 2011; Koehler et al., 2013). In short, the content knowledge base of teachers comprises depth and breadth of conceptualization of the subject matter (Koehler et al., 2013).

Again, content knowledge should enable a teacher to answer content-specific questions that may arise from the students and their peers. It should also be in greater depth to enable a teacher to teach beyond the textbook, at different levels, or using different methodologies or different pedagogies (MaKinster & Trautmann, 2014).

2.2. Pedagogical Knowledge (PK)

Pedagogical knowledge refers to a deepened understanding of strategies, methods, and processes that teachers should employ in the teaching and learning of their respective subject specializations (Mishra & Koehler, 2006, 2008; Koehler et al., 2013). It involves a thorough understanding of the aims and objectives of a subject, the educational purpose and values of the subject, and the ability to plan activities that will make the learning of the subject easy and make the subject relevant and enjoyable to learners (Mishra & Koehler, 2006, 2008; Koehler et al., 2013). MaKinster & Trautmann (2014: p. 340) states that “pedagogical knowledge broadly covers what teachers know related to teaching, curriculum, and assessment”. Also, PK is about teachers’ understanding of how learners learn, classroom management skills, lesson planning, development of classroom activities, and assessment of learners (Mishra & Koehler, 2006; Koehler et al., 2013).

2.3. Pedagogical Content Knowledge (PCK)

PCK is about the knowledge and understanding of a subject matter taught, meaning the pedagogy of a specific subject. PCK relates to Shulman’s (1986, p. 4) belief that “real teaching requires an understanding of both content and pedagogy”. It does not require one to be just a content expert or just a pedagogy expert, but it requires teachers to have the expertise to match content with relevant pedagogy so that effective learning can take place (Mishra & Koehler, 2006). According to Mishra and Koehler (2008: p. 9), this knowledge domain “revolves around the teacher’s ability to properly teach, plan relevant activities for learning, understand the core and hidden curriculum, conduct assessment, and report results of a subject”.

Hence, the concept of PCK is the transformation, by the teacher, of the content (Shulman, 1986; Mishra & Koehler, 2006; Koehler et al., 2013). A teacher who has a deep PCK can interpret the subject matter well, can present the subject matter in a way suitable to their learners, and can develop suitable teaching and learning materials to meet the needs of individual learners in their classrooms (Shulman, 1986; Mishra & Koehler, 2006; Koehler et al., 2013).

2.4. Technological Knowledge (TK)

The technological component of this framework was added to the original PCK framework of Shulman (1986) by Mishra and Koehler in 2006. They referred to this knowledge as the teachers’ standard knowledge of technology, and the skills to operate particular technologies (Mishra & Koehler, 2006, 2008). This definition did not suffice and attracted a lot of criticism due to the ever-changing nature of ICT. In trying to address the criticisms of their initial definition, Koehler et al. (2013, p. 14) implemented the definition of Fluency of Information Technology (FITness) which stated that technological knowledge is way above the traditional notion of computer literacy (Koehler et al., 2013). TK requires an individual to understand ICT in general and to apply it for productivity at work and at home (Koehler et al., 2013). FITness further specifies that TK is the ability of one to recognise when ICT can be useful or destructive towards the realisation of set goals and an individual’s ability to integrate technological changes (Koehler et al., 2013). According to

MaKinster and Trautmann (2014, p. 340), “As teachers learn to use a piece of software, they need to be able to imagine how their students would use it, what opportunities it would create, and what challenges they might face.”

TK requires a deep understanding and mastery of ICT so that they can access, process, and disseminate information (Graham, 2011). It also refers to the teacher’s understanding of communication and problem-solving (Koehler et al., 2013). It requires the teachers’ knowledge of the use of both technologies that are still in analog forms, like pencil, chalkboard/whiteboard, microscope, etc., and recent technologies that are in digital forms, like computers, tablets, mobile phones, Internet, etc. The knowledge required here should not be about physical resources only but should also be about processes applied to solve problems with these devices (Graham, 2011). Most technological devices are not made for the sole purpose of education. So, TK here requires teachers to adopt and adapt these technological resources to serve and benefit the educational environment (Mishra & Koehler, 2006, 2008).

2.5. Technological Content Knowledge (TCK)

TCK refers to the teacher’s knowledge of the interchangeable relationship between technology and content (Koehler et al., 2013). It is simply the way content and technology influence and constrains one another (Mishra & Koehler, 2006, 2008). It characterizes the integration between what a teacher knows about applicable technological applications and about the topic of interest (MaKinster & Trautmann, 2014). Here the expectation is that a teacher must know a great deal about the subject matter that they teach. Teachers should have a deep understanding of the technological applications that can be used to teach the subject and to clarify and explain the subject matter. They should know that certain technologies are best suited for certain subject matter learning (Mishra & Koehler, 2008; Koehler et al., 2013). For example, software applications like Google Earth can be useful to teach geography, GeoGebra can be a useful application to teach Geometry in Mathematics and Google Translate can be used to assist students that are studying foreign languages or a second language or third language.

It involves the teachers’ understanding of the ways in which educational technologies can represent concepts, topics, and processes in ways that are challenging, engaging, and meaningful to learners. It is the teacher’s ability to find technological tools with which to present and explore a variety of subject concepts (MaKinster & Trautmann, 2014).

2.6. Technological Pedagogical Knowledge (TPK)

TPK refers to the shared relationship between technology and pedagogy. It is defined as the teacher’s knowledge and understanding of the use of technology devices that can advance the attainment of pedagogic goals (Koehler et al., 2013). It is the teacher’s ability to select the most suitable tools or applications based on their appropriateness for the specific pedagogical approach (Koehler et al., 2013). It involves knowledge of technological devices that influence the nature of learner-teacher interaction. For example, in a school that has different educational electronic resources like computers, interactive whiteboards, radios/CD players, etc., a teacher must know which electronic resource to use for which grade, for which learners, and for which subject matter. TPK is the teacher’s capability to develop creatively and be flexible in the use of available technological resources and to repurpose these resources for specific pedagogical environments (Mishra & Koehler, 2008).

2.7. Technological Pedagogical Content Knowledge (TPACK)

Technological Pedagogical Content Knowledge (TPACK – pronounced “t-pack”) is at the center of the above-mentioned knowledge bases. It is the latest form of knowledge and understanding that goes beyond the basic components of content, pedagogy, and technology, of teaching and learning (Mishra & Koehler, 2008; Koehler et al., 2013). It involves the knowledge of the interaction between content, pedagogy, and technology (Mishra & Koehler, 2008; Koehler et al., 2013). TPACK is further explained as the teacher’s synthesized knowledge of the knowledge areas described above with the intention to integrate technology to meet pedagogical needs within a specific context. It describes how teachers’ knowledge of educational technology interacts with PCK in ways that produce effective teaching and opportunities for learners’ learning (MaKinster & Trautmann, 2014).

TPACK encompasses the teacher’s ability to use technology to make teaching and learning easy. It involves the use of ICT to bridge barriers to learning (Koehler et al., 2013). This knowledge domain is about the teacher’s knowledge and ability to detect learners’ prior knowledge (Koehler et al., 2013). It enables teachers to apply technology timeously and continuously to create, maintain and re-establish a dynamic balance among content, pedagogy, and technology (Mishra & Koehler, 2008; Koehler et al., 2013).

According to Koehler & Mishra (2009, p. 66), TPACK is “effective teaching with technology, requiring an understanding of the representation of concepts using technology; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students’ prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones”. In short, it is the use of appropriate technology in content as part of a pedagogical strategy within a given educational context (Koehler et al., 2013; MaKinster & Trautmann, 2014).

The revised version of the TPACK framework was not part of this study but contextual knowledge can be pursued for further research on the topics of TPACK (Mishra, 2019).

3. METHODOLOGY

To investigate the e-readiness of student teachers’ ability to integrate ICT in their classrooms. This study employed a qualitative research approach. The study used an online questionnaire administered through the university’s Learner Management System (LSM).

3.1. Sample

Purposive sampling was used to identify participants used in the Sixty (60) student teachers, from a total population of about 600 student teachers that are in the 4th year of their B. Ed degree was used to identify participants in the study. A closed structured questionnaire was designed using a 5 Likert scale of agreements with the variables ranging from Strongly Agree (1); Agree (2); Neutral (3); Disagree (4) and Agree (5).

The structure of the questionnaire is framed around the Technological Pedagogical Content Knowledge (TPACK) model. This was done to identify the acquired and/or lacking knowledge domains regarding ICT integration in the classroom. Seven themes were identified according to the TPACK framework, these are Content Knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Knowledge (TK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), Technological Pedagogical Content Knowledge (TPACK).

3.2. Ethical issues

Ethical clearance was obtained from the Central University of Technology, Faculty of Humanities, and Research Committee (FRIC) before collecting data. The participants were provided with an online consent form regarding their participation. The online consent form explained the purpose of the study and informed the participants that they participate in the study freely and without coercion and that they can withdraw at any time should they choose to do so. The researcher requested the participants to give consent before the commencement of data collection. This was done to avoid any potential risk to participants and to ensure that the researcher’s methods are honest, fair, and non-manipulative (Cohen, Manion, & Morrison, 2018).

4. RESULTS & DISCUSSIONS

The aim of this study was to investigate the e-readiness of student teachers in the integration of ICT for digital education in COVID-19 times. The structure of the questionnaire was in the form of the seven (7) knowledge domains of the TPACK framework. Four statements were put in for each knowledge domain.

Table 1.
Student teachers’ Content Knowledge (CK).

	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
1	I have adequate knowledge about my specialization in the teaching subject	32(53,3%)	28(46,7%)	0(0%)	0(0%)	0(0%)	60(100%)
2	I can use subject-specific strategies of thinking in my specialization in the teaching subject	32(19%)	28(41,6%)	0(0%)	0(0%)	0(0%)	60(100%)
3	I know the basic theories and concepts of my specialization in the teaching subject	17(28,3%)	31(51,7%)	12(20%)	0(0%)	0(0%)	60(100%)
4	I know the history and development of important theories in my specialization in the teaching subject	7(11,7%)	32(53,3%)	12(20%)	8(13,3%)	1(1,7%)	60(100%)

This domain refers to the outstanding knowledge of the subject matter that teachers must have to teach. A teacher must have a thorough understanding of the subject matter or content that they are going to teach. Content knowledge requires teachers to have an understanding and deep knowledge of the subject area they are teaching (Shulman, 1987; Mishra & Koehler, 2006; Koehler et al., 2013). From the table above most of the respondents seemed to agree that they have been provided with adequate and required content knowledge to teach the subjects of their specialization. University lecturers seem to pay more attention to content knowledge (CK) and student teachers are mostly exposed to it (Doukakis et al., 2010).

Table 2.
Student teachers' Pedagogical Knowledge (PK).

	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
1	I can alter my teaching based on what students understand or do not understand	24(40%)	29(48,3%)	7(11,7%)	0(0%)	0(0%)	60(100%)
2	I can adapt my teaching style to different learners	24(40%)	29(48,3%)	7(11,7%)	0(0%)	0(0%)	60(100%)
3	I can use a variety of teaching approaches in a classroom setting	24(40%)	29(48,3%)	7(11,7%)	0(0%)	0(0%)	60(100%)
4	I can assess student learning in multiple ways for different learners	16(4,9%)	31(8,5%)	11(3,5%)	2(53,5%)	0(0%)	60(100%)

Pedagogical knowledge refers to a deepened understanding of strategies, methods, and processes that teachers should employ in the teaching and learning of their respective subject specializations. It involves a thorough understanding of the aims and objectives of a subject, the educational purpose and values of the subject, and the ability to plan activities that will make the learning of the subject easy and make the subject relevant and enjoyable to learners (Mishra & Koehler, 2006, 2008; Koehler et al., 2013). Most respondents agree that they can handle differentiated pedagogies. However, they are slightly not in agreement when it comes to the administering of assessments in their classrooms.

Table 3.
Student teachers' Pedagogical Content Knowledge (PCK).

	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
1	I know how to select effective teaching approaches to guide student thinking and learning	32(53,3%)	28(46,7%)	0(0%)	0(0%)	0(0%)	60(100%)
2	I know how to develop appropriate tasks to promote student's complex thinking	32(19%)	28(41,6%)	0(0%)	0(0%)	0(0%)	60(100%)
3	I know how to develop exercises with which students can consolidate their knowledge	17(28,3%)	31(51,7%)	12(20%)	0(0%)	0(0%)	60(100%)
4	I know how to evaluate student's performance in my teaching subject	7(11,7%)	32(53,3%)	12(20%)	8(13,3%)	1(1,7%)	60(100%)

PCK is about the knowledge and understanding of a subject matter taught, meaning the pedagogy of a specific subject. PCK relates to Shulman's (1986, p. 4) belief that "real teaching requires an understanding of both content and pedagogy". It does not require one to be just a content expert or just a pedagogy expert, but it requires teachers to have the expertise to match content with relevant pedagogy so that effective learning can take place (Mishra & Koehler, 2006). The indication is that student teachers are appropriately capacitated with the PCK. This is because most respondents either strongly agreed or agreed with the statements that they were well-capacitated with PCK.

Table 4.
Student teachers' Technological Knowledge (TK).

	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
1	I am aware of new technologies in education	13(21,7%)	14(23,3%)	22(36,7%)	9(15%)	2(3,3%)	60(100%)
2	I frequently latest technologies used in my subject specialization	13(21,7%)	14(23,3%)	22(36,7%)	9(15%)	2(3,3%)	60(100%)
3	I know about a lot of different technologies applied in education	9(15%)	13(21,7%)	21(35%)	12(20%)	5(8,3%)	60(100%)
4	I have the technical skills I need to use educational technology	9(15%)	13(21,7%)	22(36,7%)	12(20%)	4(6,6%)	60(100%)

The technological component of this framework was added to the original PCK framework of Shulman (1986) by Mishra and Koehler in 2006. They referred to this knowledge as the teachers' standard knowledge of technology, and the skills to operate technologies (Mishra & Koehler, 2006, 2008). TK requires a deep understanding and mastery of ICT so that they can access, process, and disseminate information (Graham, 2011). The technological knowledge is still a challenge to the respondents. Most of them are neutral about their knowledge of educational technologies while some indicated that they lack this kind of knowledge.

Table 5.
Student teachers' Technological Pedagogical Knowledge (TPK).

	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
1	I can choose appropriate technologies to enhance the teaching approaches for lessons	7(11,7%)	11(18,3%)	21(35%)	15(25%)	6(10%)	60(100%)
2	I can choose appropriate technologies that enhance students' learning	7(11,7%)	11(18,3%)	21(35%)	15(25%)	6(10%)	60(100%)
3	I can adapt the use of the technologies that I am learning about to different teaching activities	7(11,7%)	11(18,3%)	21(35%)	15(25%)	6(10%)	60(100%)
4	I can think critically about how to use educational technology in my classroom	7(11,7%)	11(18,3%)	21(35%)	15(25%)	6(10%)	60(100%)

TPK refers to the shared relationship between technology and pedagogy. It is defined as the teacher's knowledge and understanding of the use of technology devices that can advance the attainment of pedagogic goals (Koehler et al., 2013). It is the teacher's ability to select the most suitable tools or applications based on their appropriateness for the specific pedagogical approach (Koehler et al., 2013). TPK seems to be a challenge to the respondents

because the majority of them are neutral about the statements and a number of them are in disagreement with the statements.

Table 6.
Student teachers' Technological Content Knowledge (TCK).

	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
1	I know how technological developments have changed the field of my subject	3(11,7%)	10(18,3%)	17(35%)	19(25%)	11(10%)	60(100%)
2	I can explain which technologies have been used in research in my field	3(11,7%)	10(18,3%)	17(35%)	19(25%)	11(10%)	60(100%)
3	I know which new technologies are currently being developed in the field of my subject	2(11,7%)	8(18,3%)	18(35%)	20(25%)	12(10%)	60(100%)
4	I know how to use technologies to participate in scientific discourse in my field	2(11,7%)	8(18,3%)	18(35%)	20(25%)	12(10%)	60(100%)

TCK refers to the teacher's knowledge of the interchangeable relationship between technology and content (Koehler et al., 2013). It is simply the way content and technology influence and constrains one another (Mishra & Koehler, 2006, 2008). It characterizes the integration between what a teacher knows about applicable technological applications and about the topic of interest (MaKinster & Trautmann, 2014). The respondents have indicated that they lack knowledge of the technological developments in their subjects.

Table 7.
Student teachers' Technological Pedagogical Content Knowledge (TPACK).

	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
1	I can use strategies that combine content, technologies, and teaching approaches that I learned about in my coursework in my classroom	3(11,7%)	10(18,3%)	17(35%)	19(25%)	11(10%)	60(100%)
2	I can choose technologies that enhance the content for a lesson	3(11,7%)	10(18,3%)	17(35%)	19(25%)	11(10%)	60(100%)
3	I can select technologies to use in my classroom that enhance what I teach, how I teach, and what students learn	3(11,7%)	10(18,3%)	17(35%)	19(25%)	11(10%)	60(100%)
4	I can teach lessons that appropriately combine my teaching subject, technologies, and teaching approaches	3(11,7%)	10(18,3%)	17(35%)	19(25%)	11(10%)	60(100%)

Technological Pedagogical Content Knowledge (TPACK – pronounced “t-pack”) is at the center of the above-mentioned knowledge bases. It is the latest form of knowledge and understanding that goes beyond the basic components of content, pedagogy, and technology, of teaching and learning (Mishra & Koehler, 2008; Koehler et al., 2013). It involves the knowledge of the interaction between content, pedagogy, and technology (Mishra & Koehler, 2008; Koehler et al., 2013).

Data presented indicate that most of the respondents are still experiencing challenges with TPACK. The challenges are as a result that the knowledge base needed for pre-service teachers is multidisciplinary in its broadest sense and combines information from various fields, including educational technology, pedagogy and didactics, academic subject-matter discipline, educational psychology, and educational sociology (Irwanto, 2021). For pre-service teachers to be able to analyse, evaluate, and synthesize data from various disciplines to make meaningful connections and integrate the various disciplines to render them into reasoned decisions while utilizing ICTs in their teaching, the interdisciplinarity of their professional knowledge base is crucial. Therefore, the results above the respondents still lack a number of knowledge domains regarding TPACK.

5. FUTURE RESEARCH DIRECTIONS

The finding of the research study suggests further research into student teachers' technological pedagogical teaching practices during their preparation program. To determine the extent to which the intention to use ICTs in teaching does differ, comparative research between practicing novice and in-service instructors could be done later. Future research should look for efficient ways to integrate technical knowledge with pre-service teachers' understanding of pedagogy and didactics, knowledge of the subject matter being taught, knowledge of their students, and knowledge of the educational environment. Therefore, it is important to discover ways to include technology knowledge and its consequences (rather than just its practices) into the course profiles of pedagogy, educational psychology, educational sociology, and different subject methodologies. Based on these types of research findings, the researcher expects that educators, academics, and administrators would be able to construct course profiles that strengthen pre-service teachers' ICT teaching expertise from various fields of education.

6. CONCLUSION

Looking at the above discussions and analysis of the findings based on the research questions, the research draws the following conclusions. It seems CUT not equipping student teachers with adequate ICT integration skills, as a result, student teachers might have to cope with the demands of the digital education environment in COVID -19 times. Several suggestions can be made based on the findings of this study. Firstly, there are strong indications that student teachers can use ICTs in teaching with a moderate level of knowledge and skills. However, to meet the demands of the *Professional Development Framework for Digital Learning: Building Educator Competencies in Facilitating Learning with Digital Tools and Resources* (DBE, 2018) as set by the Department of Basic Education, the university education faculties should make more of an effort to prepare qualified future teachers. The suggested national strategy calls for incorporating the most recent ICT breakthroughs in education and anticipates that newly minted prospective teachers would be skilled at utilizing the pedagogical affordances of the emerging technologies to support their teaching of academic topics. The relevant goals stated by the *Action plan to 2019: Towards the*

Realisation of Schooling 2030 (DBE, 2015) require thorough proactive strategic planning to develop the ICT pedagogy-based expertise of pre-service teachers. The ultimate emerging case for all stakeholders in the faculty of education is to ensure that aspiring teachers are prepared to pursue the aims of the national education plan.

Second, and more specifically at the practice level, the results point to the need for the faculty of education to pay closer attention to student teachers' ICT pedagogical practices, practical experimentation, and promotion of reflection on these experiences to filter and archive what would be considered ICT pedagogy-based "good practices." Therefore, it is strongly advised that more proactive support be provided for the meaningful pedagogical use of technology in student teachers' practice. The most effective teaching tactics must be taken into consideration; hence it is crucial that teacher preparation programs give lecturers plenty of opportunities to practice using a range of ICTs. Thirdly, university administrators need to support technology use in higher education and teacher preparation programs that will help teachers across the country integrate technology into their classrooms in the future.

Finally, the study recommends that rather than being taught in separate "stand-alone" courses, pedagogical ICT knowledge building needs to be integrated into all facets of teacher education. Education software used and those anticipated for use in the near future should be made acquainted to students. By doing so, student teachers are not only ready for the classrooms of today, but they are also equipped with the skills and knowledge necessary to integrate technology into the teaching and learning of the future. Additionally, the results of this study emphasize that developing student teachers' awareness of the connections between ICT knowledge and other sciences of education is crucial if pre-service teachers are to be able to use their knowledge of ICTs and their pedagogical affordances, pedagogy, content, learners, and context to successfully teach a variety of subjects using technology. Also, this chapter proposes that student teachers be afforded in-service training immediately after completing their teacher qualifications. In-service training should be largely based on TPK, TCK, and TPACK.

REFERENCES

- Biggs, J., & Tang, C. (2011). *Teaching for quality learning at university: What the student does*. Berkshire, England: McGraw-Hill Education.
- Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education*. Los Angeles: SAGE Publications.
- Department of Basic Education (DBE). (2015). *Action plan to 2019: Towards the Realisation of Schooling 2030*. Pretoria: Department of Basic Education. Retrieved from <https://www.education.gov.za/Portals/0/Documents/Publications/Action%20Plan%202019.pdf>
- Department of Basic Education (DBE). (2018). *Professional Development Framework for Digital Learning: Building Educator Competencies in Facilitating Learning with Digital Tools and Resources*. Pretoria: Department of Basic Education. Retrieved from <https://www.education.gov.za/Portals/0/Documents/Publications/Digital%20Learning%20Framework.pdf?ver=2018-07-09-101748-95>.
- Doukakis, S., Psaltidou, A., Stavradi, A., Adamopoulos, N., Tsiotakis, P., & Stergou, S. (2010, July). Measuring the technological pedagogical content knowledge (TPACK) of in-service teachers of computer science who teach algorithms and programming in upper secondary education. Paper presented at the International Conference on Information Communication Technologies in Education (ICICTE, 2010), Corfu, Greece. <https://doi.org/10.48550/arXiv.2105.09252>
- Graham, C. R. (2011). Theoretical considerations for understanding technological pedagogical content knowledge (TPACK). *Computers & Education*, 57(3), 1953-1960. <https://doi.org/10.1016/j.compedu.2011.04.010>

- Guillén, I. R., Cuellar, M. P. G., & Alfaro, L. C. F. (2020). Using technologies in 21st Century: COVID-19 as an acceleration factor to virtualize the world. *International Journal of Innovative Science and Research Technology*, 5(8), 307-309. <https://doi.org/10.38124/ijisrt20aug254>
- Irwanto, I. (2021). Research Trends in Technological Pedagogical Content Knowledge (TPACK): A Systematic Literature Review from 2010 to 2021. *European Journal of Educational Research*, 10(4), 2045-2054. <https://doi.org/10.12973/eu-jer.10.4.2045>
- Jin, Y., & Harp, C. (2020). Examining preservice teachers' TPACK, attitudes, self-efficacy, and perceptions of teamwork in a stand-alone educational technology course using flipped classroom or flipped team-based learning pedagogies. *Journal of Digital Learning in Teacher Education*, 36(3), 166-184. <https://doi.org/10.1080/21532974.2020.1752335>
- Jung, J., & Ottenbreit-Leftwich, A. (2019). Course-level modeling of preservice teacher learning of technology integration. *British Journal of Educational Technology*, 51(2), 555-571. <https://doi.org/10.1111/bjet.12840>
- Karatza, Z. (2019). Information and Communication Technology (ICT) as a tool of differentiated instruction: An informative intervention and a comparative study on educators' views and extent of ICT use. *International Journal of Information and Education Technology*, 9(1), 8-15. <http://dx.doi.org/10.18178/ijiet>
- Kimmons, R., Graham, C.R., & West, R. E. (2020). The PICRAT model for technology integration in teacher preparation. *Contemporary Issues in Technology and Teacher Education*, 20(1), 176-198.
- Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, 9(1), 60-70.
- Koehler, M. J., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge (TPACK)? *Journal of Education*, 193(3), 13-19. <https://doi.org/10.1177/002205741319300303>
- Lake, R., & Dusseault, B. (2020, April). School systems make a slow transition from the classroom to the cloud. *Centre for Reinventing Public Education*. Retrieved from <https://crpe.org/school-systems-make-a-slow-transition-from-the-classroom-to-the-cloud/>
- MaKinster, J., & Trautmann, N. (2014). The Nature of Teacher Knowledge Necessary for the Effective Use of Geospatial Technologies to Teach Science. In, J. MaKinster, N. Trautmann & M. Barnett (Eds). *Teaching Science and Investigating Environmental Issues with Geospatial Technology: Designing Effective Professional Development for Teachers* (pp.333–353). New York: Springer Dordrecht.
- Mishra, P. (2019). Considering Contextual Knowledge: The TPACK Diagram Gets an Upgrade. *Journal of Digital Learning in Teacher Education*, 35(2), 76-78. <https://doi.org/10.1080/21532974.2019.1588611>
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017-1054.
- Mishra, P., & Koehler, M. J. (2008, March). Introducing technological pedagogical content knowledge. Paper presented at the Annual Meeting of the American Educational Research Association, New York City, NY.
- Ndebele, H. (2020). Exploring the challenges of information and communication technology localization in South African higher education: a language management approach. *International Journal of Multilingualism*, 19(3), 368-382. <https://doi.org/10.1080/14790718.2020.1717496>
- Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4-14. <https://doi.org/10.2307/1175860>
- Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1-23.

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Chapter # 28

EMPLOYER, INDUSTRY AND POLICYMAKER VIEWS ON DOCTORATE EDUCATION

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ABSTRACT

As society undergoes green and digital transitions, various policymakers such as the European Commission expect universities to contribute to innovation and progress. As education's highest achieving graduates, the doctorate holder may be key in this era of innovation and problem-solving. As academic career prospects dwindle, and PhD graduates increasingly enter industry, academic research has highlighted that traditional PhD programmes may not provide the required skills and knowledge for the workforce today. To learn how best to address such issues, we consulted thirteen EU policy documents and industry-led reports; and interviewed thirteen employers to add their voice to the discussion. Findings align with previous reports of a lack of transferable skills, but also introduce new concerns such as the desire for adaptability, experience, and redefining skills with regards to self-presentation. We discuss interdisciplinarity and intersectorality as potential solutions to addressing these needs.

Keywords: doctoral education, practice perspective, programme design, skill acquisition, PhD programmes.

1. INTRODUCTION

As time passes and we become more reliant on technology, policymakers highlight the importance of universities in preparing a highly skilled workforce equipped to deal with the modern challenges of a more technologically advanced and sustainable future, otherwise coined as the Transformative Age (Directorate General for Education, Youth, Sport, and Culture [DG EAC], 2020; Lutin, 2020). Universities are now considered a major player in this societal development (Cardoso, Tavares, & Sin, 2019). However, a distinct lack of transferable skills and practical experience has led many employers to dismiss the potential of universities' most educated prospective workforce: the doctoral graduate (Cui & Harshman, 2020).

The introduction of interdisciplinary and intersectoral doctoral programmes aims to tackle these past criticisms of overspecialization and isolation by placing doctoral graduates in new environments where they must learn to adapt and work in complex teams thus better preparing them for the future work environment (Cardoso et al., 2019; Celis & Acosta, 2016; Cui & Harshman, 2020; Germain-Alamartine & Moghadam-Saman, 2020; Patricio & Santos, 2019) be it in industry or indeed in academia.

This chapter begins with an insight into the background and context of the study, followed by a discussion of our methods, our findings across three main themes and their sub-themes, and concludes with a discussion section and implications for future research.

2. BACKGROUND

Today, unique skills and knowledge are key drivers in innovation, as opposed to their material counterparts of the past such as land and labour capital (Celis & Acosta, 2016). Policymakers such as the European Union acknowledge this shift, and thus have set out strategies for skills and knowledge attainment towards an overall increase competitiveness in the global market (Haapakorpi, 2017). The Lisbon Strategy, for example, advocates investing into higher education to create “the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion” (European Parliament, 2009, p. 1). This push to develop skills and knowledge has created a knock-on effect for employers, whose demands for education have increased. The result is a push towards the highest levels of education one can complete (Santos, Veloso, & Urze, 2020). The doctorate is the ultimate form of educational attainment and as such, carries a highly respected reputation for knowledge and problem-solving. Traditionally, earning a doctorate came with an intense yet solitary research workload. Recent years, however, have seen the growth of alternative, more socialized, paths to achieving a doctorate utilizing interdisciplinary or intersectoral elements (Briehl, et al., 2016; Dasgupta, Symes, & Hyman, 2015; Donina, Seeber, & Paleari, 2017; Golembiewskih, Holmes, Jackson, Brown-Podgorski, & Menachemi, 2018).

As more people pursue a doctorate, competition increases and availability of academic posts decreases. Many doctorate holders therefore find themselves struggling to secure permanent academic employment and/or funding after their studies (Alfano, Gaeta, & Pinto, 2021; Gallemí-Pérez & Chávez-Medina, 2021). Past critiques of overspecialization and a lack of real-world applicability of their work have forced universities and doctorate candidates to re-evaluate their preparedness for careers and goals outside of academia (Caliskan & Holley, 2017; Cui & Harshman, 2020). Studies have also shown that overspecialized doctorate holders report decreased job satisfaction and earnings, or are underpaid for their extensive qualifications in comparison to non-doctoral professional peers (Germain-Alamartine & Moghadam-Saman, 2020, Haapakorpi, 2017). Unless they hold a record of industry-specific competence, doctorate holders are frequently disregarded by employers outside of the academy (Haapakorpi, 2017).

This presents a paradox in which those who are considered among the most knowledgeable and talented problem-solvers, are also considered unhelpful in solving many of the global issues we face and unable to make contributions to innovation and progress in industries. As Neumann and Tan put it, “[a]cknowledgment of the important role of the training of doctoral graduates also recognizes that a knowledge economy requires research careers beyond the traditional academic career” (Neumann & Tan, 2011, p. 603).

In this chapter we set out to help address some of these issues raised, by including practitioner voices in the discussion, most notably policymakers and employers. We do so through review of thirteen policy documents and industry reports, alongside thirteen interviews with employers. In doing so, we aim to bring the academic and practice perspectives together to identify shared targets in improving employability within doctorate education. Additionally, we seek to highlight key areas for improvement that are less discussed in the purely academic conversation.

Therefore, our research questions are as follows.

1. What skills do policy-makers and industry-based employers seek in graduates today, particularly at the doctorate level?
2. What steps can we take to build these skills in doctoral candidates?

3. METHOD

Our multimethod study includes a) a systematic review of thirteen policy and industry reports relating to doctoral education; and b) thirteen in-depth semi-structured interviews with PhD employers or experts in PhD recruitment/placement. The systematic review process included three sources of non-academic reports and policy documents:

1. Directorate General for Education, Youth, Sport and Culture strategy and plans.
2. EU level policy reports citing doctoral education.
3. Big 4 (KPMG, PwC, EY, Deloitte) consulting reports citing doctoral education.

The first search was conducted within the Directorate General for Education, Youth, Sport and Culture website while the second and third searches were conducted using Google's advanced search function. Filters applied were as follows: pdf format documents, English language, and that the website had been updated in the last year. These filters ensured a level of formality, the author's ability to analyse the information, and the currency of the documentation respectively. Each document was then reviewed using the qualitative data analysis software NVivo.

Interviewees for the semi-structured interviews were identified in the first instance through an international doctoral education consortium, spanning multiple countries including Ireland, Spain, Greece, and Finland. Further interviewees were then added through a snowball sampling approach. Having first obtained informed consent, interviews were conducted virtually using Microsoft Teams. They lasted an average of 34 minutes and ranged between 18 to 52 minutes. Interviews took a semi-structured approach and as themes began to emerge, questions evolved through an iterative process. All interviews were recorded, transcribed verbatim and analysed inductively using NVivo. This involved a three-step process of coding, beginning with open coding before progressing to selective coding and finally, theoretical coding (Glaser & Strauss, 2017). An overview of the interviewee locations, occupations, and the length of each interview is provided in Table 1 below.

Table 1.
Overview of interviews.

Interview No.	Country	Occupation	Duration
Interviewee A	Spain	Co-founder, medical informatics company	40 mins
Interviewee B	Spain	Medical Director, pharmaceutical company	52 mins
Interviewee C	Finland	Market Research Analyst, health research clinic	27 mins
Interviewee D	Ireland	Head of Innovation, technology MNC	30 mins
Interviewee E	Portugal	HR Director, private clinic and hospital group	43 mins
Interviewee F	Ireland	Co-founder, sports wearables company	32 mins
Interviewee G	Ireland	Supervisor, hospital-based research institute	39 mins
Interviewee H	Ireland	Founder, social media marketing company	34 mins
Interviewee I	Ireland	Principal Investigator, national software research center	45 mins
Interviewee J	Ireland	Director, national data analytics research center	30 mins
Interviewee K	Spain	Head of Innovation, healthcare NGO	20 mins
Interviewee L	Ireland	Careers Guidance Counsellor, university	34 mins
Interviewee M	Ireland	Data Analyst, national health organization	18 mins

4. CHARACTERISTICS OF THE REPORTS REVIEWED

Of our thirteen documents, eight of those (61.5%) were published by governmental bodies and policymakers, all of which were based in Europe. The remaining five documents were all consultant reports, with headquarters in the Netherlands (40%), United Kingdom (40%), and Switzerland (20%). Only one document was published in 2018 (approximately 8%), with one published in 2019 (8%), eight published in 2020 (61.5%) and two published in 2021 (approximately 15.3%).

It must be noted that of those published in 2020, all eight (100%) of those documents were published in the months following the outbreak of the COVID-19 pandemic. The months of publication for 2020 were as follows: one in May (12.5%), one in June (12.5%), three in September (27.5%), two in October (25%), one in November (12.5%) and one in December (12.5%). Interestingly, the only two documents to be published in 2020 (that were published by a consultant firm) were published in May and June – an entire season before the others.

Table 2.
Overview of policy and industry documents

Search	Documents Retrieved and Analysed
<p>DG Education</p>	<p>1. European Commission, (2020), <i>Commission Work Programme 2021: A Union of Vitality In A World Of Fragility</i>, Brussels, 19.10.2020 Com (2020) 690 Final Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions.</p> <p>2. <i>Strategic Plan 2020-2024</i> Directorate General for Education, Youth, Sport, and Culture Ref Ares (2020)4764872 – 11/09/2020</p>
<p>EU level policy</p>	<p>3. European Parliament, <i>The future of tertiary education in Europe</i>, Authors: Denise Chircop, Cemal Karakas, Monika Kiss and Marcin Szczepanski, with Lea Schomaker Members' Research Service PE 652.095 – September 2020</p> <p>4. <i>Tracking the careers of doctorate holders</i>, EUA-CDE Thematic Peer Group Report, October 2020</p> <p>5. EUA (European University Association), <i>Perspectives on the new European Research Area from the university sector</i>, December 2020</p> <p>6. Mark Whittle, James Rampton, <i>Towards a 2030 Vision on the Future of Universities in Europe</i> Policy Report, Independent Expert Report, Centre for Strategy & Evaluation Services LLP (CSES) September – 2020</p> <p>7. <i>Yerun Annual Report 2020</i></p> <p>8. Eurodoc, <i>Policy Input for European Higher Education Area: Focus on Doctoral Training and Doctoral Candidates</i>, Brussels, Nov 2020</p>
<p>Consultant reports</p>	<p>9. KPMG (2019) <i>Future-proofing the University</i></p> <p>10. KPMG (2020) <i>The future of higher education in a disruptive world</i></p> <p>11. Deloitte Insights, <i>Superlearning</i>, 29 June 2020</p> <p>12. World Economic Forum (in collaboration with PwC) <i>Upskilling for Shared Prosperity INSIGHT REPORT JANUARY 2021</i></p> <p>13. EY (2018), Halloran & Friday, <i>Can the universities of today lead learning for tomorrow? The University of the Future</i></p>

5. FINDINGS

Findings highlight firstly, the changing world of employment and universities as society undergoes green and digital transitions; secondly, the skills required of employees; and thirdly, the steps taken by universities to address these needs in the form of interdisciplinarity and intersectorality in doctoral programmes.

5.1. Universities and Work in Changing Contexts

In the past, universities were viewed as central hubs for education. However, the role has now changed to include contribution to innovation and societal development (Cardoso et al., 2019). There are “growing expectations that universities will not only undertake their core pedagogical function and carry out research, but also engage in other activities, such as contributing to the development of culture, cooperating outside academia, citizen engagement in research and science carried out by universities through societal outreach, and the use of research to tackle societal challenges” (Whittle & Rampton, 2020, p. 15). The world of work has changed also, thanks to more efforts in sustaining our planet, and advances in technology that were further accelerated by the COVID-19 global pandemic and mainstreaming of remote working options (European Commission, 2020; Lutin, 2020).

5.1.1. Green and Digital Transitions

This changing role of universities is due to multiple factors, some of which include the green and digital transitions our society is going through (European University Association [EUA], 2020; DG EAC, 2020). Green and digital transitions refer to the growth of technology and steps towards sustainability.

These green and digital transitions are a priority for policymakers and industry, especially within the European Union as the EU strives to be a global leader in innovation and societal change (European Commission, 2020). As such, it is critical for universities to be aware of this when preparing graduates, including those at the doctorate level, for the changing nature of work. Deloitte explain that this change to the nature of work is due to “technology innovation, a growing demand for new competencies, changing employee expectations, shifting labour demographics and inclusion/diversity strategies, new workforce models, and the evolving business environment with all its regulatory changes” (Lutin, 2020, p. 1).

In terms of the digital transition in particular, it is important that we are “ensuring strong collaboration and smart specialization between universities, research centers and firms, and adequate availability of skills” (DG EAC, 2020, p. 9). To do so, DG EAC (2020) suggest four key criteria for successful digital transition:

1. New environments that are conducive to collaboration and innovation;
2. Stronger innovation capabilities across both academia and the research sector;
3. A new generation of entrepreneurial people; and
4. The creation and the development of innovative ventures.

As previously mentioned, the pandemic has further accelerated these transitions. Not only did we become more heavily reliant on technology, we also reassessed the way we live and the impact that we have on our environment. “Changes in climate, digital technologies and geopolitics were already profoundly affecting our society and driving our agenda. However, the pandemic has sharpened the need for Europe to lead the twin green and digital transitions and make its societies and economies more resilient. This creates an unparalleled opportunity to move out of the fragility of the crisis by creating a new vitality for our Union” (European Commission, 2020, p. 1-2).

5.2. Skills for The Workforce

With the changes in how we work, it is unsurprising that both the practitioner literature and the employer interviews revealed that employers seek skills in potential employees that may not be addressed in traditional PhD programmes. Transferable skills are among those most mentioned, though other factors such as experience and adaptability are also deemed desirable in working on the “fast and small projects” of industry (Interviewee C).

5.2.1. Transferable Skills

Another priority for practitioners is ensuring that the correct skills are developed within university programmes. The European Council of Doctoral Candidates and Junior Researchers, calls for quality standards that encourage transferable skills training in doctoral programmes (European Council of Doctoral Candidates and Junior Researchers [Eurodoc], 2020). The Council Conclusions also note the need to broaden researchers’ skills and competences and propose an enhanced European Competence Framework for Research Careers (Eurodoc, 2020).

The topic of transferable skills is not new, particularly in doctoral education. Transferable skills, otherwise known as soft skills, are those that can be applied across disciplinary and professional boundaries (Haapakorpi, 2017). Some of the most commonly sought transferable skills include communication, teamwork, time management, organization and project management (Interviewee A, B, D, F & L). As put by Interviewee J, “there’s a greater need for individuals that have a broad based set of skills that are connected and interrelated and can look at a problem from a number of different angles”. Despite their applicability to a range of career paths and their attractiveness to future employers, traditional doctorate programmes do not typically invest in the development of these ‘soft skills’ (Cui & Harshman, 2020; Donina et al., 2017; Germain-Alamartine & Moghadam-Saman, 2020; Slota, McLaughlin, Bradford, Langley, & Vittone, 2018).

Employers explained that they were happy to train or provide financial supports for external training and technical development (dependent on budget constraints and size of organization). This stood in contrast to transferrable skills. Although these were valued by employers, employees were expected to develop such skills without employer support, as Interviewee E admitted their company’s hesitancy around “personal development” in favour of “professional development”. They stated plainly, “We are far away from doing a good job there” (Interviewee E). However, the most common apprehension surrounding the hiring of doctorate holders was their apparent lack of such skills. Interviewee G suggested that transferable skills were inherent already, and so employers should be expected to focus on developing ‘hard skills’ such as “knowing how to use microscope” or “comparing a drug response”, with Interviewee C additionally naming AI, machine learning and software development as a few other examples. The soft skills were viewed as something only the individual themselves could truly develop, as Interviewee G encouraged doctoral candidates and employees to reflect on career goals and capabilities independently. They explained, “I think it’s a mind shift” and referred to lifelong learning, which Interviewee I later described as a skill in itself.

5.2.2. Adaptability and Experience

Innovation and collaboration are also key according to employers. Interviewees mentioned that teamwork was important for the organization’s success as it allowed them to stay one step ahead of their competitors. However, the traditional isolation of doctoral programmes led some employers to believe that doctoral graduates – despite their expert knowledge – were not valuable assets to the organization as they lacked adaptability to the

fast-paced environment in industry (Interviewees C and H). Knowledge was only one of the criteria considered in the hiring process. Experience in a professional setting was also highlighted as strengthening one's application; "I look for particular experiences, like if I see someone who has worked in retail trade... You can have all the theory in the world, but unless you can actually learn how to apply it in a scenario, you haven't learned anything" (Interviewee H). Both would make it easier for the candidate to fit into the organization on both a technical level and personal level, the latter taking priority in some cases. "I've been faced with a choice between two people at an interview scenario, and the one that the one that on paper looks best is not the one I choose, because I just don't think they fit...I can imagine them having pints in the pub with the rest of the team...going to somebody's wedding in the team in five years time. That's the person you want to have on your team" (Interviewee J).

Interviewee G mentioned that regular evaluation sessions would occur every two months, whereby employees had the opportunity to discuss their current performance and if they wished, could request to move to a different role or department they thought best suited their skills and interests. However, a lack of confidence often resulted in doctorate holders struggling to voice their opinions. This in turn meant that they often missed out on opportunities to be flexible in their work and explore multiple options to find what best suited their interests and skill set (Interviewee G).

5.2.3. Personality as a Skill?

Building on the topic of confidence, when asked about particular skills that employers may seek in potential employees, our interviewees not only mentioned transferable skills, but also began to list skills that we, the authors, had previously thought of as personality traits. Some of these examples included confidence and a positive attitude (Interviewees H and J), resilience (Interviewee A), and determination (Interviewee F). Interviewee I even suggested that learning in itself was a skill and that self-awareness of one's strengths, weaknesses, and opportunities to develop, was key to honing it. It is worth noting however, that resilience specifically was also described as a skill by the DG EAC (2020) though this was linked to the pressure placed by the COVID-19 pandemic.

Interviewees G and I noted that as people who frequently worked with doctorate students or holders, they wished more doctorate holders would see themselves as being on an equal footing with supervisors or employees and not be afraid to challenge or suggest their own ideas. Interviewee C noted that doctorate holders often possessed many of the skills sought by employees yet were not made aware of how such skills can be demonstrated to future employers. Their university did not focus on how such skills could be marketed to achieve careers outside of the academy. This was borne out by Interviewee C's own experience as a graduate seeking employment: a collaboration with an industry organization helped Interviewee C to realize their potential to employers and to develop a market mindset. They acknowledged that this was not the case for their doctorate peers, who had very little interaction outside of their home discipline or institution.

Stereotypes of doctorate holders painted a generalization of 'loner' personality types, with Interviewee E commenting that "you wouldn't have a PhD in a sales role" where they may be expected to deal with customers or work in teams. Interviewee H echoed this sentiment, as they explained that different roles required different personalities and viewed doctorate holders as "super specialists" that were unsuited to B2B (Business to Business) marketing or customer service roles unless they had shown previous retail experience. Interviewee E often placed doctorate holders in technical positions towards "the back" of the organization. Despite academics often collaborating with each other, industry practitioners

were not aware of such work and assumed that doctorate holders were not suited to working with others and did not think of them as team players. With teamwork consistently named as one of the most desirable soft skills by employers, this outdated stereotype is worrying but highlights that practitioners are not fully aware of the goals and procedures within academia particularly at the doctorate or post-doctorate level.

Interviewee E disagreed that personality is a key requirement in their employees, but noted that personal values were important. Being able to identify with the values and culture of the organization was key and supported Interviewee J's previous comments on seeking employees who fit personally with the organization.

5.3. Interdisciplinarity and Intersectorality

Two ways of introducing opportunities to build adaptability and provide professional experience to doctoral students are through interdisciplinarity and intersectorality in the design of the PhD programme. Interdisciplinarity - the act of working with and transferring knowledge from different disciplines to one's own - has become increasingly visible in doctoral education (Kemp & Nurius, 2015; Mountford et al., 2018, Mountford et al., 2020). Interdisciplinarity provides students with new perspectives and methods of working, which employers mentioned as one particular way of bringing much needed diversity to their organization (Interviewee I). Industry leaders also highlight the importance of interdisciplinarity, with statements that futureproofing will require "building mechanisms so that understanding of the world outside Universities is drawn in systematically and across the full range of academic disciplines." This will allow universities to "shape the work of businesses through their research and teaching innovations which capitalize on new technologies, processes and approaches" (Andrew & Bagshaw, 2019, p. 12).

Interviewee I reflected on their own academic and professional journey, as they praised the benefits of interdisciplinary elements in higher education, "Now computing is everywhere. So, we have to really know and understand more about the areas within which we're working. And obviously, we're never going to get everything. But the fact that we have been trained to work with one interdisciplinary group and to break out of our silos is really good". Interviewee H explained, "Some of the employees here wouldn't have a business background, but yet they have the right attitude. One of the top employees actually has a background in chemistry and yet, she has the ability to have a very deep understanding of the meaning of marketing".

Intersectorality, whereby universities will work in collaboration with industry, is also on industry and policymaker radars (DG EAC, 2020). EUA stresses that universities are well able to equip researchers with the necessary basic and advanced skills to meet current technological and societal challenges. At the same time, universities also engage in and co-implement numerous collaborations with partners outside of academia. Through collaborative doctoral education schemes, universities foster the involvement of public and private sector actors in doctoral training" (EUA, 2020, p. 13).

Chircop, Karakas, Kiss, and Szczepanski (2020) paint a picture of an ideal industry-academia interaction where "both the expectations of industry and those of academia are satisfied to a similar extent and an equal partnership develops" (p. 14). These collaborations are "strategic and long-term. They are built around a shared research vision and may continue for a decade or beyond, establishing deep professional ties, trust and shared benefits, which can bridge the important cultural difference between academia and industry. Ideally, they are led by individuals who understand both the academic and business world" (p. 14). This is not an unpopular vision, as "[s]ome 97 % of Europeans think that it is useful for students to work on innovative projects with researchers and companies from

different countries. EU graduates who underwent some work-based experiences during their studies also reported better prospects in a graduate tracking survey conducted by the European Commission” (Chircop et al., 2020, p. 16).

Whittle and Rampton (2020) identify a need to increase the intersectoral mobility of academics and researchers: “Whilst there remains a need for many academics to work in-depth within their own disciplines, two trends are increasing the need for inter-sectoral and inter-disciplinary mobility amongst researchers: first, the trend towards short-term funding for research positions at R2 and R3 levels in general; this is requiring researchers to change roles within academia or even into and out of other sectors; second, many of the key challenges facing society require solutions that draw on and combine expertise from different academic disciplines and with expertise from non-academic sectors. There is therefore a need to develop a mix of specialist and transversal competences, which typically requires a degree of inter-sectoral and inter-disciplinary mobility, although such mobility will take very different forms and vary across different disciplines” (p. 88-89).

Interviewee J revealed that intersectoral collaborations formed the basis of much of their hiring strategy, as they got to know and work with students over the course of their studies and research: “You know, I've had quite a lot of examples of people who have completed an undergraduate final year project with me. And then I kind of got to know them that way. And then they came to do a master's that turned into a PhD and then we'd recruit them as a postdoc”. Not only did these intersectoral collaborations provide an opportunity to build their job mobility, but they also expanded the networks of PhD candidates which they later used as an asset in their job search. Interviewee F supported this idea, as they revealed they frequently hired those from their networks “because of the benefits that gave serenity of knowing the person or knowing, you know, the person that can vouch for them”.

6. FUTURE RESEARCH DIRECTIONS

The changing nature of work has been accelerated by the Covid-19 pandemic, resulting in an even greater need now for technological capabilities and greener innovation. Previous academic literature reviews did not explicitly mention such digital or green transitions (Leniston & Mountford, 2021). This highlights another way in which academia and practice are disconnected – not just doctoral education in practice but also the way in which we study and learn about doctoral education itself.

Most notably though, academics' previous understanding of ‘soft’ or transferable skills were along the lines of teamwork, time management, organization and other task-related capabilities (Cui & Harshman, 2020; Germain-Alamartine & Moghadam-Saman, 2020; Kitchin, 2015; Patterson et al., 2019). The practice perspective extends the concept of ‘hard’ or technical skills versus soft skills, adding a third category of skills: those based on what might previously have been considered personality traits. This raises questions as to whether such skills are intrinsic or can be trained – and if so, how? This may imply that other disciplines, such as psychology, can further contribute to this understanding of the practice perspective and how best to implement measures into doctoral education programmes to meet industry demands.

This is crucial as employers explained that their organizations were happy to provide the funds or resources required for their employee's technical development. Yet when it came to personal development and transferable skills, something they described as key to the organization, employees were left to figure it out for themselves. One of the interviewees mentioned that regular evaluation sessions were common in their research institute and that employees could have the choice to move to a different position should they wish.

The confidence lacking in doctoral graduates particularly meant that many would struggle to communicate their concerns and thus miss out on flexibility and valuable opportunities to work in positions better suited to their interests. This further exemplifies why doctoral education must develop transferable skills and promote the strengths of a doctoral degree in a multitude of roles and sectors. In doing so, this will also promote adaptability to doctoral students with opportunities to work in teams and/or professional environments where such skills can be developed and highlight doctoral graduates' potential to otherwise hesitant employers.

7. CONCLUSION/DISCUSSION

Society is undergoing major changes in how we work, think, and operate, through a drive towards sustainability and an increased dependency on emerging technologies. Policymakers such as the European Commission highlight this changing world and call for universities and their students to play a role in both innovation and societal development. Doctorate holders are among those who are most knowledgeable, at least on paper. However, criticisms of their overspecialization and lack of transferable skills have meant that employers often shy away from hiring them. As competition for academic jobs increases, doctorate holders must broaden their options and skillset to embrace a variety of career options.

Despite their relevancy to the discussion, employers' voices have been less prominent in the academic literature. Through our interviews, we confirmed the importance of transferable skills, but also found that stereotypes of overspecialized loners led to employers dismissing the potential of doctorate holders in favour of those with a record of adaptability and social skills. The line between what constitutes a skill and personality traits is blurred, leading us to ask whether attributes such as confidence, positive attitude, and resilience can be trained.

We suggest that the challenges presented in working in interdisciplinary teams or intersectoral projects with those outside of academia may provide opportunities to gain experience at adapting to new environments, and develop the desired transferable skills such as communication, teamwork, time management, organization and project management. We invite other researchers to investigate the topic further, in order to strengthen the relevancy of doctoral education for its future graduates and society.

REFERENCES

- Alfano, V., Gaeta, G., & Pinto, M. (2021). Non-academic employment and matching satisfaction among PhD graduates with high intersectoral mobility potential. *International Journal of Manpower*, 42(7), 1202-1223. <https://doi.org/10.1108/ijm-10-2020-0489>
- Andrew, J., & Bagshaw, A. (2019). *Future-proofing the university: An approach to strategic collaboration*. Sheffield: KPMG. Retrieved June 14, 2021, from <https://assets.kpmg.com/content/dam/kpmg/uk/pdf/2019/03/future-proofing-the-university.pdf>
- Briehl, M.M., Nelson, M.A., Krupinski, E.A., Erps, K.A., Holcomb, M.J., Weinstein, J.B. & Weinstein, R.S. (2016). Flexner 2.0—Longitudinal Study of Student Participation in a Campus-Wide General Pathology Course for Graduate Students at The University of Arizona. *Academic Pathology*, 3. <https://doi.org/10.1177/2374289516680217>
- Caliskan, O., & Holley, K. (2017). Doctoral student support programs in diverse national contexts. *Journal of Applied Research in Higher Education*, 9(4), 565-576. <https://doi.org/10.1108/jarhe-12-2016-0095>

- Cardoso, S., Tavares, O., & Sin, C. (2019). Can you judge a book by its cover? Industrial doctorates in Portugal. *Higher Education, Skills and Work-Based Learning*, 9(3), 279-289. <https://doi.org/10.1108/HESWBL-05-2018-0056>
- Celis, J., & Acosta, O. (2016). Industrial Ph.D. Programs for the strengthening of the industry's production of innovation in Colombia. *Innovar*, 26(62), 129-146. <https://doi.org/10.15446/innovar.v26n62.59393>
- Chircop, D., Karakas, C., Kiss, M., & Szczepanski, M. (2020). *The future of tertiary education in Europe*. Brussels: European Parliamentary Research Service. Retrieved June 14, 2021, from [https://www.europarl.europa.eu/RegData/etudes/IDAN/2020/652095/EPRS_IDA\(2020\)652095_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/IDAN/2020/652095/EPRS_IDA(2020)652095_EN.pdf)
- Cui, Q., & Harshman, J. (2020). Qualitative Investigation to identify the knowledge and skills that US-trained doctoral chemists require in typical chemistry positions. *Journal of Chemical Education*, 97(5), 1247-1255. <https://doi.org/10.1021/acs.jchemed.9b01027>
- Dasgupta, S., Symes, K., & Hyman, L. (2015). Leading change: Curriculum reform in graduate education in the biomedical sciences. *Biochemistry and Molecular Biology Education*, 43(2), 126-132. <https://doi.org/10.1002/bmb.20862>
- Directorate General for Education, Youth, Sport, and Culture. (2020). *Strategic Plan 2020-2024*. Brussels: European Commission. Retrieved June 14, 2021, from https://commission.europa.eu/system/files/2020-10/eac_sp_2020_2024_en.pdf
- Donina, D., Seeber, M., & Paleari, S. (2017). Inconsistencies in the governance of interdisciplinarity: The case of the Italian higher education system. *Science and Public Policy*, 44(6), 865-875. <https://doi.org/10.1093/scipol/scx019>
- European Parliament (2009). *Directorate-General for Internal Policies Committee on Employment and Social Affairs: Briefing note for the meeting of the EMPL Committee 5 October 2009 regarding the exchange of views on the Lisbon Strategy and the EU cooperation in the field of social inclusion*. Retrieved February 10, 2023, from https://www.europarl.europa.eu/meetdocs/2009_2014/documents/empl/dv/lisbonstrategybn_lisbonstrategybn_en.pdf
- European Commission (2020). *Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions: Commission Work Programme 2021*. Brussels: European Commission. Retrieved June 14, 2021, from https://eur-lex.europa.eu/resource.html?uri=cellar:91ce5c0f-12b6-11eb-9a54-01aa75ed71a1.0001.02/DOC_1&format=PDF
- European Council of Doctoral Candidates and Junior Researchers. (2020). *Eurodoc Policy Input for European Higher Education Area: Focus on Doctoral Training and Doctoral Candidates*. Brussels: Eurodoc. Retrieved June 14, 2021, from http://www.eurodoc.net/sites/default/files/news/2020/11/17/attachments/eurodocpolicyinputfor_ehea-2020.pdf
- European University Association. (2020). *Perspectives on the new European Research Area from the university sector*. Brussels: EUA. Retrieved June 14, 2021, from https://eua.eu/downloads/publications/eua%20policy%20input_perspectives%20on%20era%20from%20the%20university%20sector.pdf
- European University Association Council for Doctoral Education. (2020). *Tracking the careers of doctorate holders*, EUA-CDE Thematic Peer Group Report, October 2020
- Gallemlí-Pérez, A., & Chávez-Medina, V. (2021). Current and future challenges in interdisciplinary Ph.D. education as perceived by students. *Communications Physics*, 4(1), 1-5. <https://doi.org/10.1038/s42005-020-00497-w>
- Germain-Alamartine, E., & Moghadam-Saman, S. (2020). Aligning doctoral education with local industrial employers' needs: A comparative case study. *European Planning Studies*, 28(2), 234-254. <https://doi.org/10.1080/09654313.2019.1637401>
- Glaser, B. G. & Strauss, A. L., 2017. *The discovery of grounded theory: Strategies for qualitative research*. Routledge.
- Golembiewskih, E. H., Holmes, A.M., Jackson, J. R., Brown-Podgorski, B. L., & Menachemi, N. (2018) Interdisciplinary dissertation research among public health doctoral trainees, 2003-2015. *Public health reports*, 133(2), 182-190. <https://doi.org/10.1177/0033354918754558>

- Haapakorpi, A. (2017). Doctorate holders outside the academy in Finland: Academic engagement and industry-specific competence. *Journal of Education and Work*, 30(1), 53-68. <https://doi.org/10.1080/13639080.2015.1119257>
- Halloran, L., & Friday, C. (2018). *Can the universities of today lead learning for tomorrow?* Australia: EY. Retrieved June 14, 2021, from <https://cdn.ey.com/echannel/au/en/industries/government---public-sector/ey-university-of-the-future-2030/EY-university-of-the-future-2030.pdf>
- Kemp, S. P., & Nurius, P. S. (2015). Preparing emerging doctoral scholars for transdisciplinary research: A developmental approach. *Journal of Teaching in Social Work*, 35(1-2), 131-150.: <https://doi.org/10.1080/08841233.2014.980929>
- Kitchin, R. (2015). Undertaking PhD research in human geography in Ireland. *GeoJournal*, 80(2), 239-242. <https://doi.org/10.1007/s10708-014-9576-4>
- KPMG. (2019). *Future-proofing the University*. Retrieved February 10, 2023 from <https://assets.kpmg.com/content/dam/kpmg/uk/pdf/2019/03/future-proofing-the-university.pdf>
- KPMG. (2020). *The future of higher education in a disruptive world*. Retrieved February 10, 2023 from <https://assets.kpmg.com/content/dam/kpmg/xx/pdf/2020/10/future-of-higher-education.pdf>
- Leniston, N., & Mountford, N. (2021) Born or made - Can interdisciplinary and intersectoral doctorate education create institutional entrepreneurs? A systematic review. In J. Domenech, P. Merello, & E. de la Poza (Eds.), *Proceedings of the 7th International Conference on Higher Education Advances (HEAD'21)* (pp.791-798). Valencia, Spain. <https://doi.org/10.4995/head21.2021.12960>
- Lutin, L. (2020, June 29). *Superlearning: Reskilling, upskilling and outskilling for a future-proof workforce*. Belgium: Deloitte. Retrieved June 14th, 2021, from <https://www2.deloitte.com/us/en/insights/focus/technology-and-the-future-of-work/reskilling-the-workforce.html>
- Mountford, N., Dorrzoro Zubiete, E., Kessie, T., Garcia-Zapirain, B., Nuño-Solinis, R., Coyle, D. ... & Caulfield, B. (2018). Activating Technology for Connected Health in Cancer: Protocol for a Research and Training Program. *JMIR Research Protocols*, 7(1). <https://doi.org/10.2196/resprot.8900>
- Mountford, N., Coleman, M., Kessie, T., & Cusack, T. (2020) Interdisciplinary doctoral research networks: enhancers and inhibitors of social capital development. *Studies in Higher Education*, 45(12), 2558-2573. <https://doi.org/10.1080/03075079.2019.1623768>
- Neumann, R., & Tan, K. K. (2011). From PhD to initial employment: the doctorate in a knowledge economy. *Studies in Higher Education*, 36(5), 601-614. <https://doi.org/10.1080/03075079.2011.594596>
- Patricio, M. T., & Santos, P. (2020). Collaborative research projects in doctoral programs: A case study in Portugal. *Studies in Higher Education*, 45(11), 2311-2323. <https://doi.org/10.1080/03075079.2019.1607282>
- Patterson, C.A., Chang, C., Lavadia, C.N., Pardo, M.L., Fowler, D.A., & Butler-Purry, K. (2019). Transforming doctoral education: preparing multidimensional and adaptive scholars. *Studies in Graduate and Postdoctoral Education*, 11(1), 17-34. <https://doi.org/10.1108/sgpe-03-2019-0029>
- Santos, P., Veloso, L., & Urze, P. (2020). Students matter: The role of doctoral students in university-industry collaborations. *Higher Education Research & Development*, 40(7), 1530-1545. <https://doi.org/10.1080/07294360.2020.1814702>
- Slota, M., McLaughlin, M., Bradford, L., Langley, J.F., & Vittone, S. (2018). Visual intelligence education as an innovative interdisciplinary approach for advancing communication and collaboration skills in nursing practice. *Journal of Professional Nursing*, 34(5), 357-363. <https://doi.org/10.1016/j.profnurs.2017.12.007>
- Whittle, M., & Rampton, J. (2020). *Towards a 2030 vision on the future of universities in Europe*. Luxembourg: European Commission Directorate-General for Research and Innovation. Retrieved June 14, 2021, from <https://op.europa.eu/en/publication-detail/-/publication/a3cde934-12a0-11eb-9a54-01aa75ed71a1/language-en>
- World Economic Forum (in collaboration with PwC) (2021) *Upskilling for Shared Prosperity*. Retrieved February 10, 2023, from <https://www.weforum.org/reports/upskilling-for-shared-prosperity/>
- Young European Research Universities (Yerun). (2021). *Annual Report 2020*. Retrieved February 10, 2023, from <https://yerun.eu/publication/yerun-annual-report-2020/>.

KEY TERMS & DEFINITIONS

Interdisciplinarity: different disciplines working together with the intention of transferring knowledge between each other.

Intersectorality: different sectors working together (e.g. academia, industry, government) in pursuit of a common goal.

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Chapter # 29

RELATIONSHIP BETWEEN ORAL READING FLUENCY MEASURES AND VISUAL ATTENTION SPAN IN BRAZILIAN'S SCHOOLCHILDREN IN PANDEMIC CONTEXT

Reading fluency measures and Visual Attention Span

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ABSTRACT

The aim of this study was to relate the measures of oral reading fluency and visual attention span in Brazilian students from the 4th grade of elementary school. Eleven students were submitted to three measures of oral reading fluency and the global visual attention span (VAS) for five characters. The reading correct word per minute measure was used with three texts that differed in complexity. The study was carried out after the adoption of remote teaching in the Pandemic. Spearman analysis was performed between fluency and VAS variables, with no significance. The results revealed a greater number of correct words per minute in the third reading time compared to the first two times, revealing that the real reading performance of 4th grade students is the average of 39 to 40 words per minute and average of fixation of 50% of the characters. These findings indicate academic losses due to low reading fluency rate, fewer characters per fixation and lack of relationship between the variables. These results pointed out to the decrease in reading practices during the Pandemic. As conclusion, there is a need for further studies about this theme.

Keywords: reading fluency, visual perception, learning, educational measurement.

1. INTRODUCTION

In early March 2020, with the worsening caused by the new coronavirus Covid-19 pandemic, and to minimize the impacts of the disease, the suspension of face-to-face classes was decreed, replacing them with non-face-to-face activities and remote teaching (Sampaio, 2020). The return to face-to-face activities only occurred in August 2021, when this study had begun.

A fluent reader will have the ability to read aloud quickly, accurately, and expressively. Thus, due to its clinical and educational importance, following the proposal of this chapter, we will describe a brief review on the importance of fluency in the development of reading, in addition to the relationship with visuoatencional aspects.

2. BACKGROUND

Good readers have adequate reading fluency. It is important to note that there is a progression from decoding to fluency, with increasing reading practices and advancing level of education. At the beginning of learning to read, all cognitive efforts are concentrated on

letter-sound conversion, as the reading process matures and becomes automatic, attentional resources can shift to processes related to comprehension, a skill that integrates reading fluency. to general language skills, memory, the ability to make inferences and knowledge of the world (Martins & Capellini, 2014, 2019, 2021)

For Martins & Capellini (2019) inadequate reading fluency can negatively impact the academic performance of students and be a determining factor in school failure. Since reading fluency is strongly related to comprehension, difficulties in this ability may represent a barrier to learning school contents, discouraging students, and weakening the school-student bond.

In addition, reading fluency is related to automaticity, accuracy, and prosody. Word recognition accuracy refers to the ability of readers to read the words in a text without pronunciation errors. In this way, reading with accuracy is related to the ability to decode the written word correctly, that is, it is necessary for the reader to have knowledge of the alphabetic system and the transparency relations of the language's orthographic system, in addition to having a wide range of vocabulary (frequent words) (Young & Rasinski, 2009).

In this way, the practice of reading can make the performance more automated and, consequently, faster. Therefore, automaticity refers to the ability of proficient readers to read the words in a text correctly and effortlessly so that they can use cognitive resources such as memory and attention to attend to the meaning of reading. Prosody refers to the ability of readers to read a text with expression and with appropriate intonation in sentences to reflect the semantic and syntactic content (Escudero & León, 2007; Levesque, Kieffer, & Deacon, 2017; Young & Rasinski, 2009).

Decoding and oral reading fluency are necessary for reading comprehension to be carried out efficiently, since it is considered a skill that depends on many other cognitive processes. Among these processes are those that involve linguistic components, such as morphological awareness, related to the knowledge of the word in its lexical, grammatical, and inflectional constituents; syntactic awareness, which concerns the structure of the clause, construction processes and punctuation; lexical-semantic awareness, which refers to the mental lexicon, meaning and sense of the word. Bearing in mind that meaning comes from the mental construction that depends on the interrelation between text, previous knowledge, and basic meaning, it is therefore also associated with the reader's ability to generate inferences (Escudero & León, 2007; Levesque, et al., 2017; Young & Rasinski, 2009).

Thus, as oral reading fluency is a bridge between decoding and reading comprehension. According with Rasinski and Young (2017), lack of proficiency in the primary grades often leads to continued difficulty in reading in succeeding grades. They pointed out that some students can present difficulties to move on to full-time employment or higher education are identified as 'below basic' in reading achievement. They have been characterized as having trouble in interpreting the meaning of words in grade appropriate texts as well as achieving an adequate understanding of such texts. If comprehension can be considered the ultimate goal of reading, these students struggle to make meaning from the narrative and informational texts they encounter.

In this way, reading can be understood as a visual-perceptual task that requires string processing of several letters that make up words. Readers need to pay attention to each letter of the word, successively, for its identification (LaBerge & Samuels, 1974; Martins & Capellini, 2014, 2019, 2021). The involvement of attention in the visual processing of letter sequences was formalized by Bundesen (1990). Thus, for Bosse, Tainturier and Valdois (2007) the visual-attentional interval (VA) was defined as the number of distinct visual elements that can be processed simultaneously at once.

Bosse et al. (2007) studied the visual attentional capacity during reading, which is related to the number of distinct visual elements that can be processed simultaneously in a

visual fixation, being important in the acquisition of reading and its processes. Based on these studies, the reading task of the present study used the criterion of 5 characters in the selection of words, which is the average of characters that can be apprehended in the foveal region during the eye fixation movement. (Ans, Carbonnel & Valdois, 1998; Bosse et al., 2007).

Thus, a fluent reader is expected to present adequate accuracy in decoding words, automatic processing (speed) and prosody during reading and it is consolidated in the third school year, with readers who have achieved the automation of reading processes (Barth, Tolar, Fletcher, & Francis, 2014). In this way, it becomes important to measure and observe reading performance for schoolchildren from this school year and in subsequent years.

3. OBJECTIVE

The aim of this study was to relate the measures of oral reading fluency and visual attention span in Brazilian schoolchildren from the 4th grade of elementary school.

4. METHODS

This is a prospective, cross-sectional study. The procedures of this study were applied face-to-face during the Covid-19 Pandemic, following the recommendations of the World Health Organization (WHO). The study was approved by the research ethics committee of the Faculty of Philosophy and Sciences of the São Paulo State University – UNESP, São Paulo, Brazil, under number 5.050.126.

All schoolchildren presented the Free and Informed Consent Term. The schoolchildren were indicated by the teachers, who mentioned reading and learning difficulties. They underwent the followed procedures.

-Reading Fluency Text (ADFLU, Martins & Capellini, 2019). Each student performed reading fluency measurements of a 4th grade's text, three texts that differed in complexity. For each text, measures were taken, such as the number of words read correctly per minute (WCPM) and the measure of words read incorrectly per minute (WIPM) were measured. Therefore, for WCPM, words pronounced correctly, words corrected by oneself, repeated words, words mispronounced due to the accent and inserted words were considered. For WIPM, mispronounced words, words substituted for others, omitted words, words read out of order, addition or omission of morphemes and hesitations were considered errors (if a student hesitated with a word for 3 seconds, he was told the word and marked as incorrect). For the quantification of errors, punctuation rules were also used for unique situations, such as: lines or several words omitted, reading numbers, words with hyphens that can exist independently and abbreviations. (Good, Gruba, & Kaminski, 2002; Kaminski & Good, 1998).

-Visual Attentional Span Tasks - Global Report (Whole report condition), (Bosse et al, 2007; Valdois et al., 2014) – notebook version. The visual attention test is a software in which the stimulus will be presented on the notebook screen, aiming to verify the number of characters captured by eye fixation movements, during eye movement. In this subtest, a sequence of five consonants was displayed for 200ms in the center of the computer screen. The sequence constructed from 10 consonants (BPTFLMDSRH) without repetition. To avoid lexical activations, the sequence bears no relation to a real word. Each sequence was used 10 times, appearing twice in each position. The letters were presented in capital format, black on a white background, at a visual angle of 0.7°. To minimize the crowding effect (letter overlapping), the distance between adjacent letters was increased (0.57 cm inter-letter space). The entire array was presented at an angle of approximately 5.4°. The task was started after

10 training tests, so that the students received feedback. At the beginning of each test, a central fixation point was presented with a duration of 1000ms, followed by 50ms of a blank screen for. Then, the sequence of consonants was presented in the center of the screen with a duration of 200ms. Twenty experimental tests were displayed. The student must verbally report the name of the identified letters. The numbers of items reported accurately were measured, regardless of location, and the score was performed by correct answers and displayed as a percentage (maximum = 100).

The results were analyzed statistically, adopting the value $p < 0.05$ for the statistically significant values, being indicated with an asterisk ($*p < 0.05$). Application of the Friedman Test, to verify possible differences between the variables of interest, when compared concurrently. The Spearman Correlation was also used to verify two variables without any restriction regarding the distribution of values.

5. RESULTS

Table 1 presents the comparison for the reading fluency measures of the number of words read correctly per minute (WCPM) and words read incorrectly per minute (WIPM), three texts that differed in complexity, and one measure of Visual attentional span tasks (%VAS).

Table 1.
Comparison of read correctly per minute (WCPM) and words read incorrectly per minute (WIPM).

Variables	Mean deviation)	(standard p-value	Variables	Mean deviation)	(standard p-value
WCPM 1	39,18 (31,37)		WIPM 1	6 (2,32)	
WCPM 2	37,45 (26,89)	0,005*	WIPM 2	6(5,35)	0,839
WCPM 3	47,73 (30,56)		WIPM 3	13,73 (31,33)	
%VAS	55,9 (11,2)				

Caption: WCPM: number of words read correctly per minute; WIPM: words read incorrectly per minute; %VAS: Visual attentional span tasks.
Friedman Test ($*p < 0.05$).

Table 2 presents the analysis of Spearman's Correlation between the Visual attentional span tasks (%VAS) and the fluency measures.

Table 2.
Correlation between the Visual attentional span tasks (%VAS) and the fluency measures.

Variables	Statistic	%VAS	Variables	Statistic	%VAS
WCPM 1	correlation coefficient	0,527	WIPM 1	correlation coefficient	-0,266
	p-value	0,095		p-value	0,429
WCPM 2	correlation coefficient	0,397	WIPM 2	correlation coefficient	-0,261
	p-value	0,226		p-value	0,438
WCPM 3	correlation coefficient	0,478	WIPM 3	correlation coefficient	-0,303
	p-value	0,137		p-value	0,365

Caption: WCPM: number of words read correctly per minute; WIPM: words read incorrectly per minute; %VAS: Visual attentional span tasks.

The results revealed a greater number of correct words per minute in the third reading time compared to the first two times, revealing that the real reading performance of 4th grade schoolchildren is the average of 39 to 40 words per minute and average of fixation of 50% of the characters.

6. DISCUSSION

These findings indicate academic losses due to low reading fluency rate, fewer characters per fixation and lack of relationship between the variables.

The development of reading fluency is essential for schoolchildren, especially when they move from learning to read to reading to learn. To perform any activity automatically, it is necessary to carry out, for example, activities with some properties, such as reading without conscious attention, without effort, with speed and with autonomy (LaBerge & Samuels, 1974). Automatic decoding allows that conscious attention and memory, previously dedicated entirely to the word level, can be used in cognitive processes at the sentence level and in the meaning itself, specifically. (LaBerge & Samuels, 1974).

In addition, automatic word recognition is central to the construct of fluency and fluency's role in the comprehension of text. As automaticity develops, whether in terms of reading, perceptual-motor activities (eye movements, for example), or another skilled task, the learner's performance not only becomes accurate, but it also gets faster. With automatization of lower-level processes, readers can shift their attention from lower-level skills to higher level, integrative aspects of reading such as reading fluently with comprehension.

Disfluent readers, on the other hand, are unable to integrate these lower-level skills with higher level ones, primarily because of the effort they need to expend on word recognition (LaBerge & Samuels, 1974; Kuhn, Schwanenflugel, & Meisinger, 2010). It seems likely that seeing words in multiple contexts improves students' recognition of those words (Kuhn, et al., 2010). However, for the schoolchildren in this study, this repetition and reading experience may not have occurred satisfactorily.

The schoolchildren in this study had visual-attentional difficulties, which were not related to reading fluency. This finding may be related to the fact that the visual-attentional interval plays an important role in reading acquisition, since it outlines the amount of orthographic information that can be processed at each stage of the reading process (Valdois, Bosse, & Tainturier, 2004). A larger VA range encompasses an entire string of letters in a word, allowing each letter to be accurately identified, in parallel, so that the word can also be identified, quickly.

The schoolchildren in this study presented 50% of this interval, suggesting a deficit in visual processing capacity, since they were unable to capture the entire visual-attentional interval, resulting in slow decoding (Bosse et al., 2007). Reading practice is necessary for the development of fluency, which will be stagnant and may compromise the student's opportunity to learn academic content, which also consecutively depends on good reading (Rasinski, 2017).

Bosse et al. (2007) and Zoubrinetzky, Bielle, and Valdois (2014), who reported a relatively strong dissociation between visual attention span and phonological deficits, we observed an important overlap. In fact, all dyslexic children with visual attention deficits also presented phonological deficits, either in accuracy or in speed, and none presented pure visual attention deficits, as observed in this study.

Saksida et al. (2016) corroborate this study, bringing important reflection on the visual attention deficit and phonological aspects. The authors report that most cases with visual attention deficit also present phonological deficit and, in these cases, the presence of visual

attention deficit does not seem to worsen their reading disability. This is consistent with the view that the development of visual attention follows the ability to read and that a phonological deficit can therefore delay the development of visual attention.

However, the authors still report that as phonological skills are reciprocally influenced by reading ability, a reading disability initially induced by a visual attention deficit would be expected to delay the development of phonological skills, perhaps to the point of criterion for a phonological deficit. Therefore, in agreement with the authors, we cannot exclude that some cases in the present study actually had visual attention deficit as the primary cause of dyslexia and phonological deficit as a secondary outcome.

Thus, the results of this study indicate that schoolchildren had difficulties in the formation of lexical representation in long-term lexical orthographic memory. Studies indicate that for the essential development in learning to read is the acquisition of automatic word reading skills (defined in this study as the ability to pronounce written words in isolation) (Steady et al. 2017).

For the authors, the automation of word reading allows fluent and reliable retrieval of word representations from the orthographic lexicon, activating phonological, syntactic, morphological and semantic information to be used by the reader to form faithful representations of the text. As children learn to read, the orthographic lexicon expands through an increase in the absolute number of orthographically addressable entries, called “word-specific” representations (Steady et al. 2017). Thus, we can infer that the students in this study had difficulties in the formation of orthographic lexicon, having unreliable representations, which would justify the reading errors, and confirm the risk for specific reading learning problems.

However, it is noteworthy that such findings may have been influenced by the lack of reading practices, aggravated by the pandemic. In the school context, Brazilian education has adopted social distancing and remote teaching, which have led to unfavorable situations for both professionals and families, such as forced digitization, lack of preparation for handling technological tools and greater elaboration and availability of academic rather than social content (Hoofman & Secord, 2021).

It is also important to highlight that, in recent studies (Santana, Capellini & Germano, 2022; Stolf et al., 2021), carried out after the end of remote teaching, indicated that students presented difficulties regarding predictive reading skills, such as alphabet recognition, phonological awareness, and cognitive-linguistic skills, which can impact the reading fluency performance.

However, as highlighted in these studies (Santana, et al., 2022; Stolf et al., 2021), such difficulties have already been indicated in study prior to the Covid-19 Pandemic (Germano, César, & Capellini, 2017), calling attention to the lack of instructional teaching of the alphabetic base of the Brazilian Portuguese writing system.

7. FUTURE RESEARCH DIRECTIONS

The students were characterized as at risk for learning problems, which brings us, as future implications, the need for continuity of studies that investigate reading fluency measures and their relationship with visual attentional performance, to favor early identification and carry out referrals to multidisciplinary care services.

8. CONCLUSION

These findings indicate academic losses due to low reading fluency rate, fewer characters per fixation and lack of relationship between the variables. Thus, it is important to measure and observe reading performance for schoolchildren from this grade onwards, since the impacts of low reading performance will be reflected in academic performance.

REFERENCES

- Ans, B., Carbonnel, S., & Valdois, S. (1998). A connectionist multiple-trace memory model for polysyllabic word reading. *Psychological review*, *105*(4), 678. <https://doi.org/10.1037/0033-295X.105.4.678-723>
- Barth, A. E., Tolar, T.D., Fletcher, J. M., & Francis, D. (2014). The effects of student and text characteristics on the oral reading fluency of middle-grade students. *Journal of Educational Psychology*, *106*(1), 162-180. <https://doi.org/10.1037/a0033826>
- Bosse, M.L., Tainturier, M.J., & Valdois, S. (2007). Developmental dyslexia: The visual attention span deficit hypothesis. *Cognition*, *104*(2), 198-230. <https://doi.org/10.1016/j.cognition.2006.05.009>
- Bundesen, C. (1990). A theory of visual attention. *Psychological review*, *97*(4), 523. <https://doi.org/10.1037/0033-295X.97.4.523>
- Escudero, I., & León, J.A. (2007). Inferential processes in the comprehension of written discourse: Influence of the structure of the text in the processes of comprehension. *signs magazine. Revista signos*, *40*(64), 311-336. <http://dx.doi.org/10.4067/S0718-09342007000200003>
- Germano, G. D., César, A. B. D. C., & Capellini, S. A. (2017). Screening protocol for early identification of Brazilian children at risk for dyslexia. *Frontiers in Psychology*, *8*, 1763. <https://doi.org/10.3389/fpsyg.2017.01763>
- Good, R. H., Gruba, J., & Kaminski, R. A. (2002). Best Practices in Using Dynamic Indicators of Basic Early Literacy Skills (DIBELS) in an Outcomes-Driven Model. In A. Thomas & J. Grimes (Eds.), *Best practices in school psychology IV* (pp. 699–720). National Association of School Psychologists.
- Hoofman, J., & Secord, E. (2021). The effect of COVID-19 on education. *Pediatric Clinics*, *68*(5), 1071-1079. <https://doi.org/10.1016/j.pcl.2021.05.009>
- Kaminski, R.A., & Good, R.H. III. (1998). Assessing early literacy skills in a Problem-Solving model: Dynamic Indicators of Basic Early Literacy Skills. In M. R. Shinn (Ed.), *Advanced applications of Curriculum-Based Measurement* (pp. 113–142). The Guilford Press.
- Kuhn, M.R., Schwanenflugel, P.J., & Meisinger, E.B. (2010). Aligning theory and assessment of reading fluency: Automaticity, prosody, and definitions of fluency. *Reading research quarterly*, *45*(2), 230-251. <https://doi.org/10.1598/RRQ.45.2.4>
- LaBerge, D., & Samuels, S.J. (1974). Toward a theory of automatic information processing in reading. *Cognitive psychology*, *6*(2), 293-323. [https://doi.org/10.1016/0010-0285\(74\)90015-2](https://doi.org/10.1016/0010-0285(74)90015-2)
- Levesque, K. C., Kieffer, M. J., & Deacon, S. H. (2017). Morphological awareness and reading comprehension: Examining mediating factors. *Journal of experimental child psychology*, *160*, 1-20. <https://doi.org/10.1016/j.jecp.2017.02.015>
- Martins, M. A., & Capellini, S. A. (2014). Fluency and reading comprehension in students from 3rd to 5th of elementary school grades *Estudos de Psicologia (Campinas)*, *31*, 499-506. <https://doi.org/10.1590/0103-166X2014000400004>
- Martins, M. A., & Capellini, S. A. (2019). Relation between oral reading fluency and reading comprehension *CoDAS*, *31*(1), e20170244. <https://doi.org/10.1590/2317-1782/20182018244>
- Martins, M. A., & Capellini, S. A. (2021). Identification of struggling readers or at risk of reading difficulties with one-minute fluency measures. *Psicologia: Reflexão e Crítica*, *34*. <https://doi.org/10.1186/s41155-021-00174-z>
- Rasinski, T., & Young, C. (2017). Effective instruction for primary grade students who struggle with reading fluency. *International Perspectives on Inclusive Education*, 143-157. <https://doi.org/10.1108/s1479-363620170000011010>

- Rasinski, T.V. (2017). Readers who struggle: Why many struggle and a modest proposal for improving their reading. *The Reading Teacher*, 70(5), 519-524. <https://doi.org/10.1002/trtr.1533>
- Saksida, A., Iannuzzi, S., Bogliotti, C., Chaix, Y., Démonet, J. F., Bricout, L., ... & Ramus, F. (2016). Phonological skills, visual attention span, and visual stress in developmental dyslexia. *Developmental psychology*, 52(10), 1503. <https://doi.org/10.1037/dev0000184>
- Sampaio, R.M. (2020). Teaching and literacy practices in COVID-19 pandemic times. *Research, Society and Development*, 9(7), e519974430-e519974430. <https://doi.org/10.33448/rsd-v9i7.4430>
- Santana, M.G., Capellini, S.A., & Germano, G.D. (2022). Predicting reading skills in school children in early literacy years in pandemic times. *Revista Ibero-Americana de Estudos em Educação*, 17(4). <https://doi.org/10.21723/riaee.v17i4.16233>
- Steady, L. M., Kearns, D. M., Gilbert, J. K., Compton, D. L., Cho, E., Lindstrom, E. R., & Collins, A. A. (2017). Exploring individual differences in irregular word recognition among children with early-emerging and late-emerging word reading difficulty. *Journal of Educational Psychology*, 109(1), 51.
- Valdois, S., Bosse, M. L., & Tainturier, M. J. (2004). The cognitive deficits responsible for developmental dyslexia: Review of evidence for a selective visual attentional disorder. *Dyslexia*, 10(4), 339-363. <https://doi.org/10.1002/dys.284>
- Valdois, S., Peyrin, C., Lassus-Sangosse, D., Lallier, M., Démonet, J.F., & Kandel, S. (2014). Dyslexia in a French-Spanish bilingual girl: behavioural and neural modulations following a visual attention span intervention. *Cortex*, 53, 120-145. <https://doi.org/10.1016/j.cortex.2013.11.006>
- Stolf, M. T., Santos, N. L. D., D'Angelo, I., Del Bianco, N., Giacconi, C., & Capellini, S. A. (2021). Performance of early literacy students in cognitive-linguistic skills during the pandemic. *Journal of Human Growth and Development*, 31(3), 484-490. <https://doi.org/10.36311/jhgd.v31.12668>
- Young, C., & Rasinski T. (2009). Implementing readers theatre as an approach to classroom fluency instruction. *The Reading Teacher*, 63(1), 4-13. <https://doi.org/10.1598/RT.63.1.1>
- Zoubinetzky, R., Bielle, F., & Valdois, S. (2014). New insights on developmental dyslexia subtypes: heterogeneity of mixed reading profiles. *PloS one*, 9(6), e99337. <https://doi.org/10.1371/journal.pone.0099337>

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Relationship between oral reading fluency measures and visual attention span in Brazilian's schoolchildren in pandemic context. Reading fluency measures and visual attention span

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Chapter # 30

EFFECTS OF A TUTOR BASED INTERACTIVE-COMPUTERIZED INTERVENTION PROGRAM FOR PROMOTING COMPREHENSION SKILLS IN FIRST GRADE AT-RISK ARABIC STUDENTS

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ABSTRACT

The study investigated the effects of an interactive, individualized computer-based intervention program for advancing comprehension skills among children at risk of low literacy. Participants were forty Arabic-speaking first-grade students at literacy risk: 20 assigned to the intervention program, and 20 assigned as control group. In the intervention group, each student was paired with a tutor and was categorized in one of 4 sub-groups: high student and tutor motivation, low student and tutor motivation, high student motivation/low tutor motivation, and low student motivation/high tutor motivation. Students' comprehension achievements and progress were measured before, during and after the program. Findings showed that the intervention program succeeded in advancing students' skills beyond motivation level, although the greatest improvement was found in the sub-group where both students and tutors had high motivation. Findings demonstrate the need for a specialized intervention to efficiently close the gap in comprehension skills among students at literacy risk and the importance of motivation of both students and tutors in the learning process.

Keywords: Arabic, literacy risk, comprehension, motivation, individualized learning, computer-based intervention.

1. INTRODUCTION

A prominent issue in public agenda is the reading level of Israeli children. The required level of literacy, which is the written expression and reading comprehension both in one's native language and in other languages (Levin, 2003), continues to rise. However, there are significant failures in national reading tests, as well as gaps in achievements among low SES students and Arabic-speaking students compared to Jewish students (Ministry of Education, 2012).

A possible explanation for this gap is diglossia in the Arabic language, which is the linguistic gap between spoken and literary forms of the language. This, along with other linguistic and orthographic characteristics of Arabic, make the acquisition of reading and writing more difficult. Moreover, before entering school, an Arabic-speaking child is mainly exposed to the spoken language, a fact that complicates reading acquisition (Ministry of Education, 2001). The low socioeconomic status of Arab society compared to the Jewish society is considered another risk factor that impedes proper literacy development among Arabic speakers in Israel.

Considering the different risk factors that influence reading acquisition, evidence points to the importance of early intervention: Early identification of children who are having difficulty, combined with early intervention, increase the chances that a reader will bridge the gap and succeed in integrating into the normal teaching-learning process (Clay, 1972; 1986; 1991). The scientific literature points to the advantages of individualized learning in general and in the use of computer programs to effect it (Demirer, & Sahin, 2013; Howell, Erickson, Stanger, & Wheaton, 2000; Regan, Berkeley, Hughes, & Kirby, 2014). Thus, the learning environment created for this study integrates the principles of an interactive model (Adams, 1991) with the principles of individualized, computerized tutor-based learning. The reading tutoring program built by the researchers seeks to circumvent the difficult outcome of lack of attention to language development in a distressed population, specifically Arabic children of low SES, by focusing on fostering phonological awareness and comprehension to improve children's progress in the acquisition process. In light of these, three research questions were developed:

1. Will there be a difference between the intervention and comparison groups – before and after the execution of the intervention program?
2. Will the intervention program succeed in advancing the skills of students in the intervention group throughout the intervention?
3. What will be the effect of the interaction between student motivation for learning and tutor motivation for teaching on advancing students' comprehension skills throughout the intervention program?

2. BACKGROUND

Reading refers to the ability to decode a written word or text quickly and precisely in order to extract meaning from it. Reading difficulties, especially in early school years, can impede linguistic development in the school and outside of it. In addition to reading difficulties caused by congenital disabilities, the professional literature maps out educational-environmental causes, factors and steps that influence reading acquisition. The first factor relates to the cultivation quality of pre-literacy skills in preschool and kindergarten children, before the transition to formal education (Aram & Levin, 2001; Bus, Van Ijzendoorn, & Pellegrini, 1995; Clearfield & Nimann, 2012; Pressley, 1998; Scarborough & Dobrich, 1994; Sénéchal, LeFevre, Thomas, & Daley, 1998). The second factor focuses on the stages of early reading and building fluency via methods of reading and writing instruction used at the beginning of elementary school (National Reading Panel, 2000; Snow, Burns, & Griffin, 1998). The third factor, relevant to mature reading, is cultivation of reading comprehension and book-reading habits that will continue throughout many years of study (Stanovich & West, 1989; Stanovich, West, Cunningham, & Cipelewski, 1996).

2.1. Reading Acquisition in the Shadow of Diglossia

Reading is based on a rich vocabulary, control of grammar and syntax, knowledge of language as communication, sensitivity to the element of tone, and sociocultural knowledge connected to language (Perfetti, Landi, & Oakhill, 2005; Perfetti, 2011). It is a language-based skill and as such is influenced by deficiencies in spoken language (Halliday, 1989; Kamhi & Catts, 2011). Children who have a risk factor for language development tend to display a reduction in verbal ability, which in turn impairs normal reading acquisition (Assink, 1994; Hackman, Farah, & Meaney, 2010; Jednoróg et al., 2012; Rush, 1999).

In contrast to other languages, Arabic is a diglossic language in which the spoken language (“amayyah”) and the literary language (“poscha”) have different vocabulary,

grammar, syntax, linguistic structures and forms of expression (Khamis-Dakwar & Froud, 2007; Saiegh-Haddad, 2005; Saiegh-Haddad & Henkin-Roitfarb, 2014). Before entering school, an Arabic-speaking child is mainly exposed to the spoken language, a fact that complicates reading acquisition in general and reading comprehension especially (Ministry of Education, 2001). Research suggest that Arabic speakers acquire literary language later than speakers of other languages in which spoken and literary language are more connected (Abu-Rabia, 2000; Bentin & Ibrahim, 1996; Feitelson, Goldstein, Iraqi, & Share, 1993; Ibrahim, Eviatar. & Aharon-Peretz, 2007; Wagner, 1993).

Most current models assume that reading is a combination of processes that exist simultaneously and support one another (Perfetti et al., 2005). Due to the multiplicity of characteristics related to the nature of Arabic and that influence reading acquisition, the model that drives the current research is Adams' interactive model (Adams, 1991), which views reading as a process that demands synchronization between four linguistic processes: phonological, orthographic, semantic, and contextual. This model has been found to be helpful in mastering reading in Arabic (Abu-Rabia, 1999; 2002; 2003; Makhoul, Olshtain, & Ibrahim, 2015).

2.2. Socioeconomic Status, Linguistic Risk and Reading Acquisition

Socioeconomic status (SES) is a key factor that influences literacy development, and it has implications for academic functioning throughout the school years. Children from low SES tend to grow up in literacy-poor environments. Thus, their exposure to and experience with literacy is limited, creating differences in cognition and literacy between them and other children in their age group.

The lack of sufficient experience, knowledge and pre-literacy abilities in the early years puts these children at linguistic risk. Research suggests that children from low SES display difficulties in phonological awareness, limited vocabulary, and difficulty decoding words and writing (Clearfield & Nimann, 2012; Shonkoff & Phillips, 2000). In the 2001 PIRLS study (Mullis et al., 2003), the number of household members, parents' level of education, and number of books in the home were found to be related to academic achievement. The PIRLS study recommends intervention to compensate for the home environment by creating a school environment supportive of literacy, thus minimizing the effect created by the children's home environment.

2.3. The Current Study

The current study aims to test the effectiveness of a tutor-based computerized intervention program made to strengthen reading comprehension skills among first-grade Arabic students from low SES. The intervention focuses on phonological awareness as well as creating a beneficial interactive personalized learning environment. It has been found that integration between treatment in phonological awareness and instruction in identifying writing symbols led to a significant improvement in reading skills (Felton, 1993; Hurford et al., 1994; Makhoul, 2006; Smith, Christensen, Goodale, Ingebrand, & Steele, 1993; Snow et al., 1998). A meta-analysis completed by the National Reading Panel (Ehri et al., 2001) found a high correlation between training interventions in phonological awareness and level of phonological awareness among different populations, both normative and at risk.

The intervention program in the current study focused on creating a learning environment that composed of an interactive, computerized method and principles of individualized learning, in light of scientific literature pointing to the benefits of integrating tutoring with a computerized environment to increase the advantage of tutoring (Demirer, & Sahin, 2013; Howell et al., 2000; Regan et al., 2014).

3. METHOD

3.1. Participants

Arabic literacy tests were given to 60 first-graders (aged 6-7) of low SES from an Arabic elementary school in Northern Israel. 40 students experiencing the most difficulty were selected to participate in the study, half of them were randomly assigned to the research group while the remaining 20 constituted a comparison group. All students in the research group were assigned individual tutors (aged 20-23) who accompanied them throughout the intervention. The tutoring took place as part of an internship for students from a teacher training college.

Based on the level of motivation of both the tutors (according to the evaluation of their college instructors) and the students (according to their school teachers), four subgroups were created with each group including five student-tutor pairs: high student motivation\high tutor motivation, high student motivation\low tutor motivation, low student motivation\high tutor motivation, and low student motivation\low tutor motivation.

3.2. Research Procedures

At the beginning of the year, comprehension tests were given to 60 students individually. During the school year, the children in the study group participated in the “Tutoring-Reading” intervention program alongside regular instruction in class, with the students in the comparison group studying in class only. Towards the end of the school year, the comprehension tests were administered again to assess the progress of the students in both groups.

3.3. Description of the Learning Environment and its Functioning

3.3.1. Building the Learning Environment and its Components

Tutoring-reading program in a computer environment. This is a structured program consisting of 26 sessions, operated in a computer environment based on Adams' (1991) principles of the interactive model. The program is tailored to the needs of first-graders and works to strengthen the four processes involved in reading acquisition: phonological, orthographic, meaning-based and contextual, in addition to decoding skills adapted to children's reading selections. The program was developed by the study's researchers over three years of experimentation and evaluation in collaboration with reading instruction experts. The activities in the program were constructed according to existing consensus in the literature (such as Snow et al., 1998) and according to the model of asking comprehension questions – the Harris and Smith model (Harris & Smith, 1976).

Tutors. The tutors were third-year teachers in training, specialized in teaching first- and second grades. They received 12 hours of training prior to the start of the intervention, intended to familiarize with the program, gain knowledge about the principles of individual learning and the characteristics of the student population, as well as teaching methods for comprehension, reading and phonology, and interpersonal communication skills. Training included time for creating lesson plans. During the operation of the program, a training session was held each week before the meeting with the student where the tutor received a briefing on the content of the learned unit and important methodological tips to deal with difficulties arising during teaching. After the weekly session, a meeting was held for a reflective discussion and evaluation of the children's functioning. Tutor training was performed by the researcher.

3.3.2. Characteristics of Individualized Learning in the Tutoring-Reading Program

Interactive balanced learning. During the program, the four basic interconnected processes of reading are activated. Tasks in each week unit are divided into four main goals: developing ability to understand context and meaning, developing orthographic ability,

developing phonological skills, and practicing decoding skills adapted to the first-grade reading and curriculum.

Continuous student activity. The students spend most of their time engaged in various learning activities: thinking, giving answers, discussion, computer activities.

Repetition of material that is learned. Questions that draw on students' prior knowledge and experiences, as well as review questions, are highlighted in all assignments. Each session begins with a review of what was learned in the previous session. This procedure allows the tutor to teach learning strategies and to examine the students' learning process from unit to unit.

Guided mediation. Mediation processes by the tutor are emphasized, in order to help the students learn key skills.

Use of documentation and follow-up. In each session, the tutor documents the student's answers and the means of mediation they use in a booklet given prior to the intervention. The booklet also assesses the tutor's functioning in the individual learning process.

Fixed session structure. Each session begins with an opening conversation and ends with an emotion inducing activity. This fosters interpersonal and intrapersonal communication between student and tutor, promoting the quality of the learning process.

Review and follow-up of program implementation. The researcher, accompanied by a professional special education teacher, observed the tutors' work and ensured that the tutors acted in accordance with the program.

3.4. Instruments

Reading Comprehension Test. The comprehension test was constructed and delivered by the researcher according to accepted norms in the literature and accepted standards in the Ministry of Education's tests for this age (Ministry of Education, 1995), and the skills required by the first-grade Arabic language curriculum (1991, 1989). The test included the following components: *Short term story reconstruction* (20 points) testing students' ability to retell the entire story; *Attention to details* (10 points), testing the ability to identify key details in the story; *Sequence and time concepts* (10 points), testing the understanding of sequence of events and concepts of time; *Cause and effect* (10 points), testing identification of events' results and reasons; *Identifying main idea* (10 points), testing recognition of the main idea of the text; *Drawing conclusions* (10 points), testing success in understanding and interpreting the message of the text; *Classification and generalization* (10 points), tests the classification of five groups according to one clear criterion; *Vocabulary* (10 points), including two synonym exercises, two opposites exercises and one exercise that requires choosing the word that is different; and *Following instructions* (10 points), including one exercise with one instruction, two exercises with two instructions, and two exercises with three instructions. If students did not complete the task, the tutor asked them to choose the correct answer from two options and received half a point for giving the correct answer.

3.5. Data Analysis

An evaluation system was constructed that allowed an in-depth examination of the operating process and the learning environment, including quantitative and qualitative analyses of students' performance during the program. Data were analyzed by degrees of success or failure and degrees of support the student needed.

A total of three measurements were calculated: First measurement (T1) at sessions 1-3; Intermediate measurement (T2) conducted after 11-16 sessions; Final measurement (T3) at the conclusion of the program. Nonparametric tests were used due to small sample size.

4. RESULTS

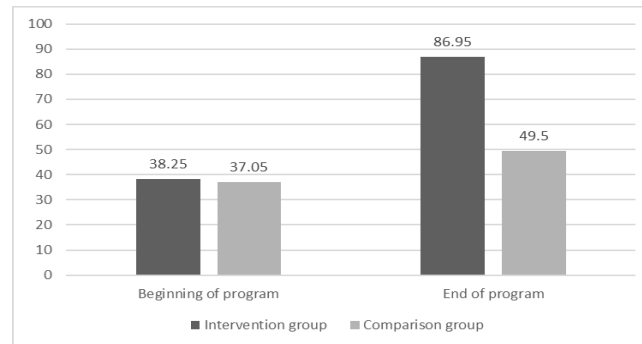
4.1. Comprehension Skills Between and Within Groups

Figure 1 presents the results of each group at the beginning and at the end of the program. To ensure that the intervention and comparison groups did not differ on comprehension level before the start of the program, group averages in the pre-test were compared using a Mann-Whitney test. Students in the two groups received similar scores, with the average of students in the intervention group being 38.25 ($SD = 8.43$) while that of the comparison group was 37.05 ($SD = 8.56$).

To compare students' progress within the intervention group, the Wilcoxon nonparametric test was conducted. Findings showed significant progress of the students in the intervention group ($Z = -36.92, p < .001$), with students' performance at the end of the program ($M = 86.95, SD = 8.43$) higher than at the beginning ($M = 38.25, SD = 8.90$). A similar trend was observed in the control group ($Z = -3.44, p < .01$), with students' performance at the end of the year ($M = 49.50, SD = 13.38$) higher than at the beginning of the year ($M = 37.05, SD = 8.65$).

Another Mann-Whitney test was conducted to examine the differences between the two groups at the conclusion of the program. Results indicate significant differences between the two groups ($Z = .93, p < .001$), with the mean of the students in the intervention group ($M = 86.95, SD = 8.43$) higher than that of the comparison group ($M = 49.50, SD = 13.38$). The findings show that the contribution of the intervention program to the advancement of students' comprehension skills in the intervention group is beyond the traditional contribution of learning in class.

Figure 1.
Intervention and Control Groups at the beginning and the end of the program.



4.2. Students' Progress in Comprehension Skills in the Intervention Group

Figures 2-6 shows the progress of the students in the intervention group on the comprehension skill measured. In the short-term memory reconstruction skill, 87% of students progressed to "experienced student" category at T3, compared to only 10% in T1. In the long-term story reconstruction skill, only 20% of the students were rated as "experienced students" at T1, compared to 79% at T3. In the skill of retrieving explicit information from text, 20% were categorized as experienced students at T1, compared to 91% at T3. In the skill of interpretive comprehension – identifying main idea, at T1 half the students (50%) were concentrated in the two lower ratings "struggling student" and "beginning student", while at T3, 78.3% of students moved to the top rating. Finally, in the interpretive comprehension skill – drawing conclusions, most students (53.4%) were rated as struggling students at T1, while 55% of the students were rated as experienced students and 33% were rated as advanced students at T3.

Effects of a tutor based interactive-computerized intervention program for promoting comprehension skills in first grade at-risk Arabic students

Tables 1-5 show the changes occurring in percentages of students per category between each two time points, for each skill tested. Students progressed gradually from lower ratings such as "struggling student" and "beginning student" to the higher ratings of "advanced student" or "experienced student", and the transitions from each time point were found to be significant in almost all ratings; that is, the students' rating at T1 was different from T2, and T2 was different from T3.

Figures 2-6.
Students' Progress by Subgroups (Frequencies by Percent) in all different skills.

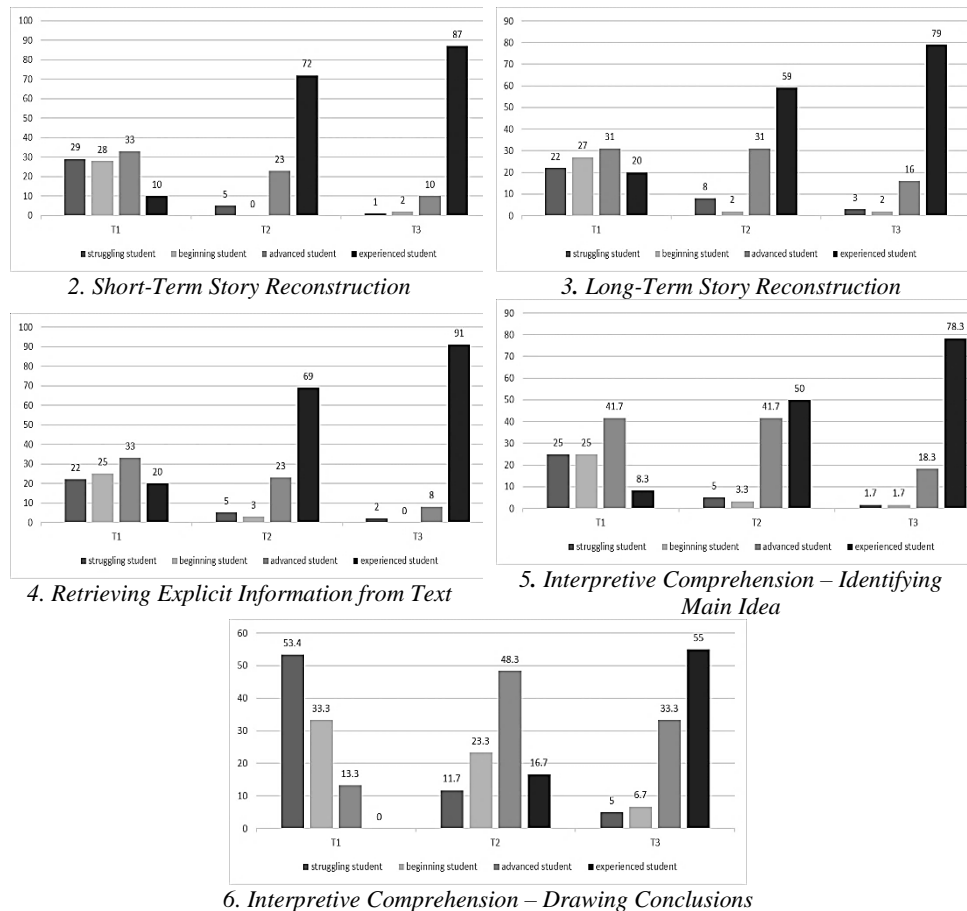


Table 1.
Differences in the Frequencies of Students in Each Subgroup: Short-Term Reconstruction.

Student level	T1 to T2	T1 to T3	T2 to T3
Struggling	-3.31*	-3.31*	.00
Beginning	-3.15**	-3.18*	-1.00
Advanced	-1.41*	-2.36*	-2.45***
Experienced	-3.56*	-4.00*	-2.30***

* $p < .001$; ** $p < .01$; *** $p < .05$

Table 2.
Differences in Frequencies of Students in Each Subgroup: Long-Term Reconstruction.

Student rating	T1 to T2	T1 to T3	T2 to T3
Struggling	-2.48***	-3.21*	.45
Beginning	-3.42*	-3.42*	.00
Advanced	-.11	-1.57***	-2.19***
Experienced	-3.02**	-3.76*	-2.35***

* $p < .001$; ** $p < .01$; *** $p < .05$

Table .3
Differences in Frequencies of Students in each Subgroup: Retrieving Explicit Information from Text.

Student level	T1 to T2	T1 to T3	T2 to T3
Struggling	-3.35*	-3.35*	-1.00
Beginning	-3.50*	-3.67*	-1.63
Advanced	-2.05***	-3.46**	-3.37**
Experienced	-3.87*	-3.94*	-3.48*

* $p < .001$; ** $p < .01$; *** $p < .05$

Table 4.
Difference in Frequency of Students in each Subgroup: Interpretive Comprehension – Identifying Main Idea.

Student level	T1 to T2	T1 to T3	T2 to T3
Struggling	-3.42*	-3.42*	.00
Beginning	-2.97**	-3.12**	-.58
Advanced	.00	-1.79	-2.13***
Experienced	-3.35*	-3.74*	-2.41*

* $p < .001$; ** $p < .01$; *** $p < .05$

Table 5.
Difference in Frequency of Students in each Subgroup: Interpretive Comprehension – Drawing Conclusions.

Student level	T1 to T2	T1 to T3	T2 to T3
Struggling	-3.70*	-3.91*	-1.00
Beginning	-1.08	-2.86**	-1.88
Advanced	-2.87**	-2.24***	-1.37
Experienced	-2.23***	-3.46*	-3.07**

* $p < .001$; ** $p < .01$; *** $p < .05$

4.3. Effectiveness of the Intervention Program in Promoting Comprehension Skills: Interaction with Tutor-Student Motivation

Table 6 shows that in T1, "experienced student" ratings differed by motivation status (high-motivation tutors/high-motivation students: 32.0%; high-motivation tutors/low-motivation students: 11.3%; low-motivation tutors/high-motivation students: 12.7%; low-motivation tutors/low-motivation students: 4%.) This proves that the best environment for learning and progress is when students and tutors alike are highly motivated. The group of high-motivated tutors/low-motivated students increased in their abilities

between measurements: their ratings as "experienced student" rose from 72% at T2 to 98% at T3. This shows that a highly motivated teacher can promote their struggling, unmotivated students and achieve excellent results. In the low-motivation tutors/high-motivation students (third group), "experienced student" ratings were achieved by only 52%, compared to 72% of the high motivation tutors/low motivation student group (the second group). In T3, the second group almost completed its ascend to "experienced student" (98%) while in the third group it was only 85.3%. It is important to note that an effective tutor-student interaction was found among students who studied with highly motivated tutors, even if they themselves had low motivation when they started the program. The students of this group achieved almost as much as the first group; that is, the tutors were able to help their students move forward and the personal commitment of tutors contributed to learning. Progress was also found among highly motivated students, even though they studied with low-motivated tutors. The students' level of motivation and ability helped them realize their potential for learning. The group where both tutors and students had low motivation was the weakest. At T2, only 32.7% were "experienced students" and at T3 only 51.3%. Moreover, only 36% of students arrived at the "advanced" level.

Table 6.
Percentage of Students in Each Category of Tutor\Student Motivation in Each Measurement, Across All Comprehension Skills.

Tutor/Student Motivation Category	T1				T2				T3			
	1	2	3	4	1	2	3	4	1	2	3	4
High tutor motivation/ high student motivation	10.0	22.7	35.3	32.0	3.4	0.0	11.3	85.3	0.0	1.3	2.0	96.7
High tutor motivation/ low student motivation	24.7	29.3	34.7	11.3	0.0	2.7	25.3	72.0	1.3	0.0	0.7	98.0
Low tutor motivation/ high student motivation	26.7	25.3	35.3	12.7	7.4	5.3	35.3	52.0	0.0	0.0	14.7	85.3
Low tutor motivation/ low student motivation	44.6	30.7	20.7	4.0	15.3	8.7	43.3	32.7	8.0	4.7	36.0	51.3
Total (N = 20)	26.5	27.0	31.5	15.0	6.5	4.2	28.8	60.5	2.4	1.5	13.3	82.8

1=Struggling Student; 2=beginning student; 3=advanced student; 4=experienced student.

5. DISCUSSION

The current intervention program combined a personal tutoring framework with an e-learning environment aimed at establishing balanced and interactive learning to cultivate the four basic processes of reading. The results of the study suggest that with the help of a multi-component intervention program it is possible to help Arabic-speaking children of low SAS to overcome the cumulative shortcomings posed by the Arabic language at the beginning of reading acquisition. Moreover, it was found that the motivational component, both in learning and teaching, is elementary to reading acquisition.

5.1. Contribution of the Intervention Program to Comprehension Skills

The findings of the study indicate that the intervention improved basic skills needed to advance the reading of the participants. These findings are consistent with research consensus that structured intervention programs that combine phonological awareness with instruction in identifying writing symbols lead to significant improvement in reading skills (Ehri et al., 2001; Felton, 1993; Hurford et al., 1994; Smith et al., 1993; Snow et al., 1998). Olshtain and Zuzovsky (2004) suggest that compensatory intervention within the school, i.e. creating a supportive in-school reading environment for students from low SAS, could be a solution to deficiencies stemming from students' home environment.

Results also show that the structured learning environment in this study, combining interactive and individualized learning with tutoring, was able to bridge the language gap and overcome obstacles arising from the problem of diglossia of the struggling students. These findings are consistent with the results of studies relating to the Arabic language which underline the importance of a targeted multi-component program (Abu-Rabia, 1999, 2000, 2002, 2003; Makhoul, 2006).

The optimality of the teaching method in the intervention program occurs with the simultaneous fostering of semantic and contextual knowledge that aids the processes of decoding and understanding. Novice readers must devote many of their resources to decoding, but semantic and contextual knowledge can address the resulting difficulty and contribute to the processes of reading comprehension (McKoon, & Ratcliff, 1992; Perfetti et al., 2005; Pressley & Afflerbach, 1995; Pressley, 1998). Accordingly, it is important to cultivate reading strategies that help the learner acquire phonemic-graphic matching skills, since understanding context guides the child in the decoding process and provides them with immediate feedback on the quality of their decoding (Torgesen & Hecht, 1996). This process reflects the interactive aspect of the reading process that combines "bottom-up" processes with "top-down" processes, a concept which served as a basic principle in the current intervention.

5.2. Contribution of the Tutors and the Interaction between Tutor and Student Motivation to the Development of the Students' Comprehension Skills

In all comprehension skills, the group most successful in promoting learning was that of highly motivated tutors and highly motivated students, whereas the least effective group was low-motivated tutors and low-motivated student pairs. This shows that although the interactive program did promote good achievements in all subgroups, in promoting literacy development it is necessary to address the motivation of the child to learn and the teacher's motivation to teach. That is, it is not enough to find struggling students and prepare a suitable curriculum for them; there must be activities targeting students' motivation to participate in the program and learn through it. In addition, ways must be devised to find suitable teachers and to ensure their high motivation.

There is a significant contribution of the tutoring environment in promoting student achievement in reading skills. The findings of the study show that students acquired the comprehension and phonological awareness skills during the program, and almost half of the students had good achievements by the intermediate measurement. Our findings are consistent with the findings of many studies that point to tutoring as an educational environment with substantial potential for improving and promoting reading ability (Cohen, Kulik, & Kulik, 1982; Fitzgerald, 2001; Juel, 1996; Leslie & Allen, 1999), especially for students diagnosed as at risk for reading acquisition.

6. CONCLUSIONS

This research shows that early intervention may prevent future failure, thus early detection and intervention are critical. Also, it is important to address individual differences in students' level of functioning in language and reading. This requires attending to the needs of the individual, especially among vulnerable populations with substantial language deficits. It is also important to build multi-component intervention programs that address the various factors that affect the reading and comprehension process (language characteristics, emotional aspects, general knowledge, etc.). The combination of motivational teachers, a learning environment that emphasizes social-emotional learning, and innovative tools suitable for the 21st century, may aid in closing literacy gaps formed by early risk factors.

The study showed the value of an individualized learning environment specifically for the struggling Arab learner. Therefore, consideration should be given to expanding the use of this method in the national Arab school system. Due to the unique characteristics of the Arabic language, it is important to master the phonological aspects and understanding of context. Teaching methods in Arabic must built on the principles of the interactive model in order to deal with the difficulties mentioned above. That is, any syllabus for literacy instruction should develop a foundation of comprehension and phonological awareness skills before systematically engaging in decoding skills. These principals are ought to be implemented via national education policies and curricula set by the Ministry of Education.

The quality of teaching is a central component of an educational system (Bean, 2020) and it is connected to the development and advancement of students' achievement (Darling-Hammond, 2017). As shown in the current study, it is important to choose teachers in training carefully, examining their degree of personal commitment and their ability to realize the theoretical principles in practical pedagogic tools that promote every student. These abilities are no less important than the academic abilities of the teachers in training, since without high motivation and personal commitment they will not succeed in contributing to and advancing the field of education.

7. FUTURE RESEARCH DIRECTIONS

The results of the current study point to the benefits of this intervention program for children at literacy risk. However, while a significant component of the learning environment developed and examined in the study was the integration of computers in teaching and as a means of supporting mediation, the contribution of the computer itself was not directly evaluated. Therefore, further research is suggested to examine the extent to which e-learning environment influences achievement in the comprehension and phonological awareness skills.

The sample in the present study included 20 students in each group, and the intervention group was divided into subgroups of 5 student-tutor pairs. Because the study incorporated both quantitative and qualitative tools, this sample is sufficient to test the hypotheses. However, it is advisable to conduct a follow-up study on a larger sample.

The motivation of the tutors and students was determined prior to conducting the study, by teacher trainers for the tutors and classroom teachers for the students. The results of the study indicate that motivation diagnosis was maintained over the 26 sessions; but it will be beneficial to specifically examine change in the initial motivation of tutors and students in longitudinal and cross-sectional studies.

Another aspect related to the students' achievements is the extent to which these achievements affect the students' progress in acquiring reading in second grade. It is advisable to further study the effect of the intervention on students' acquisition of reading skills later in their studies.

REFERENCES

- Abu-Rabia, S. (1999). The effect of vowels on the reading comprehension of second- and sixth-grade native Arab children. *Journal of Psycholinguistic Research*, 28, 93-101. <https://doi.org/10.1023/A:1023291620997>
- Abu-Rabia, S. (2000). Effects of exposure to literary Arabic on reading comprehension in a diglossic situation. *Reading and Writing: An Interdisciplinary Journal*, 13, 147-157. <https://doi.org/10.1023/A:1008133701024>
- Abu-Rabia, S. (2002). Reading in a root-based-morphology language: the case of Arabic. *Journal of Research in Reading*, 25(3), 299-309. <https://doi.org/10.1111/1467-9817.00177>
- Abu-Rabia, S. (2003). The influence of working memory on reading and creative writing processes in a second language. *Educational Psychology*, 23(2), 209-219. <https://doi.org/10.1080/01443410303227>
- Adams, M.J. (1991). *Beginning to read: thinking and learning about print*. MIT Press.
- Aram, D. & Levin, I. (2001). Mother-child joint writing in low SES: Socio-cultural factors, maternal mediation, and emergent literacy. *Cognitive Development*, 16(3), 831-852. [https://doi.org/10.1016/S0885-2014\(01\)00067-3](https://doi.org/10.1016/S0885-2014(01)00067-3)
- Assink, E.M.H (1994). *Literacy Acquisition and Social Context*. Routledge.
- Bean, R.M. (2020). The Reading/Literacy Specialist. In Bean, R. M., & Dagen, A. S. (Eds.). *Best Practices of Literacy Leaders: Keys to school improvement*. Guilford Press.
- Bentin, S., & Ibrahim, R. (1996). New evidence for phonological processing during visual word recognition: The case of Arabic. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 22(2), 309-323. <https://doi.org/10.1037/0278-7393.22.2.309>
- Bus, A.G., Van Ijzendoorn, M. H., & Pellegrini, A. D. (1995). Joint book reading makes for success in learning to read: A meta-analysis on intergenerational transmission of literacy. *Review of Educational Research*, 65(1), 1-21. <https://doi.org/10.3102/00346543065001001>
- Clay, M.M. (1972). *Reading: The patterning of complex behaviour*. Heinemann Educational Books.
- Clay, M.M. (1986). *The early detection of reading difficulties (3rd ed.)*. Heinemann Educational Books.
- Clay, M.M. (1991). *Becoming literate: The construction of inner control*. Heinemann Educational Books.
- Clearfield, M. W., & Niman, L. C. (2012). SES affects infant cognitive flexibility. *Infant Behavior and Development*, 35(1), 29-35. <https://doi.org/10.1016/j.infbeh.2011.09.007>
- Cohen, P.A., Kulik, J.A., & Kulik, C.L.C. (1982). Educational outcomes of tutoring: A meta-analysis of findings. *American Educational Research Journal*, 19(2), 237-248. <https://doi.org/10.3102/00028312019002237>
- Darling-Hammond, L. (2017) Teacher education around the world. What can we learn from international practices? *European Journal of Teacher Education*, 40(3), 291-309. <https://doi.org/10.1080/02619768.2017.1315399>
- Demirer, V., & Sahin, I. (2013). Effect of blended learning environment on transfer of learning: an experimental study. *Journal of Computer Assisted Learning*, 29(6), 518-529. <https://doi.org/10.1111/jcal.12009>
- Ehri, L. C., Nunes, S. R., Willows, D. M., Schuster, B. V., Yaghoub-Zadeh, Z., & Shanahan, T. (2001). Phonemic awareness instruction helps children learn to read: Evidence from the National Reading Panel's meta-analysis. *Reading Research Quarterly*, 36(3), 250-287. <https://doi.org/10.1598/RRQ.36.3.2>
- Feitelson, D., Goldstein, Z., Iraqi, J., & Share, D.L. (1993). Effects of listening to story reading on aspects of literacy acquisition in a diglossic situation. *Reading Research Quarterly*, 28(1), 70-79. <https://doi.org/10.2307/747817>
- Felton, R.H. (1993). Effects of instruction on the decoding skills of children with phonological-processing problems. *Journal of Learning Disabilities*, 26(9), 583-589. <https://doi.org/10.1177/00222194930260090>
- Fitzgerald, J. (2001). Can minimally trained college student volunteers help young at risk children to read better? *Reading Research Quarterly*, 36(1), 28-36. <https://doi.org/10.1598/RRQ.36.1.2>
- Hackman, D.A., Farah, M.J., & Meaney, M.J. (2010). Socioeconomic status and the brain: Mechanistic insights from human and animal research. *Nature Reviews Neuroscience*, 11, 651-659. <https://doi.org/10.1038/nrn2897>

- Halliday, M. A. K. (1989). *Spoken and Written Language*. Oxford University Press.
- Harris, L. A., & Smith, C. B. (1976). Reading instruction: Diagnostic teaching in the classroom. Macmillan.
- Howell, R., Erickson, K., Stanger, C., & Wheaton, J. E. (2000). Evaluation of a computer for reading failure. *Journal of Special Education Technology*, 15(4), 5-14. <https://doi.org/10.1177/016264340001500401>
- Hurford, D.P., Johnston, M., Nepote, P., Hampton, S., Moore, S., Neal, J., Mueller, A., McGeorge, K., Huff, L., Awad, A., Trato, C., Juliano, C., & Huffman, D. (1994). Early identification and remediation of phonological-processing deficits in first-grade children at risk for reading disabilities. *Journal of Learning Disabilities*, 27(10), 647-659. <https://doi.org/10.1177/002221949402701005>
- Ibrahim, R., Eviatar, Z., & Aharon-Peretz, J. (2007). Metalinguistic awareness and reading performance: A cross language comparison. *The Journal of Psycholinguistic Research*, 36(4), 297-317. <https://doi.org/10.1007/s10936-006-9046-3>
- Jednoróg, K., Altarelli, I., Monzalvo, K., Fluss, J., Dubois, J., Billard, C., Dehaene-Lambertz, G., & Ramus, F. (2012). The influence of socioeconomic status on children's brain structure. *PLOS ONE*, 7(10), e42486. <https://doi.org/10.1371/journal.pone.0042486>
- Juel, C. (1996). What makes literacy tutoring effective? *Reading Research Quarterly*, 31(3), 268-289. <https://doi.org/10.1598/RRQ.31.3.3>
- Kamhi, A.G., & Catts, H.W. (2011). *Language and Reading Disabilities* (3rd Edition). Pearson.
- Khamis-Dakwar, R. & Froud, K. (2007) Lexical processing in two language varieties: An event-related brain potential study of Arabic native speakers. In M. Mughazy (Ed.) *Perspectives on Arabic Linguistics* (pp. 153-168). John Benjamins.
- Levin, B. (2003, November). Improving research-policy relationships: Lessons from the case of literacy. Paper presented at the OISE/UT International Literacy Conference, Toronto, Canada. Retrieved from <https://allchildrenlearning.org/wp-content/uploads/2019/12/Improving-Research-policy-relationships.pdf>
- Leslie, L. & Allen, L. (1999). Factors that predict success literacy intervention project in an early age. *Reading Research Quarterly*, 34(4), 404-424. <https://doi.org/10.1598/RRQ.34.4.2>
- Makhoul, B. (2006). *Kheker tahalikh rekhishat miyumanyu'ot kri'ah b'safa ha'aravit b'misgeret khonkhut muvnet*. [Exploring the process of acquiring reading skills in Arabic as part of structured tutoring.] (Unpublished Doctoral Dissertation). Hebrew University of Jerusalem, Israel.
- Makhoul, B., Olshtain, E., & Ibrahim, R. (2015). Promoting comprehension skills among at-risk first graders: The role of motivation in one-to-one tutoring environment. *Psychology*, 6(4), 375-386. <https://doi.org/10.4236/psych.2015.64034>
- McKoon, G. & Ratcliff, R. (1992). Inference during reading. *Psychological Review*, 99(3), 440-466. <https://doi.org/10.1037/0033-295X.99.3.440>
- Ministry of Education (1989). *Tochnit l' hora' at ha-lashon ha'aravit v'sifruta l'beit sefer hayesodi ha'aravi, kitot aleph ad vav*. [A program for teaching the Arabic language and its literature in Arab elementary schools, grades 1-6.].
- Ministry of Education (1991). *Madrikh l'morah l'sefer El Riyad, kita aleph*. [Teacher's guide to the book El Riyad, First grade.].
- Ministry of Education (1995). *Tokhnit basis b'khashbon, handasa v'havanat hanikra l'beit sefer ha'yesodi*. [Basic programs in mathematics, geometry, and reading comprehension for elementary school.]. Van Leer Institute.
- Ministry of Education (2001). *Likrat kri'a v'k'tiva tipuakh ha'safa ha'ktuva v'hadvurah b'ganei yeladim*. [Towards improving reading and writing: Fostering the written and spoken language in kindergarten.]. Report of the Early Education Department and the Department for Planning and Development of Educational Programs. Retrieved from https://cms.education.gov.il/NR/rdonlyres/F056D0C0-361C-4230-BC3A-D0DC1036273B/8560/ganim_d.pdf
- Ministry of Education (2012). Meitzav 5772, *madedei ye'ilut v'tzmikha beit sifrit – dokh mivhanei hesegim*. [Meitzav 5772, Indices of School Efficiency and Growth – Achievement Test Report.] Report of the National Authority for Measurement and Evaluation in Education (RAMA), Israel. Retrieved from https://meyda.education.gov.il/files/Rama/Hesegim_Report_2012_f.pdf

- Mullis, I. V., Martin, M. O., & Gonzalez, E. J. (2003). *PIRLS 2001 international report*. International Study Center. Retrieved from https://timssandpirls.bc.edu/pirls2001i/pdf/p1_IR_book.pdf
- National Reading Panel. (2000). *Report of the National Reading Panel: Teaching children to read: an evidence-based assessment of the scientific research literature on reading and its implications*. U.S. Department of Education and Human Development. Retrieved from <https://www.nichd.nih.gov/sites/default/files/publications/pubs/nrp/Documents/report.pdf>
- Olshtain, E., & Zuzovsky, R. (2004). *Hakniat orianut hakri'ah b'yisrael: Mamze'i hamechkar habenleumi b'orianut hakri'ah PIRLS-2001*. [Reading literacy acquisition in Israel: Findings of the international study on reading literacy PIRLS-2001.] University of Tel Aviv: Ramot. Retrieved from <https://kotar.cet.ac.il/KotarApp/Viewer.aspx?nBookID=92677230>
- Perfetti, C. A. (2011). Phonology is critical in reading: But a phonological deficit is not the only source of low reading skill. In S. A. Brady, D. Braze, & C. A. Fowler (Eds.), *Explaining individual differences in reading* (pp. 153-171). Routledge.
- Perfetti, C. A., Landi, N., & Oakhill, J. (2005). The acquisition of reading comprehension skill. In M. J. Snowling & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 227-247). Blackwell Publishing. <https://doi.org/10.1002/9780470757642.ch13>
- Pressley, M. (1998). *Reading instruction that works*. Guilford Press.
- Pressley, M. & Afflerbach, A. (1995). *Verbal protocols of reading: The nature of constructively responsive reading*. Erlbaum.
- Regan, K., Berkeley, S., Hughes, M., & Kirby, S. (2014). Effects of computer- assisted instruction for struggling elementary readers with disabilities. *The Journal of Special Education, 48*(2), 106-119. <https://doi.org/10.1177/00224669134972>
- Rush, K.L. (1999). Caregiver-child interactions and early literacy development of preschool children from low-income environments. *Topics in Early Childhood Special Education, 19*(1), 3-14. <https://doi.org/10.1177/027112149901900101>
- Saiegh-Haddad, E. (2005). Correlates of reading fluency in Arabic: Diglossic and orthographic factors. *Reading and Writing, 18*(6), 559-582. <https://doi.org/10.1007/s11145-005-3180-4>
- Saiegh-Haddad, E. & Henkin-Roitfarb, R. (2014). The structure of Arabic language and orthography. In Saiegh-Haddad, E. & Joshi, M (Eds.). *Handbook of Arabic Literacy* (pp. 3-27), Springer. https://doi.org/10.1007/978-94-017-8545-7_1
- Scarborough, H. S., & Dobrich, W. (1994). On the efficacy of reading to preschoolers. *Developmental Review, 14*(3), 245-302. <https://doi.org/10.1006/drev.1994.1010>
- Sénéchal, M., LeFevre, J., Thomas, E.M., & Daley, K.E. (1998). Differential effects of home literacy experiences on development of oral and written language. *Reading Research Quarterly, 33*(1), 96-116. <https://doi.org/10.1598/RRQ.33.1.5>
- Shonkoff, J. P., & Phillips, D. A. (2000). *From neurons to neighborhoods: The science of early childhood development*. National Academies Press.
- Smith, S.S, Christensen, L., Goodale, D., Ingebrand, S., & Steele, K. (1993). *Effects of phonemic awareness training on impoverished first and second graders*. Paper presented at the annual meeting of the National Reading Conference, South Carolina, Charleston.
- Snow, C.E., Burns, S.M., & Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children*. National Research Council. National Academy Press.
- Stanovich, K.E. & West, R.F. (1989). Exposure to print and orthographic processing. *Reading Research Quarterly, 24*(4), 402-433. <https://doi.org/10.2307/747605>
- Stanovich, K., West, R., Cunningham, A., & Cipelewski, J. (1996). The role of inadequate print exposure as a determinant of reading comprehension problems. In Cornoldi, C. & Oakhill, J., (Ed.), *Reading comprehension difficulties: Processes and intervention* (pp. 15-32). Lawrence Erlbaum Associates.
- Torgesen, J. K. & Hecht, S.A. (1996). Preventing and Remediating Reading Disabilities: Instructional Variables That Make a Difference for Special Students. In *The first R: Every child's right to read*. Teachers College Press and the International Reading Association.
- Wagner, A. (1993). *Literacy, culture, and development: Becoming literate in Morocco*. Cambridge University.

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Chapter # 31

SELF-REPORTED KNOWLEDGE, EXPERIENCES AND PREDISPOSITION TOWARDS INTERPROFESSIONAL EDUCATION AND COLLABORATIVE PRACTICE IN FACULTY MEMBERS FROM THE CENTRE-WEST REGION OF BRAZIL: A QUALITATIVE STUDY

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ABSTRACT

The mechanisms that facilitate interprofessional education and collaborative practice (IPECP) associated with the academic training project include the effective involvement of faculty members, a topic about which there is little available knowledge in Portuguese speaking countries. The goal of the present study was the understanding of self-reported knowledge, experiences, and willingness towards IPECP of health/related areas professors, from two universities in the centre-west region of Brazil. The intentional sample included 16 professors, members of the College and Teaching Structuring Cores (definition, management and update of undergraduate pedagogical projects), who answered a semi structured interview script and filled in a sociodemographic and professional profile questionnaire. The interviews were transcribed verbatim, validated by the participants and then submitted to a thematic content analysis, supported by NVivo, version 11. The results revealed six inductive thematic categories (Undergraduate Training Process, Professional Experience in IPECP, Mechanisms for IPECP, Openness to IPECP, Interprofessional Relations and Representation of IPECP), and 24 subcategories. In general, participants revealed to be open to IPECP, even though not all had knowledge of the mechanisms or technical, political, and ethical tools that favour the development of IPECP, in undergraduate degrees.

Keywords: interprofessional education, health, undergraduate studies, teaching, predisposition.

1. INTRODUCTION

Interprofessional education and collaborative practice (IPECP) in health are prospected as conditions for ongoing qualification in healthcare settings and for the progress of worldwide health systems (Barr, 2010; Gilbert, 2013; Reeves, Perrier, Goldman, Freeth, & Zwarenstein, 2013; Reeves, Boet, Zierler, & Kitto, 2015). IPECP is the result of the synergy between many-sided efforts, from the macro organisation of health and education policies, to the commitment of the administration of higher education institutions and structure of training programmes, including the comprehension, appreciation and openness of faculty members, professionals and health units' managers to articulate knowledge from several areas in the specific training offered to each future health professional (Barr et al., 2017; WHO, 2010). In particular, knowledge about faculty members' predisposition towards IPECP is heterogeneous and, in some countries, very limited.

Loversidge and Demb (2015) led a qualitative/phenomenological study, approaching 32 professors (medicine and nursing courses) at three American universities. The goal was to explore the experiences of participants in IPECP. Results showed that participants were committed to teaching, collaborative practice in health care and understood that experiences, with supervision and post-activity reflection, led students to incorporate concepts and develop favourable attitudes towards collaborative practice. Conversely, they recognised the existence of institutional and curricular barriers that need to be addressed through the collaboration of more participative teams and the use of systematised teaching methodologies.

Lapkin, Levett-Jones and Gilligan (2012) assessed how IPECP was used in Australian and New Zealander health courses, to teach safety in the use of prescribed drugs, and how it was incorporated into the course syllabus. Of 41 faculty members contacted to answer a questionnaire, the response rate for both countries stood at 72%. In total, 80% reported they provided their students with IPECP experiences, and around 8% were planning or developing projects to provide IPECP in their courses. The remaining said they were considering, but did not implement them, or did not think to provide IPECP experiences to their students.

In the southwest of Brazil, da Silva, Peduzzi, Orchard and Leonello (2015) developed a triangulated qualitative study (multimethod) with the purpose of understanding the perceptions of faculty members, professionals and students about IPECP in primary healthcare. The interviews to 18 professors allowed to build, among others, a thematic category that showed that IPECP is a condition that allows both students and health professionals to better understand patients' needs and, answer those needs within an integrated care approach. Moreover, the professors saw that a therapeutic plan directed at users should be all-encompassing and not dichotomised or restricted to each professional. The authors concluded that a better communication and interrelations are conditions to reduce asymmetries in the professional-user relationship.

In the northeast of Brazil, Barreto et al. (2018) researched the process of interprofessional collaboration (IPC) among managers, family health strategy (FHS) professionals and faculty members. Upon analysing documents and conducting qualitative interviews, the authors found that professors from two universities (n=29), in different municipalities, saw similarities in the teaching goals and expected care when compared to FHS professionals. Hence, professors understood the advantages of teaching undergraduate students in a health care context, in order to have students develop more humane and more empathic attitudes towards patients.

Costa, Patrício, Câmara, Azevedo and Batista (2015) analysed the Reorientation National Program in Health Professional Formation (Pro-Health) and the Education by Work for Health Program, both from Brazil's Ministry of Health, as IPECP-inducing policies, upon studying 120 "Annual Technical Reports" of Pro-Health and PET-Health Projects, and 119 "Self-Assessment Reports", which were filled in by the participating higher education institution. The authors noted the analysed projects revealed new forms of interprofessional interaction and communication, with a positive impact on specific spheres of health care, among other benefits. However, the authors acknowledged the persistence of two obstacles: problems in the qualification towards collaborative practice, and problems concerning the lack of articulation between health services and universities.

In general, literature presents several studies about training faculty members in IPECP regarding health courses (Adler & Gallian, 2018; Walsh et al., 2018) as well as teachers and tutors of both medical and non-medical courses (Lima & Rozendo, 2015; Walsh et al., 2018). Nonetheless, there are few studies developed by Brazilian faculty members, from different undergraduate degrees in the field of health and education, which revealed the limited knowledge and evidence about how they think, value and act regarding IPECP.

Self-reported knowledge, experiences and predisposition towards interprofessional education and collaborative practice in faculty members from the centre-west region of Brazil: a qualitative study

Silva et al. (2021) described the experience gained through direct observation of the work of professors, at two Brazilian public universities, recorded in “logbooks”. The authors evaluated activities from 2014 to 2019 and their records were submitted to content analysis. The results showed that interprofessional education is still a challenging field, that may be enhanced through more regular activities. Professors of different undergraduate courses, by intensifying the dialogue and the preparation of activities among themselves, can potentiate their own training for an interprofessional education, as well as presenting new possibilities for the training of undergraduate and graduate students. In the same perspective, Da Costa and Pinho (2021) questioned the traditional health training, based on medical specialties, and drew attention to the organization of the Brazilian public health system, which needs to place the patient's needs at the center of the training of health professionals, as internationally recommended. Therefore, changing the attitude of teachers is essential to obtain better outcomes in the care provided. Finally, da Silva, Silva, Silva and Batista (2022) analyze teacher training (and its action as a social practice), from an interprofessional perspective, and highlighted the role of policies through the commitment of the government and managers from educational and health institutions engaged in the excellence of care and human dignity.

In our experience, the absence of interprofessional education and collaborative practice in health care tends to increase communication problems, power disputes, making the formation of a health team identity unfeasible, increasing intolerance between professionals with different backgrounds, reducing solidarity as well as compromising communication with patients contributing to alienate their needs. The present study aims to understand the perspectives of faculty members from two universities in the centre-west region of Brazil about their knowledge, experiences and predisposition (representations and attitudes) towards developing interprofessional collaborative practices and education programs within undergraduate degrees, in health care.

2. METHODS

2.1. Type of study

Qualitative, cross-sectional and exploratory.

2.2. Participants

Sixteen higher education professors from undergraduate degrees in the fields of health and/or education and health, of two universities from the centre-west region of Brazil (one private-community and one public federal), of both genders with a minimum lecturing experience of three years. The sample is purposive, and all participants needed to have experience in the Collegiate and Teaching Structuring Core (TSC), which is a committee within the higher education legislation of Brazil that aims to formulate and/or follow the pedagogical projects of undergraduate degrees (inclusion criteria).

2.3. Ethical considerations

This study was designed in compliance with Resolution no. 466, of 12th December 2012, and Resolution no. 510, of 7th April 2016, both by the National Health Council of the Brazilian Ministry of Health (BRASIL, 2012; 2016). All participants signed an informed consent form.

2.4. Instruments

This study used a Sociodemographic and Professional Profile Questionnaire (gender, age, nationality, marital status, time of professional experience as professor, teaching weekly hours and experience in working with healthcare teams, among others), and a semi-structured

interview script that included open questions based on the literature (Barr et al., 2017) and on the researcher's experience with healthcare teams. Participants were asked to consider the following central themes: specific curricular content about collaborative practice during and/or after their undergraduate or post-graduate degrees; relevance of content on collaboration and communication in healthcare teams; relevance of working in healthcare teams; mental representation of interprofessional education, among others.

2.5. Procedures

Following the approval of the research project by the Research Ethics Committees of the Brazilian universities (CEP/CONEP/CAAE n° 61664116.9.0000.5078, Report n° 2.313.969), an electronic communication was sent to the group of professors of health courses in the Brazilian institutions, who were part of the TSC, informing about the research. Those who accepted were approached, individually, and invited to participate in the interview at a place of their choosing. The majority of participants chose their office, with the exception of two professors, with whom the meeting was held in a separate room in the library of the institution. Of all those contacted, only one did not show to the interview after agreeing to participate.

All interviews began with the signing of the informed consent and the filling of the sociodemographic and professional profile questionnaire followed by the questions, based on the script. All interviews were led by the same senior researcher in qualitative research and were audio recorded verbatim.

2.6. Data Analysis

The interviews were sent by email to every participant (n=16), with a request to review and complement the information previously provided, with a 100% response rate. Following the corresponding transcription and validation, the interviews were submitted to a thematic content analysis that produced inductive categories (Bardin, 2013). The thematic categories and attributes (sociodemographic and professional profile) were introduced in NVivo version 11 for further analysis. NVivo helps organize a large amount of qualitative data into larger groupings and then into thematic categories. In addition, NVivo favors the analysis of stronger and deeper relationships in qualitative data, even if resulting from small samples (Alves da Silva, Figueiredo Filho, & da Silva, 2015).

3. RESULTS

Participants (Table 1) were predominantly women (75%), over 50 years old (81.2%) and married or with a regular partner (87.5%, graduated in Speech Therapy (6.2%), Dentistry (6.2%), Nutrition (6.2%), Psychology (12.5%), Social Work (6.2%), Medicine (25.0%) and Nursing (37.5%).

In general, participants were highly qualified, with extensive experience in teaching and practice with healthcare teams. Table 1 presents the sample characteristics: 81.2% participants held doctorate degrees or post-doctorate degrees (12.5%) and a minimum experience of five years in higher education lecturing. Regarding teaching experience, 87.5% reported having more than 20 years teaching undergraduate and/or post-graduate degrees; 68.9% dedicated 10 to 30 hours of their time to research and 50% reported no university extension activity (curricular activities developed by professors either within the university or the community around it). Approximately 93.8% of participants had experience in public policies in the areas of health, education and social work; 50.0% had 20 years or more of experience working with healthcare teams; 50% maintained their institutional bond through a public tender or a full-time work contract (43.7%).

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Table 1.
Sociodemographic characterisation of Brazilian Professors (n=16).

Variable	%	Variable	%
Gender		Age (years)	
Male	25.0	30.1 – 40	6.2
Female	75.0	40.1 - 50	12.5
		Over 50	81.2
Weekly hours dedicated to teaching (undergraduate and post-graduate)		Weekly hours dedicated to Research	18.7
10.1 to 20	12.5	Under 10	68.9
20.1 to 30	50.0	10.1 to 30	6.2
30.1 to 40	37.5	Over 30	6.2
		No research activity	
Service as professor (years)		Undergraduate Degree	6.2
5.1 to 10	8.3	Social Work	37.5
10.1 to 15	29.2	Nursing	6.2
15.1 to 20	12.5	Speech Therapy	6.2
20.1 and more	50.0	Nutrition	12.5
		Psychology	25.0
		Medicine	6.2
		Dentistry	
Marital Status		Experience with health teams (years)	6.2
Married/Regular partnership	87.5	Under 5	18.7
Divorced/Separated/Widow	12.5	5.1 to 10	25.0
		10.1 to 15	50.0
		20.1 and over	
Experience in public policies (health, education and social)		Main institutional bond	50.0
Yes	93.8	Public tender	43.7
No	6.2	Full-time contract	6.2
		Part-time contract	
Education		Number of post-graduate courses taught	50.0
Master Degree	6.2	01	31.2
Doctorate Degree	81.2	02	18.7
Post-Doctorate	12.5	None	
Weekly Extended Hours			
Under 10	25.0		
10.1 to 30	25.0		
No extension activity	50.0		

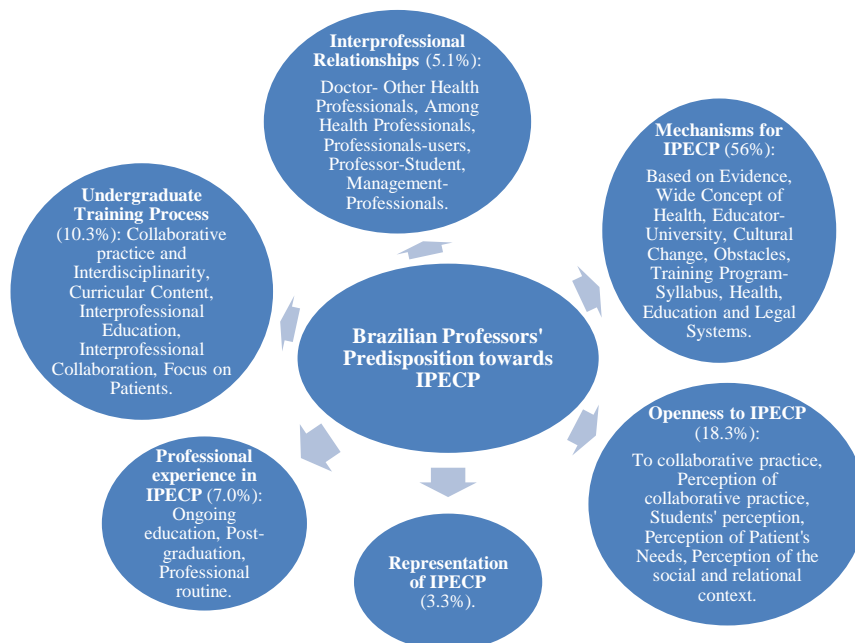
The results showed (Table 2 and Figure 1) six main categories that emerged: Professional Experience in IPECP (7.0%), Mechanisms for IPECP (56.0%), Openness to IPECP (18.3%), Undergraduate Training Process (10.3%), Interprofessional Relations (5.1%) and Representation of IPECP (3.3%). Except for the latter, all the other categories were incorporated into the thematic subcategories.

Table 2.
Designation and Description of Thematic Categories.

Thematic Category	Description (Thematic Subcategories - SC)
Mechanisms for IPECP	Potential factors in the promotion or inhibition of IPECP during their undergraduate studies or professional path.
Interprofessional Relationships	Quality or frequency or nature of perceived relationships between the several health professionals, patients and students.
Undergraduate Training Process	Curricular experiences (formal and informal) or experiences in interdisciplinarity, IPECP in teams, acquired during their undergraduate studies.
Professional Experience in IPECP	Experiences in interprofessional education or collaborative practices after graduating.
Openness to IPECP	Predisposition to act (cognitive, perceptive, valuation and ethical aspects) towards the development of an IPECP project.
Representation of IPECP	Mental representations, associations and abstract models regarding IPECP.

The professors' knowledge was represented in two thematic categories: Mechanisms for IPECP (Based on Evidence; Educator-University; Cultural Change; Obstacles; Training Programme-Syllabus; Health, Education and Legal Systems) and Interprofessional Relationships (among different health professionals, management-professionals, medical doctors-other health professionals, professor-student, professionals-patient).

Figure 1.
Thematic Categories and Subcategories within Interprofessional Health Education and Interprofessional Health Collaboration.



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Professors' predisposition was represented by the categories of Representation of IPECP and Openness to IPECP (that included Openness to Collaborative practice, Broader Concept of Health, Perception of the Social-Relational context, Perception of the Patients' Needs, Perception of Students' Predisposition towards IPECP, Perception of Colaborative Practice).

All thematic categories and subcategories were submitted to a cluster analysis through NVivo, which allowed to find the higher (Figure 2) and lower (Figure 3) thematic similarities. As a result, the Training Programme-Syllabus, Mechanisms for IPECP, Educators-University Relationship and Cultural Change showed a triangulated position of convergence between each other (Figure 2). Conversely, Training Focused on Patients, Experience in Training in IPECP, Ongoing Training, Interprofessional Relationships and Professor-Student Relationships showed a low thematic convergence (Figure 3).

Figure 2.
Cluster according to Higher Thematic Similarity – Brazilian Lecturers (n=16) – Jaccard Index. Source: Nvivo.

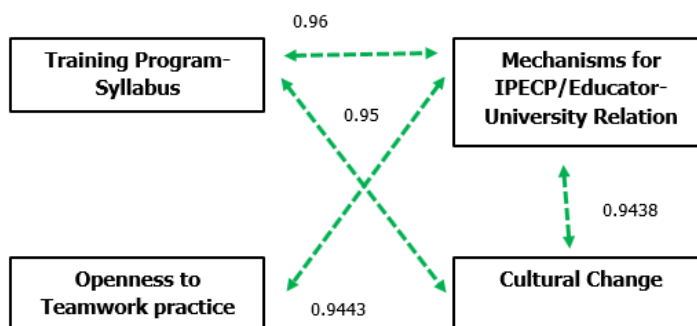
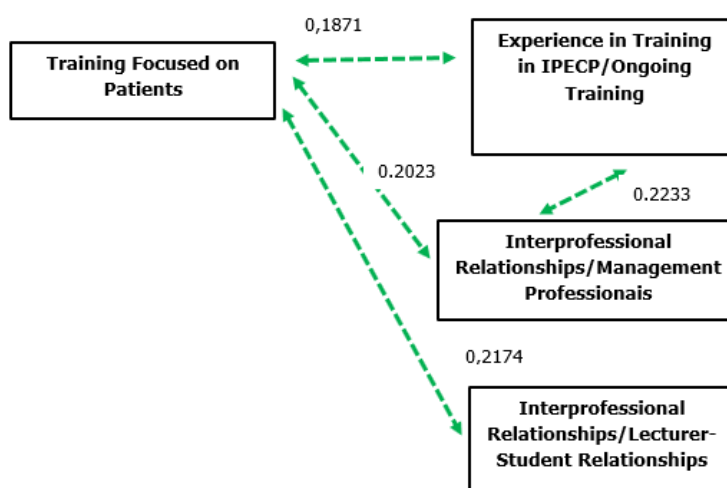


Figure 3.
Cluster according to Lower Thematic Similarity – Brazilian Lecturers (n=16) – Jaccard Index. Source: Nvivo.



4. DISCUSSION

This study aimed to explore the knowledge, experiences and predisposition towards interprofessional health education and collaborative practice, of faculty members from the centre-west region of Brazil.

4.1. Knowledge of IPECP

Participants' knowledge of IPECP was represented in two major categories (Table 2): Interprofessional Relations and Mechanisms for IPECP. Regarding interprofessional relationships, those included a web of relationships established between: a) medical doctors and other health professionals; b) among other health professionals health professionals; c) professionals and patients; d) managers and professionals; and, e) professor and student.

Regarding the relationship between medical doctors and other health professionals, there was a clear divergence between those who believed the hierarchic relationships still exist, where medical doctors are at the top of the decision-making chain, versus those who understood that the traditional relational model has been changing over the last years into a more dialoguing interaction. Among those who highlight the hierarchical relationship, a psychology professor reported: *"(...) I don't believe it has changed that much...because what has improved is the communication between psychology professionals and medical doctors (...), mutual tolerance (...) but that is not something that is institutionalised."* Others believed the relationship between medical doctors and health professionals had evolved such as a nursing professor who reported more exchanges among each other *"(...) their posture has also changed significantly. It used to be they were those gentlemen, who looked like a troop colonel when I graduated. Nowadays, it's not! They ask, they debate with us. It's that easy. I think in that sense it's better. It has improved"*.

A speech therapy professor reported the awkwardness, or idea of not being accepted by each other as common both in medical doctors and in health professionals: *"(...) I know academics with a degree in medicine look at other degrees and 'they do not like us.' So, there is still a collective subconscious speech that medicine does not want to talk. Naturally, that idea is perpetuated on to their students and, at times, I do see people being afraid to take a position."*

The image of interprofessional education in professors' minds, regarding the topic of relationships in the health care context, is characterised by different positions that can be grouped in two: 1) the existence of conflicts and distant relationships between medical doctors and other health professionals, perpetuated by institutional practices and experiences, hierarchic models (presented and maintained by professors at undergraduate and post-graduate degrees and by professionals and health services managers), and different epistemological values and scientific knowledge upheld in each profession; and, 2) existence of a relationship model, not so clear or rigorous, characterised by increased collaboration, trust, data exchange and joint planning between medical doctors and other health professionals. In that perspective, medical doctors are more open to exchanges with other health professionals; communication tends to be more assertive and based on expertise, knowledge, and ability of the professions involved in a certain exchange setting. Reducing the existing stereotypes within relationships in the health context may be driven by interprofessional education, as highlighted by Mahler, Schwarzbeck, Mink and Goetz (2018).

The relationships among different health professionals, by all accounts, as seen by the participants, are not exactly easier than those between medical doctors and other health professionals. Likewise, there are two distinctive dualities. On the one hand, there is more cooperation among different health professionals, as claimed by a social worker professor:

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“I think that, over these last decades, our experience in the area of health has allowed that to happen: professionals are mingling with other areas. So, I think that has been very enriching for social work., but on the other hand, at times I see social work somewhat closed (...) in its own dome and power, making that dialogue more difficult.”

Many professionals believe the relationship with users is hindered by the fact that people do not put themselves in each other's shoes. Consequently, duties in medical care are automatised and professionals remove themselves physically and mentally from the patient's reality. The technicism employed in that sense hides a reality of inadequacy of professionals regarding the patient's needs. A medicine professor reported that: *“(...) an experience I never forgot! I always had patients in the intensive care unit (ICU) because of cardiology issues (...) but I never stopped visiting my patient, even when the medication was not prescribed by me (...). And one day, a patient next to mine addressed me and said, ‘Wouldn't you like to be my doctor?’ I said, ‘No. You have your own doctor.’ And he said, ‘I do, but he does not come here (...)’.* He realised I was following-up. And that lack of follow-up was perceived as bad for him. So, he proposed changing medical doctors (...).” In situations like the ICU, or palliative care, for example, many professionals who were previously accompanying the patient then delegate all the medical care to the ICU and/or palliative care teams. However, a gap in the relationship with the patient is created; there is a break in the established bond. The idea of having the patient at the centre of care is also put forward by other professors (Figure 3) who believe there is a distance from health professionals towards patients. Even in contexts of health promotion, participants also feel there is a certain distancing. That distancing between the professional and the patient can be a process of self-preservation, triggered by professionals due to the negative feelings they experience over time (Bortoletti, Vasconcelos & Sebastiani, 2017).

Few participants gave emphasis to relationships between university managers and health professionals. At universities, maybe because participants felt a distance between those who make decisions and faculty members; and in healthcare units, probably because most participants were not involved in extension activities or with the community in general. Thus, managers were not perceived to be open to listening to health professionals – and even less to faculty members. This lack of openness is one of the challenges or barriers that should be overcome in order to create conditions that are more compatible with interprofessional education and collaboration in health care teams, as was also mentioned by Anderson, Smith and Hammick (2015).

Concerning the relationship between professor and undergraduate students, some participants believe there has been a more understanding relationship over the years. However, for others, there is still a sense of authority that makes it impossible to have a more open communication between teacher-student which, consequently, reduces the students' possibility to grow and develop their own knowledge. This transition into more dialogue between professors and students, according to a social work professor, *“(...) also entails restructuring the syllabus and teaching procedures.”*

Regarding the Mechanisms for IPECP, participants understood the other health professionals' aspects and the complexity entailed by a certain health condition within a broader concept of health. Moreover, participants understood that one way to teach such a broader health concept is through cross-disciplinary activities developed across several undergraduate degrees. However, some participants recognise a disciplinary and legal limit outlining each profession. In that sense, there is a certain caution so as to not cross disciplinary and legal boundaries.

Based on the data, there is an assumption that the consolidation of a broader view of health is achieved by combining the technical sense of the term with the experience gained

through several exchanges with patients and the different health needs of the population. Hence, faculty members going with students into the field is an important condition for the articulation between theory and practice, which is often delayed or made impossible by matters of lack of institutional planning and/or funding, which in turn interferes in the relationship between educator and the teaching institution. Therefore, even though faculty members should guide students regarding the reality of the health system, they do not have the appropriate conditions to accompany that immersion process. Moreover, the organisation of the teaching/lecturing work at universities and the need to meet the demands of the higher education rating agencies have delayed a greater proposition and fulfilment of interprofessional health education as reported by a nutrition professor, *“Another [difficulty] is the institution itself changing that entire structure. Adapting itself, understanding that it really needs to be done; not only in paper but because it involves financial and personnel resources, that is why I think it’s very complicated.”* When the teaching institution also demands a certain teaching position without favouring conditions, that becomes a stressor in the relationship, as stated by the same professor *“(…) it fosters that problem, but at the same time, I think it’s complicated because I have 60 students in class.”*

When the institution does not introduce collaborative practice formally, sometimes educators start developing activities due to professional or personal reasons, as pointed out by a psychology professor, *“What happens are spontaneous movements initiated by the professionals themselves in order to bridge that gap in content (...) and that is a barrier yet to be overcome.”* In that sense, a medicine professor mentioned that universities are always slower in providing answers to social needs: while the health system is constantly requiring new professionals and a new relationship between universities and public health systems; universities tend to focus on what is demanded by rating agencies. Consequently, innovation and proposals from universities in a social context are often left to second plan; universities are much more reactive than proactive, as already discussed by the classic work of Ribeiro (1975).

Participants believed that there are many obstacles to making IPECP a reality in undergraduate studies, namely: pedagogical projects (syllabus) designed exclusively for the topics covered; the current structure of the higher education system; the limited structure of educational institutions to favour active teaching methodologies and also stable working contracts; the lack of interdisciplinary and integrated collaborative practice based on the theoretical concepts taught to students; faculty members’ closed attitudes towards collaborative practice; the lack of student’s supervision by faculty members in the different and real healthcare contexts; the relative submission or subordination of some professions to others; the historic foundations of certain professions associated with moral judgements; the medical hegemony in decisions and greater social recognition in the health domain; and, the takeover of some professions over others, by the market, as reported by a medicine professor: *“Because then they [medical institutions] took on a national movement, across all states in the country, they pursued a national movement that could have multiprofessional residence, but without a physician involved...so much so that the multiprofessional modality does not have a single physician, nowadays.”*

Lastly, academically, the lack of knowledge, motivation or preparation of managers dealing directly with pedagogical projects and faculty members also delays the debate about IPECP, as illustrated by a speech therapy professor and evaluator of undergraduate studies for Brazil’s Ministry of Education: *“Because managers are not prepared either (...) when I say manager, I mean the course coordinator (...) responsible for triggering all the learning processes, at every health unit. So, they are the bridge between the faculty members and upper management. They are the ones who have to master all the methodologies for that to*

happen (...) And it isn't so." Therefore, obstacles are perceived by participants as both theoretical and conceptual, and also of an institutional, political, ideological and ethical nature. Such obstacles persist in the health domain where there are strong power relations, where democratic tradition is still scarce and where there are consecutive reactions towards maintaining a *status quo* and a *modus operandi* that, according to Fitzsimmons, Cisneros and Sannore (2014), reduce the appreciation for collaborative work.

In particular, regarding the training programme offered by undergraduate courses, participants believed students arrived at a real practice scenario very late in their education process. In internship experiences, students were more likely to interact with other professionals, but they were not always guided or monitored towards it. Subsequently, many students may start to mistakenly believe that working and communicating with other health professionals is a waste of time because, supposedly, they should be dealing directly and only with patients.

Even though some participants feel IPECP content could be organised towards a topic or a formal course throughout an undergraduate degree, most of them believe that content should be taught through experiences or large teaching units that favour interprofessional collaborative practices, and by students having contact with patients in the first semesters of the course, through integrating methodologies, as described by Souto et al. (2014). To that example, a psychology professor reported: *"So, you have a whole set of new teaching methodologies that provide that...you put individuals in action. That is where he/she will learn how to do that. Integrating with other professions, understanding what the other is doing. Why are there others with him/her? What's the common goal? So, the common goal is to care for the patient. (...) How are we going to do that together? That is not a classroom, that is action."* Naturally, there are issues to be addressed in training programs, particularly regarding the nature of content to be taught, how to schedule it throughout the course as well as the articulation with health practices, particularly, the experience of interprofessional articulation with students from different professions, in addition to the need to provide models for students to be motivated towards IPECP.

According to the participants' perspectives, mechanisms for IPECP involve an intersectoral approach established between health, education, and legal systems. In Brazil, with the new 1988 Constitution, there was a favourable environment towards creating the public policy of the Unified Health System from which the family health program stemmed, when the areas of nursing and medicine played the major roles, at first. Nonetheless, by providing the multiprofessional residence in a health program (a joint action between Brazil's Health and Education Ministries), the proposal to establish a partnership between those two professions was frustrated with the medical class, as perceived by a nursing professor: *"(...) when we created the first multiprofessional residence in Goiás, the nursing faculty (...) coordinated that residence (...). We had 20 vacancies, 10 for nurses, 10 for medical doctors (...), but there was so much resistance and interference by the Regional Council of Medicine (...); it was a very painful process, because they did not accept it: how were they going to have a multiprofessional residence coordinated by a nursing faculty? Many students reported they were forced to abandon that residence."*

Despite the governmental intervention, through the Program for the Promotion of Changes in Medical School Curricula, some participants felt the conditions to substantially change the training offer in medicine programmes was not possible and, as a result, the gap between medical doctors and other health professionals could not be repaired. Consequently, even though there is some articulation between health, education, and legal systems, especially in Brazil, there is an endogamy posture, in undergraduate degrees, not allowing the creation of better conditions for an interprofessional training, despite a few positive

IPECP experiences in the southwest of Brazil (Souto, Batista, & Batista, 2014). Also, there is a great asynchronism between municipal and state health structures, which either facilitate the integration of faculty members and students in healthcare scenarios, or maintain them at bay for the most different reasons, including administrative ones. Since many health units are managed by social organisations (defined as a not-for-profit private legal institution), teaching at those units is not always authorised, or authorisation is not always compatible with the needs of the academic calendar.

Finally, the last subcategory of Mechanisms for IPECP, addressed cultural change. This topic entails the ongoing and recurrent discussions about the undergraduate pedagogical projects and the awareness of the role of IPECP aimed at caring for the population. The idea of trial and error associated with cultural change is very present for some participants, which opens a processual and evaluation dimension to the acquisition of a new stance that favours a change in teaching proposals, content and strategies. To that extent, a nursing professor reported: *"... to make it formal, it needs to happen during the curricular reform (...) and, perhaps, we do not have a very in-depth knowledge about it yet...because it's taking isolated topics to structure an organised knowledge, to build a curricular subject in those lines (...) but we are still in a maturing phase."*

In Brazil, cultural change might also come through the new curricular guidelines for undergraduate health degrees, since those establish the skills that are common to the different health professions, as reported by a nursing professor: *"(...) putting in practice (...) our curricular guidelines, and skills, that is what we aim for...but between what we aim for and what we, professors, in the way we are trained, can give shape to, it's difficult... because when we look at those skills, they require a different way of being and thinking our teaching and doing!"*

4.2. Experiences in IPECP

The experiences of Brazilian faculty members in IPECP, based on the categories of the Training Process and Professional Experience (Table 2) showed that, in general, most participants did not have training (curricular content) on interprofessional education, but they did report allusive experiences during their mandatory curricular internship period, many of which coincided with the two last academic semesters. In addition, the experiences in optional topics or open courses for curricular integration were remembered as the main activities where students from different undergraduate degrees, could meet. In those topics, the norm was a theoretical approach, with little or no experience in collaborative practice. However, as reported by a psychology professor, at the university at that time with the military government in Brazil, the goal was to avoid meetings and dialogue with individuals from other universities, as exchanges between professionals were not encouraged. Of all the professionals interviewed, nurses were the health professionals with more reports of interfaces with other students, even though they assessed, those experiences as regular or insufficient, in the face of the needs observed during their curricular internships. Another element in personal experiences was interprofessional collaboration. For nursing professors, interactions with medical students and residents were almost non-existent, even though their internships were mainly within hospital units, in the early 80s. A nursing professor reported: *"and it was the first degree at the university... and it came from a school managed by nuns....do that concern was very present and we were forbidden to talk to medicine residents and academics."* That segregation was also perceived by medical students who studied at the same time as nursing students: *"In my undergraduate degree, I was already interested in that [collaborative practice... when I realised there was a very strict separation, especially where*

I studied, between medicine and nursing. I also began realising that over there (...) in the wards (...) we worked side by side, but the separation and the hierarchy were absolute.”

Some participants also reported that collaborative practices were only possible in university extension projects, which they took on voluntarily. Likewise, interprofessional collaboration experiences took place, for most participants, through isolated events associated with internships. However, those activities were not considered integrated, but overlapped. Those who went to university in the 90’s reported preliminary experiences in healthcare teams, as pointed out by a social work professor, *“In my undergraduate studies, the profession of social work itself, in which I was trained, was already very general. So, it already had that characteristic of interprofessional collaboration.”*

Regarding post-university experiences, these can be grouped in different contexts: obtained through professional routines reported by a nursing professor, *“(…) the first team meeting I ever participated in, at the hospital where I worked, was attended by social work, psychology, medical, and nursing professionals – and it was run by nurses [...]. It was my first time and I’ll never forget it!”* or through ongoing training at work (reported by a medical professor, *“I took some courses where that was mentioned, it was encouraged and we even practiced in workshops (...), we actually had some training in the medical school”*); or even through post-graduation courses reported by a speech therapy professor, *“I eventually built that knowledge through my specialty courses in the area of academic teaching [...] with active methodologies. So, I already had that, a vision of that collective, of the group, collaborative practice, observing others and their experiences [...]”*).

Based on their university training and on their professional experiences, participants believed the content fostering interprofessional education should include: leadership, collaborative practice, communication (assertive), ethics in research, collaborative practice philosophy, personal development, social interaction and health education. Interestingly, few reports mentioned receiving a learning experience that focused on patients’ needs, an essential aspect of interprofessional training (Gilbert, 2013; Reeves et al, 2015, WHO, 2010).

4.3. Predisposition Towards IPECP

When participants were asked to describe what came first to their minds when hearing the expression “interprofessional education”, it took them a few seconds until they could provide an answer. In general, participants used inductive thought, associating aspects to the term before formulating a synthesis of the mental representation they had created. The “interprofessional education” expression was associated with empowerment, attitudes, paradigms change, feeling part of a team, mutual learning, players involved (patient, community, individuals, faculty members and students), challenges, integration, transition between spaces and ideas, training of different individuals but within a common philosophy. Thus, even without a conceptual definition, participants made associations with structuring elements of IPECP, as exemplified by a medical professor, who reported, *“The image (...) is a debate room with at least four different professionals, discussing a topic, or a case (...), an image of a joint visit to a patient’s bed, or in a ward, or (...) in the outpatient service (...).”*

In terms of personal openness to IPECP, there was a great and positive appreciation from Brazilian professors, even if some don’t feel fully qualified to develop IPECP. As reported by a nursing professor, *“I think we need to learn that, and teach that at university, but I believe we are only going to have interprofessional or collaborative practice when we, universities, start teaching it. It has to come from here.”* Despite recognising its difficulties, participants assess participants as more open to IPECP, but they do acknowledge that faculty members may have little practice, and provide little encouragement towards IPECP at higher education institutions. The fact that this study included a purposive sample of faculty

members who think and contribute to the evolution of pedagogical projects, may induce the idea that participants are more open to IPECP and have a better perception of collaborative practices. Also, it is precisely this motivation that is supposed to pave the way for interprofessional education, at the university level (Filho, Da Costa, Forster, & Reeves, 2017).

For participants, openness to IPECP was also related to the perception of social and relational contexts established in different practice scenarios. Such scenarios can be unpredictable and unknown, demanding problem-solving actions through the collaboration of different players. In that sense, collaborative practice needs professors and students to be technically prepared, while also establishing personal and affective relationships that are more mature, in order not to overload the public system and resources. Therefore, participants perceive IPECP as a way to optimise human, material and financial resources, with the ability to push forward the goals of public policies. To that matter, a nursing professor reported, *“The system as well, (...) because it creates fewer public expenses, if we think about it. When we’re more assertive in a certain action, in a case where teams exchange ideas, where they talk, everybody wins.”* Likewise, the perception of the patient’s needs was also associated with openness to IPECP, and participants recognise the need to focus more on that relationship, as reported by a medical professor: *“(…) once we had a debate about what is a team, how it works and its characteristics, from the perspective of both professionals and patients.... something curious happened (...): when faced by the team, the patient loses the reference of who is the person most connected to him/her.”* Understanding that the patient needs to connect with a health professional, whether a psychologist, physician, social worker, or any other professional, requires being open to understand the patient’s needs. In this matter, IPECP tends to intensify or enlarge the understanding of the patient as a whole person.

Last, but not least, openness to IPECP in faculty members entails their own perception of students’ predisposition. For participants, students respond in a positive and motivated manner to the experiences provided by professors and/or professionals at health care units. Through experience, students can observe models, wide their understanding of other professionals’ work, and their own limitations as well. When students perform a task together with students from different courses, they tend to value what they accomplish. Naturally, that collaboration, that co-creation is a matter of pride and status for students. According to participants, Students Associations tend to favour interdisciplinary experiences, which can be better channelled or be more intense through regular school programs based on a greater professional collaboration.

5. CONCLUSION

Even though few participants from the sample are familiar with the technical literature and world experiences in IPECP, they did demonstrate to be open to interdisciplinarity and understand the limitations of working alone, fostering a potential field of action for the development of IPECP. Moreover, the involvement of other faculty members and students from the centre-west region of Brazil can be extended and consolidated towards IPECP when knowledge is more available and those, in leadership positions, provide institutional and training mechanisms, in line with the perspective and mission of interprofessional education and collaborative practice.

REFERENCES

- Adler, M. S., & Gallian, D. M. C. (2018). Escola médica e Sistema Único de Saúde (SUS): Criação do curso de medicina da Universidade Federal de São Carlos, SP, Brasil (UFSCar) sob perspectiva de docentes e estudantes [Medical schools and Brazilian National Health System (SUS): Implantation of the Federal University of São Carlos (UFSCar) medical school from the perspective of teachers and students]. *Interface - Comunicação, Saúde, Educação*, 22(64), 237-249. <https://dx.doi.org/10.1590/1807-57622015.0455>
- Alves da Silva, D. P., Figueiredo Filho, D. B., & da Silva, A. H. (2015). O poderoso NVivo: Uma introdução a partir da análise de conteúdo [The Mighty NVivo: An introduction from content analysis]. *Revista Política Hoje*, 24(2), 119-134, dez. 2015.
- Anderson, E., Smith, R., & Hammick, M. (2015). Evaluating an interprofessional education curriculum: A theory-informed approach. *Medical Teacher*, 38(4), 385-94 <http://dx.doi.org/10.3109/0142159X.2015.1047756>
- Bardin, L. (2013). *Análise de Conteúdo* [Content analysis]. Lisboa: Edições 70.
- Barr, H. (2010). Medicine and the making of interprofessional education. *British Journal of General Practice*, 60(573), 296-299. <https://doi.org/10.3399/bjgp10X484039>
- Barr, H., Ford, J., Gray, R., Helme, M., Hutchings, M., Low, H., Machin, A., & Reeves, S. (2017). *Interprofessional education guidelines*. London: CAIPE.
- Barreto, I. C. de H. C., Ribeiro, K. G., Moreira, A. E. M. M., Goya, N., Dias, M. S. de A., & Andrade, L. O. M. de (2018). Integração de instituições de ensino superior com sistemas municipais de saúde à luz de uma tipologia da colaboração interprofissional [Integration of higher education institutions with municipal health systems from the perspective of an interprofessional collaboration typology]. *Interface - Comunicação, Saúde, Educação*. <https://dx.doi.org/10.1590/1807-57622016.0860>
- Bortoletti, F. F., Vasconcelos, E. G. & Sebastiani, R. W. (2017). Síndrome de Burnout: quando o cuidador adocece. Uma abordagem psiconeuroimunológica [Burnout Syndrome: when the caregiver becomes ill. A psychoneuroimmunological approach]. V. A. Angerami (org). *E a Psicologia entrou no Hospital* [And Psychology entered the Hospital] (pp. 279-307). Belo Horizonte: Artesã.
- BRASIL. Ministério da Saúde. Conselho Nacional de Saúde. Resolução nº 466, de 12 de dezembro de 2012. Aprova as diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. [Resolution No. 466, of December 12, 2012 that approves the regulatory guidelines and standards for research involving human beings]. *Diário Oficial da União*. Brasília, 12, p. 59. Seção 1. Retrieved from <http://bit.ly/1mTMIS3>
- BRASIL. Ministério da Saúde. Conselho Nacional de Saúde. Resolução nº 510, de 7 de abril de 2016 [Ministry of Health Resolution No. 510, of April 7, 2016]. *Diário Oficial [da] República Federativa do Brasil*, Brasília, DF, 24 maio 2016. Seção 1, 44-46. Retrieved from <http://conselho.saude.gov.br/resolucoes/2016/Reso510.pdf>
- Costa, M. V. da., Patrício, K. P., Câmara, A. M. C. S., Azevedo, G. D., & Batista, S. H. S. Da S. (2015). Pró-Saúde e PET-Saúde como espaços de educação interprofissional [Pro-Health and PET-Health as interprofessional education spaces]. *Interface (Botucatu)*, 19(suppl 1), 709-720. <http://dx.doi.org/10.1590/1807-57622014.0994>.
- da Costa, J. A. B., & Pinho, R. C. X. (2021). Formação docente para educação interprofissional (EIP) na saúde para o ensino da teoria a prática no âmbito SUS [Teacher training for interprofessional education (EIP) in health for the teaching of theory and practice in the framework of the unique health system (SUS)]. *Humanidades e Inovação*, 8(44), 88-99.
- da Silva, G. T. R., Silva, E. A. L., Silva, R. M. de O., & Batista, S. H. S. da S. (2022). Training of teachers in the Health field from the perspective of interprofessional education. *Revista Brasileira de Enfermagem*, 75(4), e20201369. <https://doi.org/10.1590/0034-7167-2020-1369>
- da Silva, J. A. M., Peduzzi, M., Orchard, C., & Leonello, V. M. (2015). Interprofessional education and collaborative practice in Primary Health Care. *Journal of Nursing USP*, 49(Suppl 2), 15-23. <https://doi.org/10.1590/S0080-623420150000800003>

- Filho, J. R. F., da Costa, M. V., Forster, A. C., & Reeves, S. (2017). New national curricula guidelines that support the use of interprofessional education in the Brazilian context: An analysis of key documents. *Journal of Interprofessional Care*, 31(6), 754-760. <https://doi.org/10.1080/13561820.2017.1346592>
- Fitzsimmons, A., Cisneros, B., & Sannore, J. (2014). A learner developed longitudinal interprofessional education curriculum. *Journal of Interprofessional Care*, 28(1), 66-67. <https://doi.org/10.3109/13561820.2013.820692>
- Gilbert, J. H. V. (2013). Interprofessional – education, learning, practice and care. *Journal of Interprofessional Care*, 27(4), 283–285. <https://doi.org/10.3109/13561820.2012.755807>
- Lapkin, S., Levett-Jones, T., & Gilligan, C. (2012). A cross-sectional survey examining the extent to which interprofessional education is used to teach nursing, pharmacy and medical students in Australian and New Zealand Universities. *Journal of Interprofessional Care*, 26(5), 390-396. <https://doi.org/10.3109/13561820.2012.690009>
- Lima, P. A. de B., & Rozendo, C. A. (2015). Challenges and opportunities in the Pró-PET-Health preceptorship. *Interface: Comunicação, Saúde e Educação*, 19(Suppl 1), 779-791. <https://doi.org/10.1590/1807-57622014.0542>
- Loversidge, J., & Demb, A. (2015). Faculty perceptions of key factors in interprofessional education. *Journal of Interprofessional Care*, 29(4), 298–304. <https://doi.org/10.3109/13561820.2014.991912>
- Mahler, C., Schwarzbeck, V., Mink, J., & Goetz, K. (2018). Students' perception of interprofessional education in the bachelor programme "Interprofessional Health Care" in Heidelberg, Germany: an exploratory case study. *BMC Medical Education*, 18(1), [19]. <https://doi.org/10.1186/s12909-018-1124-3>
- Reeves, S., Boet, S., Zierler, B., & Kitto, S. (2015). Interprofessional Education and Practice Guide No. 3: Evaluating interprofessional education. *Journal of Interprofessional Care*, 29(4), 305-312. <https://doi.org/10.3109/13561820.2014.1003637>
- Reeves, S., Perrier, L., Goldman, J., Freeth, D., & Zwarenstein, M. (2013). Interprofessional education: effects on professional practice and healthcare outcomes (update) (Review). *The Cochrane Library*. <https://doi.org/10.1002/14651858.CD002213.pub3>
- Ribeiro, D. A (1975). *Universidade necessária*. 2. ed. Rio de Janeiro: Paz e Terra.
- Silva, E. A. L., da Silva, G. T. R., dos Santos, N. V. C., Silva, R. M. de O., Fraga, F. M. R., Ribeiro-Barbosa, J. C., & Leal, B. C. (2021). Formação docente para o ensino da educação interprofissional [Training of faculty members on interprofessional education]. *Cogitare Enfermagem*, 26:e73871. <https://doi.org/10.5380/ce.v26i0.73871>
- Souto, T. da S., Batista, S. H., & Batista, N. A. (2014). A educação interprofissional na formação em Psicologia: olhares de estudantes [The interprofessional education in educational Psychology: Student's perspectives]. *Psicologia: Ciência e Profissão*, 34(1), 32-45. <https://dx.doi.org/10.1590/S1414-98932014000100004>
- Walsh, D. S., Lazorick, S., Lawson, L., Lake, D., Garrison, H. G., Higginson, Vos, P., & Baxley, E. (2018). The Teachers of Quality Academy: Evaluation of the Effectiveness and Impact of a Health Systems Science Training Program. *American Journal of Medical Quality*, 34(1), 1-9. <https://doi.org/10.1177/1062860618778124>
- WHO - World Health Organization (2010). *Framework for action on interprofessional education & collaborative practice*. Geneva: WHO.

LIMITATIONS OF THE STUDY

The findings in this study were based on one public university and one private community university from the centre-west region of Brazil, which therefore do not express regional differences in Brazil, an issue that needs new research for a better comprehension.

Self-reported knowledge, experiences and predisposition towards interprofessional education and collaborative practice in faculty members from the centre-west region of Brazil: a qualitative study

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DECLARATION OF INTEREST

The authors declare there is no conflict of interest. Moreover, the authors are the only ones responsible for the content of this chapter.

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Chapter # 32

SCIENCE TEACHERS' PERCEPTIONS AND PRACTICES ON USING MOBILE-BASED INFORMAL FORMATIVE ASSESSMENT FOR INQUIRY-BASED TEACHING IN SOUTH AFRICAN SCIENCE CLASSROOMS

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ABSTRACT

The proliferation of mobile technologies in different contexts contributes to the rapid and extensive implementation of mobile-based teaching and learning practices across the globe. Effective implementation of mobile-based informal formative assessment practices in science classrooms could yield to scientifically literate learners who are able to communicate, work collaboratively to construct knowledge and think critically. Data was collected from four purposively selected science teachers around Gauteng province, through questionnaire, classroom observations and stimulated-recall discussions. The findings from the questionnaire indicated that all four participating science teachers still enact formative assessment following the traditional and teacher-dominated approach. Numerous challenges such as insufficient classroom time, inadequate resources and unstable Wi-Fi connection hinders teachers from frequently practicing inquiry-based instructional strategies and technology-enhanced formative assessment. Although these four science teachers have experienced numerous challenges, they have pointed out numerous benefits of implementing mobile-based formative assessment for inquiry-based learning. Benefits such as enhanced learner engagement, knowledge construction, participation, motivation, and comprehension of scientific concepts during the learning process were reported. However, certain changes such as flexible curriculum, adequate teaching and learning time and adequate and relevant teacher professional development must be implemented to ensure successful mobile technology-enhanced formative assessment for inquiry-based learning practices.

Keywords: formative assessment, informal formative assessment, inquiry-based teaching, mobile technologies.

1. INTRODUCTION

The shift from traditional teacher-dominant teaching approaches towards inquiry-based teaching approaches has led to a critical consideration of technological tools that have great potential to effectively support formative assessment practices in an inquiry-based science classroom. Trending technologies such as mobile technologies are developed and rapidly integrated into educational contexts to offer adequate support to teachers for the effective enactment of formative assessment practices (Woolf, 2010). The 21st-century learners are regarded as a technology-savvy generation that is eager to experiment and enjoy learning and assessments through educational applications such as Kahoot! Socrative and Quizizz on their mobile devices (Anamalai & Yatim, 2019).

Research reveals that game-based formative assessment tools such as Socrative and Kahoot! have a positive impact on the learners' learning experiences, enhancing learners'

motivation and active engagement toward science learning (Ismail & Mohammad, 2017). It is accordingly important for science teachers to adopt and use mobile technologies to support effective informal formative assessment practices for inquiry-based teaching. Although mobile-based formative assessment is still an emerging area in the mobile learning research context, mobile technologies have great potential in facilitating formative assessment practices in an inquiry-based classroom (Nikou & Economides, 2018). Formative assessment is an important component in the teaching and learning process which supports learners in acquiring skills, knowledge, and expertise that will help them to be critical and competent learners in the 21st-century era (Nikou & Economides, 2018).

Currently, the skills that are in demand in the 21st-century era include communication, critical thinking and creativity, and collaboration. There are numerous benefits associated with the effective use of mobile technologies for formative assessment practices. To point out a few benefits, *firstly*, mobile technologies enable easier administration of formative assessment activities (Bacca-Acosta & Avila-Garzon, 2021). *Secondly*, formative assessment conducted through mobile technologies has the potential of enhancing learners' motivation and achieve the stipulated learning goals (Nikou & Economides, 2018). *Thirdly*, mobile technologies can further support a wide variety of assessment practices such as formative assessment, informal formative assessment, and game-based assessment (Sung, Chang, & Liu, 2016). *Fourthly*, the effective use of mobile technologies can help teachers to successfully assess their pedagogical practices as well as the learners' competencies related to 21st-century knowledge and skills such as critical thinking, collaboration, creativity, communication, and problem-solving (Nikou & Economides, 2018). *Fifthly*, mobile technologies can be used to capture learners' performance and analyze the captured data to inform the next teaching and learning steps while providing appropriate support to learners according to their needs and level of conceptual understanding based on their performance (Sung et al., 2016).

Empirical research (Oyelere, Suhonen, Shonola, & Joy, 2016) has reported that mobile devices play a vital role in learners' academic achievement, providing adequate support to foster meaningful teaching and learning experiences and improve engagement with the learning material, collaboration, enjoyment, and interest, promoting continuous interactions and can also facilitate innovative pedagogical strategies that will equip learners with higher-order thinking skills. Despite the numerous affordances associated with mobile-based formative assessment practices in the 21st-century era, science teachers are experiencing numerous challenges that hinder the successful enactment of informal formative assessment using mobile technologies. Lack of appropriate teaching and learning resources, adequate technical and management support, teachers' adequate knowledge and experience, and teachers' positive attitudes and beliefs towards mobile-based formative assessment are the main challenges that hinder teachers from implementing mobile-based formative assessment (Nikou & Economides, 2018). It is noticeable that teachers receive arguably little or no guidance to select and effectively implement mobile technologies for formative assessment when following an inquiry-based pedagogical approach. Grob, Holmeier, & Labudde (2017) argue that teachers' lack of formative assessment literacy has been reported and professional development is suggested as an approach to developing teachers' formative assessment literacy.

1.1. Conceptualizing Informal Formative Assessment

Ruiz-Primo (2011) describes informal formative assessment as a practice that allows the teacher and learners to collect evidence of learners' understanding by using various assessment opportunities. In any classroom, the informal formative assessment can take place

between the teacher and learner and learner-to-learner interaction, depending on the purpose of the assessment. Therefore, the informal formative assessment does not require naturally predictable events that occur in any classroom but requires ongoing small-scale, frequent learning opportunities that teachers will use to collect, analyze, and interpret learners' performance and conceptual understanding toward the stipulated learning goal (Ruiz-Primo, 2011). Thorough planning, structuring of assessment questions, and timing are critical aspects required to ensure that teachers implement informal formative assessment effectively in real-time every day (Ruiz-Primo, 2011). This means that when teachers are practicing informal formative assessment, they need to be aware that informal formative assessment is consistent with the purpose of sound educational assessment which goes beyond conventional assessment. Informal formative assessment requires teachers to make decisions "on the fly" and allow them to reflect in action and use learners' responses to direct the next teaching and learning step.

The informal formative assessment constitutes social nature as one of the fundamental mechanisms by which learning occurs even beyond the classroom and various contexts. As a result, learning activities such as classroom conversations can foster the social nature of informal formative assessment in the classroom. Ruiz-Primo (2011) argues that informal formative assessment should create opportunities for 'evaluating, modifying and re-thinking the learning opportunities intended to enable learners to achieve their learning goals' (p.16). In the 21st century era, there is an increasing expectation that teachers will use technological tools, including mobile technology to teach and assess learners' learning. Accordingly, there have been developments in what should be expected of 21st-century learners in today's world, which is characterized by 21st-century demands. These learners are expected to acquire 21st-century skills including critical thinking, problem-solving, communication, creativity, collaboration, and innovation (Luckin, Clark, Avramides, Hunter, & Oliver, 2017). The adoption and negotiation of these skills suggest a need to review the ways in which students' learning is assessed, which implies that teachers must adopt and improve their pedagogical and formative assessment strategies. Assessment strategies such as mobile-based assessment can be employed in a classroom in such a way that learners acquire the in-demand 21st-century skills. The focus of this chapter is on investigating the benefits and challenges that in-service science teachers experience when enacting mobile-based formative assessment for inquiry-based learning in a South African classroom.

2. BACKGROUND

We live in a world where teachers are constantly challenged to reflect, modify, and change their pedagogical strategies to fit with current trends and demands. Innovative pedagogical strategies are necessary in a 21st-century classroom where learners will be equipped with adequate knowledge and skills to be competent and meet the demands anywhere in the world, in the present and future. There are numerous factors that play a significant role in the teaching and learning process, such as the school structure, organization, policies, and management but what happens in the classroom between the teacher and the learners is very crucial. This includes the assessment process which is an integral part of teaching and learning. Therefore, it is important to understand how mobile technology can be used to administer formative assessments that will enhance learners' conceptual understanding, communication, collaboration, and critical thinking, and ensure that all learners attain and exceed the intended curriculum intended aims. In South Africa, the White Paper on e-Education, further emphasizes that the thoughtful and successful integration of technological devices can enhance the learners' motivation and productivity,

improve the quality of the teaching and learning processes, and promote high-order thinking skills such as critical and creative thinking, scientific reasoning and problem-solving (Department of Education White Paper on e-Education, 2004).

Mobile learning is perceived as a process of learning mediated by technological handheld devices such as smartphones, tablets, Personal Digital Assistants (PDAs), and e-book readers to enhance and support the teaching and learning process (Kukulska-Hulme, Lee, & Norris, 2017). Mobile learning is perceived as a form of learning that occurs through social and content interactions in multiple contexts using personal handheld electronic devices. Based on these perceptions, mobile learning mainly emphasizes how learning is tethered from various contexts and how learners learn the subject matter artifacts using mobile technologies (Crompton, Burke, & Gregory, 2017).

These mobile technological devices have been repeatedly claimed to offer flexibility and assistance in enhancing the learners' motivation, interest, and autonomy while supporting learners in interacting and collaborating with their peers, as well as increasing the learners' engagement and cognitive growth during the learning process (Khaddage, Müller, & Flintoff, 2016). Empirical research has reported several benefits of the successful use of mobile technologies in classrooms. Crompton et al. (2017) point out that mobile technologies can be used to afford learners contextualized and personalized learning experiences and provide both learners and teachers with affordances to interact anytime from various locations. Learning concepts through mobile technology-enhanced approaches could afford learners the opportunities to reflect deeply, acquire adequate communication and collaboration skills, and promote social and constructivist learning. Mobile learning technologies have been reported to be a powerful tool that can be employed in a classroom to enhance pedagogical practices while ensuring that the needs of the 21st digital native learners' need are met to ensure meaningful and self-regulated learning.

Furthermore, Cerratto Pargman, Nouri, and Milrad (2018) stipulate that those mobile technologies foster different types of mobile activities including a mix of instructions, assessing, and providing constructive formative assessment feedback to the learners. There is a growing emphasis on ensuring that teaching and learning activities promote creative, constructive, and interactive learning environments by using current trending technologies, such as mobile technologies. Ozdamli (2012) posits that learning activities facilitated through mobile technologies such as mobile cell phones are underpinned by learning theories such as the constructivist learning theory. Based on Piaget's (1967) cognitive constructivism and Vygotsky's (1978) social constructivism which together shape the nature of inquiry-based instruction, several instructional models of inquiry have been developed. Constructivism is a paradigm that assumes that knowledge is subjective, contextual, and inherently partial and has become particularly prominent in science education through the focus on Inquiry (Minner, Levy, & Century, 2010). Accordingly, Dias et al. (2008) assert that the constructivist learning theory is the most significant learning theory for describing learning that is facilitated by mobile technologies. Suarez, Specht, Prinsen, Kalz, and Ternier (2018) point out that the integration of mobile technology in an inquiry-based context affords opportunities for new guidance, interactivity in technology-supported inquiry-learning activities, and participation in classroom conversations and knowledge construction. According to Elliot, Ngugi, and Malgwi (2018), technological tools can be used by teachers to successfully administer formative assessment in both formal and informal approaches. Internationally, K-12 public schools have introduced the Bring Your Own Device (BYOD), which encourages teachers to implement technology as a formative assessment tool. Research conducted by Charlesworth (2012) reported that using technology in a classroom presents several benefits, including increased learner engagement, offering a

simple and quick way of providing feedback to both the learners and the teacher, which will further help the teacher to have a clear understanding of the learners' learning progress and comprehension.

Laurillard (2007) highlights the importance of the dialogue interactions between the teacher and the learners, which is mediated through educational technology platforms in order to improve the learners' understanding of particular phenomena. The integration of technology in the formative assessment practices will further allow learners to revisit the questions anytime they need while enabling both learners and teachers to monitor progress and gather feedback on the entire teaching and learning process.

Empirical research has shown that the use of formative assessment can foster meaningful learning for learners and support the development of inquiry competencies in learners in science classrooms (Black & Wiliam, 2005; Hume & Coll, 2010).

Formative assessment is regarded as an "assessment for learning" and a critical process that involves interpreting the evidence of learner performance, which is then used to inform the next teaching and learning step (Grob et al., 2017). Additionally, formative assessment is typically practiced in classrooms with the aim of testing the abilities, skills, and knowledge that learners acquired in order to achieve the desired learning outcomes (Alotaibi, 2019). Research (Alotaibi, 2019; Young & Jackman, 2014) posits that although teachers have positive attitudes towards formative assessment practices, they are reluctant and less confident to effectively implement formative assessment in their classrooms. This situation is due to various reasons including time constraints, excessive workload, large class sizes, teacher anxiety, ambiguous guidelines for effectively enacting formative assessment practices, and a rigid curriculum, which is summative in nature and forces teachers to teach for summative assessment purposes (Alotaibi, 2019).

The lack of adequate understanding of formative assessment on the part of teachers has been observed as one of the determinant factors of either successful or unsuccessful implementation of formative assessment practices in classrooms (Vandeyar & Killen, 2007). Consequently, teachers who have an adequate understanding of formative assessment practices will effectively employ it daily in their classrooms; whereas teachers who have an inadequate understanding of formative assessment practices, will not employ this practice in their daily teaching practices. The National Policy on Assessment and Qualifications for Schools is aimed at guiding teachers to effectively apply formative assessment and use it to identify the learners' learning difficulties, which are then addressed early before the summative assessments. Black and Wiliam (2005) posit that teachers can experience formative assessment as an effective and beneficial practice only if the teachers have adequate understanding to accept and use it to enhance learners' conceptual understandings and skills during the learning process in a classroom.

The rationale for this exploratory qualitative case study is to obtain a more in-depth understanding of the significant role played by the use of mobile technologies by teachers when enacting formative assessments for inquiry-based teaching of science subjects. Given the above-mentioned reasons behind the South African science teachers' inability to enact mobile technology-enhanced formative assessment practices in inquiry-based teaching, the current study is relevant because it seeks to:

- Identify the challenges that impede LS and PS teachers from enacting mobile technology-enhanced formative assessment practices in inquiry-based teaching.
- Suggest the empowerment evaluation approach as a professional development strategy that will help in overcoming intrinsic and extrinsic factors affecting the effective implementation of mobile technology-enhanced formative assessment.

3. RESEARCH QUESTIONS, AIMS, OBJECTIVES, METHODOLOGY, AND DESIGN

3.1. Research Question, Aim, and Objectives

Despite global empirical research (Sung et al., 2016; Grob et al., 2017) that has reported the significant role of implementing mobile-learning technologies in an inquiry-based pedagogy, the teachers' experiences, and challenges in the use of mobile-based formative assessment, not many studies in science education have reported on the teachers' experienced benefits and constraints with the use of mobile-based formative assessment in a South African context. Thus, for this study, the overall aim was to investigate South African science teachers' experienced benefits and constraints with the use of mobile-based formative assessment for inquiry-based teaching. The following research question was posed to drive the inquiry.

What are science teachers' experienced benefits and constraints with the use of mobile-based formative assessment for inquiry-based teaching?

In answering the posed research question, we purposively and conveniently selected four science teachers from around the Gauteng province schools, which presumably had the resources for enacting mobile-based formative assessment and inquiry-based teaching to participate in this study. The objectives included to;

- *investigate science teachers' experienced benefits with the use of mobile-based formative assessment for inquiry-based teaching.*
- *explore science teachers' experienced constraints in the use of mobile-based formative assessment for inquiry-based teaching.*

3.2. Theoretical Framework

The constructivist learning theory proposed by Vygotsky (1978) and Piaget (1967) was adopted as suitable to theoretically guide this study. Constructivism has two categories, namely social constructivism (Vygotsky, 1978) and cognitive constructivism (Piaget, 1967) which both shape the nature of inquiry-based pedagogy and provide explanations on how individual learners adapt and refine knowledge through active and collaborative participation. Aligning to constructivism learning theory, empirical research Ozdamli (2012) pointed out that the constructivist learning theory is the most significant learning theory for describing, guiding, and underpinning learning facilitated through mobile technologies.

3.3. Research Methodology

Creswell and Creswell (2017) define qualitative research methodology as an approach that gives the researcher room to be descriptive and consider social phenomena. Taking into consideration this definition, the qualitative research methodology was adopted and deemed suitable for gathering data that will help us answer the research question of this study. A case study design was adopted as it a design that allowed the researcher to follow participant science teachers over an extended period.

3.4. Data collection and analysis

Participants of this study included four science teachers' pseudonyms as T_A, T_B, T_C, and T_D from three different South African schools in Gauteng province. Three teachers had 5 – 6 years experience of teaching science subjects such as Life Sciences and Physical Sciences, and the fourth teacher had a three-year experience of teaching Life Sciences. Data was collected in three stages namely, Stage 1 – open-ended questionnaires: Stage

2- classroom observations, and Stage 3- stimulated-recall discussions. Open-ended questionnaire data collected in stage 1 was collected with the aim of identifying participants' perceptions on enacting mobile-based formative assessment for inquiry-based teaching. In Stage 2 of data collection, classroom observations were video-recorded with the aim of understanding the actual practices of the participating science teachers in terms of how they enact mobile-based formative assessment in inquiry-based teaching within a natural setting of their classrooms. The video-recorded lessons were approximately 45 – 60 minutes long per lesson. All open-ended questionnaire responses from stage 1 and video-recorded stage 2 data were transcribed and analyzed using thematic and deductive coding, in order to identify the correlation and differences between the science teachers' perceptions and actual pedagogical practices of mobile-based formative assessment for inquiry-based teaching. Thereafter, the findings from the first two stages guided the formulation and administration of the questions for the stimulated-recall discussions for stage 3 of the data collection.

4. RESULTS AND FUTURE RESEARCH DIRECTIONS

Regarding formative assessment, findings from the open-ended questionnaire analyses revealed that the science teachers do practice formative assessment in a traditional, teacher-dominated approach, with the aim of testing learners' understanding of the content, identifying any knowledge gaps, and helping learners to prepare for summative assessment. Some of the formative assessment activities they used included homework activities, class shirt quiz, question-and-answer, and spot tests. However, these forms of formative assessment practices do not provide teachers with opportunities to provide instant feedback and continuously probe learners' responses by asking follow-up questions during the teaching and learning process. Formative assessment activities such as classwork and homework activities require teachers to have a couple of days of marking and give feedback to the learners, by that time learners have even forgotten what they were learning, this somehow affects the continuous sequence between one lesson to the next. As a result, it becomes a challenge for teachers to use learners' performance and use it to inform the next teaching and learning step. Furthermore, the findings indicated that these science teachers seldom implement mobile technologies to enact formative assessments. During the stimulated-recall discussions, they indicated that there are numerous hindrances to the successful enactment of mobile-based formative assessment for inquiry-based learning. The identified hindrances include insufficient classroom time, limited knowledge on various forms of formative assessment, and inadequate knowledge and skills on the use of mobile applications such as Kahoot! and Socrative and mobile technology integration to effectively enact formative assessment every day throughout the lesson. Only two out of four participant teachers have experienced and know how to use mobile-based formative assessment platforms such as Socrative and Kahoot!, while the other two have no experience and knowledge of such platforms for conducting the formative assessment.

Following the nature of this study, the participating science teachers were provided with guidance on how to conduct formative assessments using platforms such as Kahoot! On mobile technologies. Thereafter, they were given an opportunity to implement Kahoot! for mobile-based formative assessment. During the observations of the lessons, it was revealed that inadequate knowledge and skills have an impact on how teachers enact mobile-based formative assessment for inquiry. As it was clearly visible that these teachers do not understand the key significance of using formative assessment, instead to them it is just another approach for engaging learners and keeping them active during the lesson. Overall, it was observed that all four participating science teachers could not complete their

lessons within the stipulated lesson time, they could not analyze, interpret and use learners' performances from the Kahoot! and Socrative to inform the next teaching and learning step. Wi-Fi connectivity issues were observed and the coherent teaching and learning process was affected.

Accordingly, these findings were fully explained by the participating science teachers during the stimulated-recall discussions, where they indicated that school context and certain socio-economic factors contribute to how teaching and learning take place. For instance, in two schools - learners do not normally bring mobile devices to school for learning purposes and some learners cannot afford such devices, which hinders' full learner participation during mobile technology-enhanced teaching and learning. Secondly, the time allocated per lesson, which is ranging between 30 to 60 minutes is insufficient for teachers to effectively engage learners, and ensure meaningful and constructive learning, as a result, exploration, elaboration, and even assessment time are very limited, and thereafter, teachers tend to bend towards traditional, teacher-dominant teaching. Thirdly, there were noticeable differences between the teachers' use of game-based formative assessment, as one out of four used Socrative while the other three used Kahoot! platform. Only 2 out of 4 participating teachers managed to use learners' responses to stimulate classroom discussions and ask follow-up questions with the aim of identifying knowledge gaps and enhancing learners understanding before moving to the next quiz questions. Whereas the other two teachers only administered the Kahoot! and Socrative at the end of the lesson with little to no interpretation and use of learners' responses to inform the next teaching and learning step.

The findings from this study reveal that although science teachers recognize the importance of incorporating mobile technologies and have acquired basic knowledge and skills to effectively enact mobile-based formative assessment for inquiry-based teaching, their mobile-based formative assessment practices still require extensive guidance and development. These findings concur with research findings such as (Cochrane, 2014; Sung et al., 2016; Grob et al., 2017) that attest that mobile technologies can be successfully implemented and be more effective with pedagogies such as inquiry-based teaching and formative assessment, however, teachers are experiencing difficulties in implementing mobile technologies for inquiry-based teaching and formative assessment due to lack of adequate knowledge and skills, inadequate teaching and learning resources, large class sizes, insufficient teaching time. South African curriculum structure does not give teachers opportunities to be flexible and teach according to their classroom context as they must rush to complete the prescribed syllabus content on time, as a result, the use of mobile-based formative assessment for inquiry-based teaching is not possible as this pedagogical approach requires time for preparing, administering, and discussing learners' input during the learning process.

Based on the above-presented results, there is still a need for meaningful development of in-service teachers in equipping them with adequate knowledge and skills to enact 21st-century pedagogy like the mobile-based formative assessment. Based on these findings, we recommend that the science education fraternity including, Department of Education authorities, researchers, and teacher educators provide intervention programs for in-service teachers on the effective enactment of mobile-based formative assessment for inquiry-based teaching. Studies of this nature could help inform higher institutions and teacher-training programs about the gaps and the type of guidance and support required to equip teachers with adequate knowledge and skills to effectively enact mobile-based formative assessment for inquiry-based teaching.

5. CONCLUSION

Based on the literature reviewed in this study, it can be concluded that the enactment of mobile-based formative assessment can improve learners' interest and engagement in science classrooms. However, the effective enactment of mobile technology-enhanced formative assessment is still a challenge for South African science teachers. Taking into consideration the 21st-century technology-savvy learners we have in science classrooms; the traditional use of formative assessment practices and non-inquiry-based pedagogies are no longer relevant and effective for teaching and learning. Even though the challenges that in-service teachers experience when enacting mobile technology-enhanced formative assessment in inquiry-based science classrooms still need to be addressed, the data studied suggest that the benefit of this pedagogical practice and EE professional development approach are great. This conclusively confirms that the EE professional development approach to providing adequate support and training to in-service science teachers needs to be seriously considered with the aim of improving the teaching and learning of science concepts through innovative pedagogical strategies.

REFERENCES

- Alotaibi, K. A. (2019). Teachers' Perceptions on Factors Influence Adoption of Formative Assessment. *Journal of Education and Learning*, 8(1), 74. <https://doi.org/10.5539/jel.v8n1p74>
- Anamalai, T. R., & Yatim, M. H. (2019). A comparative study of formative assessment tools. *Journal of Information System and Technology Management*, 4(14), 41–71. <https://doi.org/10.35631/jistm.414006>
- Bacca-Acosta, J., & Avila-Garzon, C. (2020). Student engagement with mobile-based assessment systems: A survival analysis. *Journal of Computer Assisted Learning*, 37(1), 158–171. <https://doi.org/10.1111/jcal.12475>
- Black, P., & Wiliam, D. (2005). The Formative Purpose: Assessment Must First Promote Learning. *Yearbook of the National Society for the Study of Education*, 103(2), 20–50. <https://doi.org/10.1111/j.1744-7984.2004.tb00047.x>
- Cerratto Pargman, T., Nouri, J., & Milrad, M. (2017). Taking an instrumental genesis lens: New insights into collaborative mobile learning. *British Journal of Educational Technology*, 49(2), 219–234. <https://doi.org/10.1111/bjet.12585>
- Charlesworth, M. (2012). Promoting the use of classroom response systems, Learning with mobile technologies, handheld devices, and smartphones: Innovative methods. *Huddersfield, UK: The University of Huddersfield*.
- Cochrane, T. D. (2014). Critical success factors for transforming pedagogy with mobile Web 2.0. *British Journal of Educational Technology*, 45(1), 65–82. <https://doi.org/10.1111/j.1467-8535.2012.01384.x>
- Creswell, J.W., & Creswell, J.D. (2017). *Research design: qualitative, quantitative, & mixed methods approaches (5th ed.)*. Thousand Oaks, CA: Sage
- Crompton, H., Burke, D., & Gregory, K. H. (2017). The use of mobile learning in PK-12 education: A systematic review. *Computers & Education*, 110(110), 51–63. <https://doi.org/10.1016/j.compedu.2017.03.013>
- Dias, A., Carvalho, J., Keegan, D., Kismihok, G., Mileva, N., Nix, J., & Rekkedal, T. (2008). *An introduction to mobile learning. Work Package*.
- Department of Education. (2004). White paper on e-education. *Government Gazette*, (236734).
- Elliot, E. A., Ngugi, B., & Malgwi, C. A. (2018a). Mitigating microfinance marketing channels inefficiencies with customerization of mobile technology. *International Marketing Review*, 35(4), 619–636. <https://doi.org/10.1108/imr-11-2015-0256>

- Grob, R., Holmeier, M., & Labudde, P. (2017). Formative Assessment to Support Students' Competences in Inquiry-Based Science Education. *Interdisciplinary Journal of Problem-Based Learning*, 11(2). <https://doi.org/10.7771/1541-5015.1673>
- Hume, A., & Coll, R. (2010). Authentic student inquiry: the mismatch between the intended curriculum and the student-experienced curriculum. *Research in Science & Technological Education*, 28(1), 43–62. <https://doi.org/10.1080/02635140903513565>
- Ismail, M. A.-A., & Mohammad, J. A.-M. (2017). Kahoot: A Promising Tool for Formative Assessment in Medical Education. *Education in Medicine Journal*, 9(2), 19–26. <https://doi.org/10.21315/eimj2017.9.2.2>
- Khaddage, F., Müller, W., & Flintoff, K. (2016). Advancing mobile learning in formal and informal settings via mobile app technology: Where to from here, and how? *Educational Technology and Society*, 19(3), 16-26.
- Kukulka-Hulme, A., Lee, H., & Norris, L. (2017). Mobile Learning Revolution: Implications for Language Pedagogy. *The Handbook of Technology and Second Language Teaching and Learning* (C. A. Chapelle & S. Sauro, Eds.; pp. 217–233). John Wiley & Sons, Inc. <https://doi.org/10.1002/9781118914069>
- Laurillard, D. (2007). Pedagogical forms of mobile learning: framing research questions. In N. Pachler (Ed.). *Mobile learning: Towards a research agenda* (pp. 153-175). London: W1.E Centre.
- Luckin, R., Clark, W., Avramides, K., Hunter, J., & Oliver, M. (2017). Using Teacher Inquiry to Support Technology-Enhanced Formative Assessment: A Review of the Literature to Inform a New Method. *Interactive Learning Environments*, 25(1), 85-97. <https://doi.org/10.1080/10494820.2015.1121152>
- Minner, D. D., Levy, A. J., & Century, J. (2010). Inquiry-based science instruction-what is it and does it matter? Results from a research synthesis years 1982 to 2002. *Journal of Research in Science Teaching*, 47(4), 474-496.
- Nikou, S. A., & Economides, A. A. (2018). Mobile-based assessment: A literature review of publications in major referred journals from 2009 to 2018. *Computers & Education*, 125, 101-119. <https://doi.org/10.1016/j.compedu.2018.06.006>
- Oyelere, S. S., Suhonen, J., Shonola, S. A., & Joy, M. S. (2016, October). Discovering students mobile learning experiences in higher education in Nigeria. In *2016 IEEE Frontiers in Education Conference (FIE)* (pp. 1-7).
- Ozdamli, F. (2012). Pedagogical framework of m-learning. *Procedia-Social and Behavioral Sciences*, 31, 927-931. <https://doi.org/10.1016/j.sbspro.2011.12.171>
- Piaget, J. (1967). The mental development of the child. *Six psychological studies*, 3-73.
- Ruiz-Primo, M. A. (2011). Informal formative assessment: The role of instructional dialogues in assessing students' learning. *Studies in Educational Evaluation*, 37(1), 15–24. <https://doi.org/10.1016/j.stueduc.2011.04.003>. ISSN:0191-491X
- Suarez, A., Specht, M., Prinsen, F., Kalz, M., & Ternier, S. (2018). A review of the types of mobile activities in mobile inquiry-based learning. *Computers & Education*, 118, 38-55. <https://doi.org/10.1016/j.compedu.2017.11.004>
- Sung, Y.-T., Chang, K.-E., & Liu, T.-C. (2016). The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis. *Computers & Education*, 94, 252-275. <https://doi.org/10.1016/j.compedu.2015.11.008>
- Vandeyar, S., & Killen, R. (2007). Educators' conceptions and practice of classroom assessments in post-apartheid South Africa. *South African Journal of Education*, 27(1), 101-115.
- Vygotsky, L. S. (1978). *Mind in society: The development of Higher Mental Processes*, (edited by Cole, M., et al). Harvard University Press, Cambridge, Massachusetts.
- Woolf, B.P. (Ed.) (2010). *A Roadmap for education technology*. Washington, DC: The National Science Foundation. Retrieved from <http://cra.org/ccc/wp-content/uploads/sites/2/2015/08/GROE-Roadmap-for-Education-Technology-Final-Report.pdf>
- Young, J. E., & Jackman, M. G. A. (2014). Formative assessment in the Grenadian lower secondary school: teachers' perceptions, attitudes and practices. *Assessment in Education: Principles, Policy & Practice*, 21(4), 398-411. <https://doi.org/10.1080/0969594x.2014.919248>

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Chapter # 33

IMPACT OF TEACHER CREATIVITY STYLES ON SCIENCE TEACHER TRAINING IN INQUIRY-BASED SCIENCE EDUCATION

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ABSTRACT

The efficiency of teacher education is an essential issue in continuous professional development. The main areas affecting this efficiency are innovative educational methods, teacher training methods and personality characteristics, including creativity styles. The study is devoted to researching the roles of teacher creativity styles in science teacher training in implementing inquiry-based science education. The research was conducted in the frame of the European project PROFILES. Design-based research has been used as a research frame. Fifty Czech science teachers - participants in the PROFILES project were identified as innovators using Kirton Adaption-Innovation Inventory. A comparison of teachers' activities during training with characteristics of teachers-innovators was conducted. The research results confirmed teachers' innovative behaviour during the training of IBSE implementation. The main research finding is that the style of creativity (innovators) influenced the interest and process of teacher training. The research implies that it is necessary to accept the creative style of teacher-participants in training courses to be efficient.

Keywords: creativity style, efficiency, inquire-based science education, science education, teacher education.

1. INTRODUCTION

A significant problem of teacher education is its efficiency. Several projects focused on teacher continuous professional development (hereinafter CPD) meet with this problem and try to solve it. Inefficiency is the crucial failing of teacher CPD confirmed by numerous studies. Raymond (1997) monitored teachers for four years to see whether they implemented innovative teaching methods acquired in teacher training into classroom practice. Most of them reduced the frequency of implementation of these new methods with each passing year and returned to those ones used before teacher training (Trna, Trnova, & Sibor, 2012; Duffy & Roehler, 1986; Fullan, 1991; Constantinou, Tsivitanidou, & Rybska, 2018). Similar results were obtained in the four-year study (Stallings & Krasavage, 1986) because teachers implemented new methods and desired behaviours in the fourth year much less often than in the first two years. According to Meyer (1988), the implementation level of new educational methods presented to teachers in short training programs with only a few hours of workshops and limited follow-up activities is estimated at only about 15 percent.

The efficiency of teacher CPD was also at the centre of interest of the PROFILES project (Professional Reflection-Oriented Focus on Inquiry-based Learning and Education through Science) funded by the FP7 programme of the European Commission (PROFILES, 2015). The project PROFILES was aimed to promote inquiry-based science education (hereinafter IBSE) as a component of teaching/learning. Teachers-participants in the PROFILES project underwent a teacher CPD programme (hereinafter PROFILES CPD),

which was described in detail in the study (Bolte, Holbrook, & Rauch, 2012). Teachers went step by step through this PROFILES CPD in four roles: teacher as a learner; teacher as a teacher; teacher as a reflective practitioner; teacher as a leader. This study presents results from the PROFILES CPD phase in which teachers acted in the role of teachers as learners and underwent education based on IBSE to develop their professional knowledge and skills as well as creativity.

The intent of this contribution is to describe of achieving greater efficiency of the PROFILES CPD based on the study of roles of teacher creativity styles in science teacher training in IBSE. Earlier research on this topic incentivised for this focus on teacher creativity (Trnova & Trna, 2014; Trnova, Kopecka, & Trna, 2014).

2. BACKGROUND

2.1. Paradigm of research

The paradigm of this research is the belief in the crucial role of creativity and its development in the education of students and teachers. Our core statements of creativity are:

- Creativity is a specific mental capacity where creative thought is divergent (Guilford, 1950, 1980).
- Creativity can be developed (Fryer, 1996; Parnes, 1963; Torrance, 1963; Torrance & Myers, 1970).
- Everyone has the potential to be creative (Craft, 2001; Esquivel, 1995; Feldman & Benjamin, 2006; Kaplan, 2019; NACCCE, 1999).
- Factors of creativity (Guilford, 1950, 1980; Torrance, 1963, 1974): fluency, flexibility, originality, elaboration, redefinition, and sensitivity to problems.

Since the end of the 1990s, creativity has become the centre of interest within education and wider society (Craft, 2005). In the world of technological and scientific development, human skills and especially creativity are essential resources (Robinson, 2001; 2012; Tekmen-Araci, & Mann, 2019).

Now creativity plays a crucial role also in education as relevant competency for the 21st century (Robinson, 2006; Robinson, 2012; Rocard et al., 2007) and needs to be included in education as a fundamental life skill (Craft, 1999) which is necessary for surviving and prosperity of future generations in the 21st century (Parkhurst, 1999). A significant fact is that developing creativity through education is confirmed by many studies (Lin, 2011; Kaplan, 2019).

According to experts' findings, teacher creativity is important for developing student creativity (Amabile, 1996; Craft, 2005; Gryskiewicz, 1982; Lin, 2011; Sternberg, 1999). Most of the teacher creativity is manifested in teachers' creative work with the subject content as a creative educational practice (Barbot, Besançon, & Lubart, 2011). Through their creativity, teachers affect the creative development of their students. Creative education is an intentional activity with specific methods and setting conditions to make these methods effective. Creativity is also a crucial factor in the multidimensional development of teacher professional competencies.

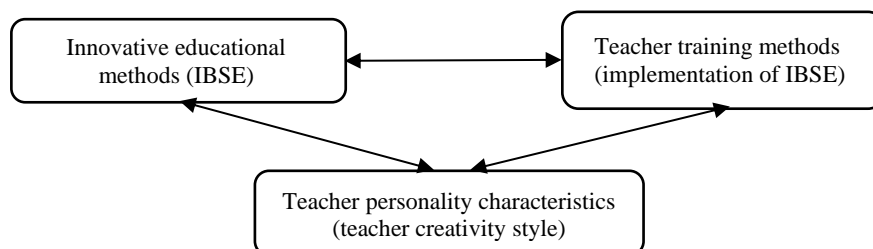
2.2. Areas of limiting teacher CPD

Limiting factors of teacher education (CPD) were examined in three essential areas:

- Innovative educational methods (focused on IBSE)
- Teacher training methods (focused on the implementation of IBSE)
- Teacher personality characteristics (focused on teacher creativity style)

These three areas comprise several factors which also interact (see Figure 1).

Figure 1.
Areas of limiting teacher CPD.



These three areas correspond to the three-working hypothesis of limiting the sources of inefficiency in teacher CPD:

- The cause of the low efficiency of teacher education is inappropriate innovative educational methods (teachers do not consider the methods to be helpful)
- The cause of the low efficiency of teacher education is inappropriate teacher training methods (authors of teacher training courses ignore the educational needs of teachers)
- The cause of the low efficiency of teacher education is inappropriate teacher personality characteristics (e.g., teacher cognitive and creativity style)

The study takes a closer look at the third area, which contains teacher personality characteristics. Teacher styles of creativity were selected for the detailed research.

2.3. IBSE PROFILES CPD

All three limiting factors could occur in the PROFILES CPD. Providers of the PROFILES CPD tried to minimize the negative impact of all limiting factors. Developing teacher creativity was also one of the preventive procedures in these efforts (Bolte et al., 2012). Essential components (Craft, 2005; Lin, 2011) of creativity were supported by core factors of IBSE (such as a stimulating environment, connection with problems of everyday life, instruction based on inquiry, teamwork, and strong motivation).

IBSE seems to be the appropriate way to develop teacher and student creativity because it involves many components of creativity and its development (Trnova et al., 2014; Alake-Tuenter et al., 2012). Teachers play in IBSE the role of special adviser and guide for students (Cairns & Areepattamannil, 2019). They encourage unusual ideas and solutions, and they allow mistakes. So, they create a creative environment (Banchi & Bell, 2008; Nunaki, Damopoli, Kandowangko, & Nusantri, 2019). Teachers-participants in the PROFILES project first passed the PROFILES CPD based on IBSE as learners, and after it, they implemented IBSE in their schools as teachers. They created their IBSE school programme - IBSE modules. Using IBSE as the core component of the PROFILES CPD, their professional knowledge, skills, and creativity were developed.

2.4. Styles of creativity

For this study, it is necessary to briefly describe the style of creativity. Kirton's Adaptation-Innovation Inventory (hereinafter KAI) is a measurement tool of the KAI theory (Kirton, 1987, 1994; Kubes, 1998). The KAI inventory was developed to measure differences in cognitive styles - creativity styles. According to the points individuals get in KAI, it is possible to include each of them in one of two groups, adaptors or innovators (Kirton, 1994). Everyone can be located on a continuum ranging from highly adaptive (adaptor) to highly innovative (innovator).

Highly innovative individuals (innovators) prefer to do things differently, to challenge the paradigm or structure. They are sometimes seen as undisciplined, thinking tangentially, and approaching tasks from unexpected angles. They bring radical solutions to problems. If the teacher is unaware of the different styles of students' creativity, the student with the features of an innovator can be considered naughty or unruly.

Highly adaptive individuals (adaptors) prefer to improve things while working within the given paradigm or structure. They are characterized by precision, reliability, efficiency, discipline, and conformity. They are sometimes seen as both safe and dependable in their work. Adaptors reduce problems through improvement and greater efficiency (Kubes, 1998; Puccio, 1999).

To put it shortly, innovators "do things differently", and adaptors "do things better" (Kirton, 1987; Puccio, 1999). Individuals possess a share of each style; however, each of us prefers one style to the other (Gregorc, 1979). Each style has specific strengths and weaknesses (see Appendix 1). One style is not better than the other; both styles are useful. According to Šorgo et al. (2012), adaptors could be better at creative teaching and inventors (innovators) at teaching creativity.

The creativity style of a teacher is outside the centre of attention. In doing so, a teacher's creativity style can significantly influence the work of a teacher. This study focused on a teacher's creativity style's effect on his/her education.

A comparison of teachers-innovators and teachers-adaptors characteristics was made with these results:

- Both teachers-innovators and teacher-adaptors are creative, the only difference is how they express their creativity.
- Teachers-adaptors operate within a framework of systems. They are associated with enough originality, efficiency, and rule-group conformity. In comparison, teachers-innovators break away from the existing framework of systems, and they are associated with high-interest levels in terms of the originality of ideas. However, they are less interested in efficiency and rule group conformity.
- Teachers-adaptors tend to produce fewer implementable solutions to problems and are more compliant and bureaucratic within the workgroup. In contrast, teacher-innovators tend to be brimming with ideas, flout rules, and display little regard for bureaucratic details (Bagozzi & Foxall, 1995).
- Teacher-adaptors prefer to create change by improving the existing structure and favour staying in groups (Kirton, 1994). In addition, they maintain cohesion by following the accepted ways and prefer to solve problems in a disciplined, methodical, and predictable manner.
- On the other hand, teacher-innovators often come up with many new and practical ideas and are risk-oriented. They prefer to stay as individuals and create change by altering the existing paradigm (Kirton, 1994).
- Teachers-innovators are better in creating suitable learning environments supporting task-involvement of students than teachers-adaptors. (Ee, Seng, & Kwang, 2007).
- Educational methods that are not routine for teachers require the approach from new angles and to think divergently: teachers-innovators are better in their implementation in education than teachers-adaptors (Brophy, 1998; Runco, 1994).
- IBSE, as innovative educational method, needs both innovators (IBSE guided and open levels) and adaptors (IBSE confirmation and structured levels).
- Teacher-innovators and teacher-adaptors who operate at opposite ends of the continuum might have difficulty working together. Due to significant differences in thinking and working style, a conflict between the teachers-adaptors and teachers-innovators in group work could arise. To prevent such conflict, which can

disrupt the good work of the team, it is important to know the style of creativity of members of the team (Kirton, 2000).

The most important result is that teacher-adaptors prefer to behave differently from teachers-innovators, as it is against their nature to solve problems by bending the rules. Similarly, teachers-innovators prefer to behave differently than teacher-adaptors, as it is against their nature to solve problems by following rules (McHale & Flegg, 1986). This fact must realize by implementers of teacher CPD. It is necessary to choose different approaches to CPD adaptors and innovators. This fact has been detected within the PROFILES CPD.

3. METHODOLOGY OF RESEARCH

3.1. General background of research

Increasing the efficiency of teacher CPD of innovative educational methods was the general research problem. Under the above facts about the areas of limiting teacher CPD, this study attempted to solve a part of the major research problem, how to increase the efficiency of science teacher training with an innovative educational method – IBSE. Studied the limiting factor is the teacher's creativity style.

Research question

The study focused on a specific part of this general research problem, which was formulated in the research question:

How to increase the efficiency of teacher training in the implementation of IBSE using teacher creativity styles?

Sample

The sample consisted of 50 science teachers of lower and upper secondary schools in the Czech Republic - participants in the PROFILES CPD in 2011-2014 (Table 1). The subject, gender, and experiential composition of the sample were as follows:

*Table 1.
Sample selection - PROFILES - Czech Republic.*

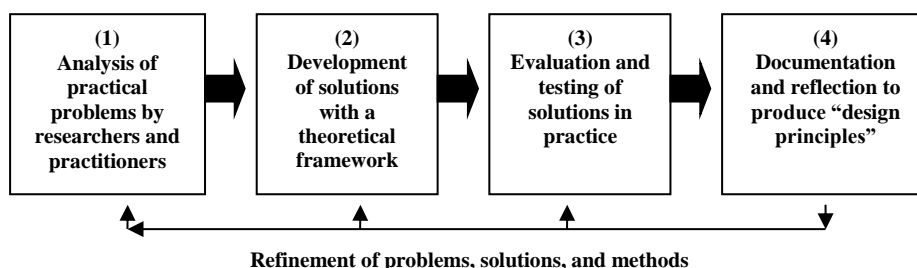
Subject of teaching	N	Gender of teachers	N	Teaching experience of teachers	N
Total	50		50		50
Physics	16	F	41	0-5 y	6
Chemistry	16	M	9	5-15 y	19
Biology	18			15 y and more	25

These teachers were not chosen randomly but based on their interest in being involved in the project. These teachers work in schools with different numbers of students and classes. Their schools were located in a large cities, small towns and villages.

3.2. Research instruments and procedures

Design-based research (hereinafter DBR) was the basic framework of the research. DBR (Reeves, 2006) is a development research approach which can be described as a cycle: (1) analysis of a practical problem, (2) development of solutions, (3) evaluation and testing of solutions in practice, and (4) reflection and production of new design principles (Figure 2).

Figure 2.
Scheme of design-based research (according to Reeves, 2006).



In the study, these steps have the following forms:

(1) *Analysis of practical problems*: detection of creativity styles of teachers-participants in the PROFILES CPD; identification of roles (risks) of teacher creativity styles in science teacher training in the implementation of IBSE.

(2) *Development of solutions with a theoretical framework*: creating of the PROFILES CPD appropriate to teachers with different creativity styles; using teacher creativity styles to enhance the efficiency of teacher CPD.

(3) *Evaluation and testing of solutions in practice*: testing of modified the PROFILES CPD with the respect to different teacher creativity styles.

(4) *Documentation and reflection to produce "Design principles"*: documentation and establishment of the design principles for the increasing of efficiency of teacher CPD with the respect to different teacher creativity styles.

Within DBR, research methods and tools were used in the study: case study, structured observation, questionnaire, structured interview, analysis of teachers' products. These include special methods, mainly KAI and comparative analysis (comparison the PROFILES CPD activities and characteristics of teachers-innovators) which are described in more detail:

KAI: To determine the style of teacher creativity standardized method of Kirton's Adaptation-Innovation Inventory (KAI) was applied (Kirton, 1994). KAI lists three facets that correspond to three-factor traits:

(1) Sufficiency of originality refers to a preference for producing a few implementable solutions to problems.

(2) Rule governance concerns a social tendency to maintain workgroup cohesion by doing things in accepted ways.

(3) Efficiency refers to a bureaucratic concern with being exact, systematic, and disciplined.

Kirton's standardized questionnaire validated in research in the Slovak Republic was applied and administrated to the participants exactly according to instructions described in (Kubes, 1992, 1998). The questionnaire developed by Kubes (1992, 1998) was translated into the Czech language. Although the Czech and Slovak languages are very close, an expert carried out the translation for both languages.

Comparison of teachers' the PROFILES CPD activities and characteristics of teachers-innovators:

A comparative analysis of the activities of teachers during the PROFILES CPD and characteristics of teachers-innovators has been made. Sixteen special teacher activities in the PROFILES CPD focusing on IBSE were discovered during this comparative analysis (see Table 2). These activities have become categories for detailed observation scheme of teachers' PROFILES CPD activities.

Table 2.
Comparison teachers' the PROFILES CPD activities and characteristics of teachers- innovators.

<i>Teachers' PROFILES CPD activities</i>	<i>Characteristics of teachers-innovators according to (Ee & Tan, 2009)</i>
1 Teachers chose unusual topics of IBSE; they unexpectedly responded to suggestions of other teachers.	Innovator seen as thinking tangentially, approaching tasks from unsuspected angles; undisciplined, unpredictable.
2 Teachers anticipated problems that might arise when teaching based on IBSE and proposed unusual solutions.	Innovator tends to discover problems as well as less expected avenues of solution.
3 When solving problems - processing into IBSE form - teachers did not act on proven teaching strategies, on the contrary, they rather questioned them.	Innovator tends to question a problem's concomitant assumptions; manipulates problems.
4 During teamwork, teachers behaved individually and presented their opinions but did not create standard outputs.	Innovator is catalyst to settled groups, irreverent of their consensual views; seen as abrasive, creating dissonance.
5 Teachers were not afraid to experiment, to risk failure. They were fearless in putting into education even higher levels of IBSE.	Innovator in solving problems, seeks to explore untested areas that may be risky and jeopardize the situation.
6 In discussions, particularly some teachers hard defended their views on teaching methods based on IBSE used by them.	Innovator shows less respect for others' views, more abrasive in presenting solutions.
7 Teachers were delighted that they could teach "according to themselves."	Innovator does things differently.
8 Teachers suggested unusual educational aids, and they invented new experiments.	Innovator in pursuit of goals is liable to challenge accepted means.
9 During the four years of the PROFILES CPD, teachers changed already created modules IBSE - they taught them differently. They created new modules.	Innovator is usually unable to stay on detailed routine (system maintenance) work for longer than short bursts, quick to delegate routine tasks.
10 Teachers easily coped with the problems that arose in teaching/learning based on IBSE; they improvised.	Innovator tends to take control in unstructured situations.
11 At the beginning of the PROFILES CPD, there were problems with abiding by the rules for creating modules IBSE. Teachers changed the recommended structure of IBSE modules and experiments.	Innovator often challenges rules; may have little respect for past customs.
12 A popular method of teachers was brainstorming - they had many ideas, but were unwilling to implement the ideas of others; they preferred their own ones.	Innovator appears to have low self-doubt when generating ideas, not needing consensus to remain steadfast in face of opposition; less certain when placed in core of system.
13 During IBSE, teachers managed very well the new situation, even when using IBSE modules for the first time.	Innovator is ideal for tackling unscheduled crises in the institution, or for helping to avoid them, if can be trusted by adaptors.
14 Teachers wanted a change - they liked creating their own modules more than using already created ones.	Innovator appears insensitive to people when in pursuit of solutions, hence often threatening group cohesion and cooperation.
15 Teachers liked that they could use new methods to teach obligatory topics differently.	Innovator provides the dynamics to bring about periodic radical change, without which institutions tend to become rigid.
16 Teachers wanted to stand out; they tried to make their modules not only quality but also original. They were creating groups of teachers in schools who used their modules.	Innovator tends to adopt mastery goal orientation.

Observation of teaching activities took three years, and object of observation was 50 of the same teachers.

3.3. Data Analysis

The research yielded much data. For clarity, we show the results of KAI and Comparison teachers' the PROFILES CPD activities and characteristics of teachers-innovators.

KAI: There were 32 items in the KAI instrument. Each item was scored from one to five points. The theoretical measurement interval is between 32 and 160. As a result of the administrations by the researchers, the scores were generally found to vary between 46 and 145. The average score is 96 (Kirton, 1987, 1994, 1999). A person with an adaptive cognitive style will score in the 60-90 range. Someone with an innovative style will score between 110 and 140 (Mudd, 1996). The KAI scale was found to be reliable ($\alpha = 0.94$).

Comparison of teachers' PROFILES CPD activities and characteristics of teachers-innovators: They were used conventional methods of data processing for the structured observation, with the support of data from product analysis (portfolio) and structured interviews. Special data analysis was compiled in the form of the table of the PROFILES CPD activities of teachers-innovators in binary code (see Appendix 2, 3).

4. RESULTS OF RESEARCH

KAI: Styles of the creativity of teachers-participants of the PROFILES CPD in the Czech Republic were determined using the KAI inventory. Scores of the KAI (hereinafter sKAI) inventory of Czech teachers-participants of the PROFILES CPD were between 101 and 132. Their scores are presented in Table 3. All scores of the Czech teachers were higher than the average score (96) presented in the literature. Their average score was 113.9. According to Mudd (1996), only eight persons were not in the interval (110 - 140) for the pure innovative style, but their scores were above the interval (60-90) for the adaptive style. Therefore, they were rightfully included among the innovators.

Table 3.
Scores of the KAI (sKAI) inventory of PROFILES - Czech teachers (N = 50).

sKAI	101	105	105	106	107	107	108	109	110	110
sKAI	110	110	110	111	111	111	111	111	112	112
sKAI	112	112	112	113	113	113	113	114	114	114
sKAI	115	115	115	116	116	116	116	117	117	118
sKAI	118	119	119	120	121	123	124	124	125	132
Average score						113.86				
Median						113				
Standard deviation						5.71				
Variance						32.64				

Based on the above criteria, it can be concluded one teacher has shown a strong preference for innovativeness (sKAI 132). Seven teachers exceeded the "limit" of 120 points; they could be considered "very strong" innovators. Ten teachers exceeded by only 1-2 points the "limit" (110 points) for innovative style. Eight teachers (sKAI 101-109) exhibited characteristics of both adaptive and innovative styles and were not "pure" innovators. According to average scores, teachers possess a preference for innovative style. According to experts, individuals possess varying degrees of both styles. During the CDP, teachers

exhibited characteristics of both the adaptive and innovative styles, but commonly they preferred to “do things differently” as teachers-innovators.

We can state that Czech science teachers-participants of the PROFILES CPD can be considered innovators. In our opinion, the reason for this result is that the PROFILES CPD participants were teachers who want to 'change' their teaching, which is a fundamental characteristic of innovators. These results of our research partly surprised us. This finding led us to carry out a second part of the research, in which it was possible to determine whether teacher-innovators behaved as innovators in real situations during CPD.

Comparison the PROFILES CPD activities and characteristics of teachers-innovators: Comparative analysis of the activities of teachers during the PROFILES CPD and characteristics of teachers-innovators yielded results that at the maximum number of points 16, the average score was 12.94 points and the median 13 points (see Appendix 2, 3).

Table 4.
Scores of the comparison of the PROFILES CPD activities of teachers (N = 50) and innovators characteristics.

Average score	12.94
Median	13
Standard deviation	1.59

These 16 activities (categories) were studied in detail for three years using complex observation and analysis of teachers' portfolios. Interviews with the teachers confirmed their results and brought information about their conscious self-reflection. The project resulted in the finding that there has been a significant increase in teachers' ownership.

5. DISCUSSION

The research question was asked about the role of the teacher creativity style in teacher CPD focused on IBSE.

The research presented in the context of DBR brought several key findings, which now are commenting:

- *The interest of Czech science teachers about the PROFILES CPD, based on implementation of IBSE, was significantly influenced by their creativity style.*

Similar findings were observed during the CPD in other countries participating in the PROFILES project. Many teacher-participants from other countries in the PROFILES project showed traits of innovators. We can assume that teachers' creativity style influences teachers' CPD interest in innovative educational methods such as IBSE. Due to the small number of teachers observed and the specific training of teachers in IBSE, the research is a case study in nature. This research should establish follow-up correlational research to verify the difference in the interest of teacher-adapters and teacher-innovators participating in CPD for innovative teaching methods in education.

- *The design of teacher CPD must be modified by the creativity style of teachers.*

During the three-year of the PROFILES CPD, teacher education design was modified by teachers' creativity style. In the case of Czech teachers-innovators, passive lectures were limited, were extended independent activity of teachers, teachers were able to come up with new ideas, was strengthened personal communication etc. The main outcome of the creative activity of teachers-innovators was their new teaching/learning PROFILES modules. CPD makers might consider teachers' creativity styles and modify the training course according to the creativity styles of the teachers-participants.

- *Teachers-innovators (participating the PROFILES CPD in the Czech Republic) constantly use innovative teaching methods in their practice. It showed an increase in their ownership and permanent and functional obtaining of high-quality professional competencies to implement IBSE.*

This finding must be verified during research on a larger sample of teachers of various subjects. A long-term study which would confirm the persistence of teacher knowledge about innovative methods and the frequency of their implementation in education would be appropriate. If the finding is confirmed, the efficiency of CPD may increase due to modification of CPD according to the teacher's creativity styles.

- *Most teachers-innovators become teachers-leaders and disseminate innovative methods (IBSE) among other teachers, who were not participants of the PROFILES CPD.*

Due to their personality characteristics, including creative style, these teachers-innovators have significant potential for disseminating innovative educational methods (e.g., IBSE) in their schools, particularly among teachers-adaptors. So, there is a multiplier effect of the increase in innovation instead of the expected decline. Further research should focus on the relationship between the personality characteristics of teachers and their leadership position in CPD.

6. CONCLUSIONS AND IMPLICATIONS

A serious problem of teacher CPD is its low efficiency. Many projects and other activities in teacher education and innovation will be wasted. It is a problem not only of education quality and development but also financially. Resources invested in teachers' CPD must bring the expected outcomes.

As stated above, many factors influence teacher education's efficiency. This study focused on the influence of the creativity style of science teachers on the efficiency of their CPD. Within the project PROFILES, the Czech Republic has arisen in a situation where all participants CPD signalled the creative style of teacher-innovator. The comparative analysis was used, which confirmed that teachers-innovators have special educational needs, and their behaviour matches their creativity style - innovator.

The main output of the research is the finding that teacher creativity style is a factor which influences science teacher education. Research shows that teacher creativity style impacts on the progress and efficiency of teacher CPD for science teachers. At the core of the DBR are the following:

- Teacher creativity style is the factor fostering teacher education.
- The result (nearly 13 points from 16 maximum achievable in comparative analysis) confirmed that teachers-innovators behave really like innovators in teacher training in IBSE implementation.
- It is necessary to develop and implement CPD courses consider the personal characteristics of the individual teacher-participants – especially creativity style.

These results obtained in the frame of the PROFILES project for a sample of 50 Czech science teachers can be considered evidence. Since this descriptive research has features of a case study, it is necessary to complement it with the other broader and long-term research that has just commenced.

Significant creativity development of teachers-participants of the PROFILES CPD was discovered as additional research implications. The study verified that IBSE is suitable for developing teacher and student creativity. There is an overlap between factors supporting creativity and the core principles of IBSE (Trnova & Trna, 2012).

Teachers' creating new curricular materials for IBSE (modules) was a comprehensive expression of the increase in the teachers' creativity level. According to research observation, content analysis of data and structured interviews, each participant improved, in accordance with the definition of creativity, his/her abilities (participants created new materials etc.), individual approach (teachers changed worksheets etc.) and process (teachers worked very hard etc.).

Another complementary output of the study of teacher creativity style is finding about creativity styles, which is an important factor for teamwork (Kirton, 1994) in the frame of teacher CPD. This aspect needs to be addressed, and it may be one reason for the inefficiency of teacher CPD.

Diagnosis of teacher creativity styles benefits cooperation with other participants of CPD in the task of problem-solving. To communicate effectively, individuals must understand the tendencies and potential of other team members. This knowledge helped to collaborate more effectively among all stakeholders in the PROFILES CPD.

REFERENCES

- Alake-Tuenter, E., Biemans, H. J., Tobi, H., Wals, A. E., Oosterheert, I., & Mulder, M. (2012). Inquiry-based science education competencies of primary school teachers: A literature study and critical review of the American National Science Education Standards. *International Journal of Science Education*, 34(17), 2609-2640. <https://doi.org/10.1080/09500693.2012.669076>
- Amabile, T. M. (1996). *Creativity in context*. Boulder, CO: Westview.
- Bagozzi, R. P., & Foxall, G. R. (1995). Construct validity and generalisability of the Kirton adaption-innovation inventory. *European Journal of Personality*, 9, 185-206.
- Banchi, H., & Bell, R. (2008). The Many Levels of Inquiry. *Science and Children*, 2, 26-29.
- Barbot, B., Besançon, M., & Lubart, T. (2011). Assessing creativity in the classroom. *The Open Education Journal*, 4, 58-66. <https://doi.org/10.2174/1874920801104010058>
- Bolte, C., Holbrook, J., & Rauch, F. (Eds.). (2012). *Inquiry-based Science Education in Europe: First Examples and Reflections from the PROFILES Project*. Berlin, Freie Universität Berlin. Print: University of Klagenfurt.
- Brophy, D. R. (1998). Understanding, measuring and enhancing individual creative problem-solving efforts. *Creativity Research Journal*, 11(2), 123-150. https://doi.org/10.1207/s15326934crj1102_4
- Cairns, D., & Aarepattamannil, S. (2019). Exploring the relations of inquiry-based teaching to science achievement and dispositions in 54 countries. *Research in science education*, 49(1), 1-23. <https://doi.org/10.1007/s11165-017-9639-x>
- Constantinou, C. P., Tsvitanidou, O. E., & Rybska, E. (2018). What is inquiry-based science teaching and learning? In *Professional development for inquiry-based science teaching and learning* (pp. 1-23). Springer, Cham. https://doi.org/10.1007/978-3-319-91406-0_1
- Craft, A. (1999). Creative development in the early years: some implications of policy for practice. *Curriculum Journal*, 10(1), 135-150. <https://doi.org/10.1080/0958517990100110>
- Craft, A. (2001). Little c creativity. In A. Craft, B. Jeffrey, & M. Leib-ling (Eds.), *Creativity in education*. London: Continuum.
- Craft, A. (2005). *Creativity in schools: Tensions and dilemmas*. London: Routledge.
- Duffy, G., & Roehler, L. (1986). Constraints on teacher change. *Journal of Teacher Education*, 35, 55-58. <https://doi.org/10.1177/002248718603700112>
- Ee, J., Seng, T. O., & Kwang, N. A. (2007). Styles of creativity: Adaptors and innovators in a Singapore context. *Asia Pacific Education Review*, 8(3), 364-373.
- Ee, J., & Tan, O. S. (2009). Facilitating problem-solving processes for adaptors and innovators. In Tan, O. S. (ed.), *Problem-based learning and creativity* (Chapter 3, pp. 39-50). Singapore: Cengage Learning Pte Ltd.
- Esquivel, B. (1995). Teacher behaviors that foster creativity. *Educational Psychology Review*, 7(2), 185-202. <https://doi.org/10.1007/BF02212493>

- Feldman, D. H. & Benjamin, A. C. (2006). Creativity and education: An American retrospective. *Cambridge Journal of Education*, 36, 319-336. <https://doi.org/10.1080/03057640600865819>
- Fryer, M. (1996). *Creative teaching and learning*. London: Paul Chapman Publishing Ltd.
- Fullan, M. G. (1991). *The New Meaning of Educational Change*. New York: Teachers College Press.
- Gregorc, A. F. (1979). Learning/teaching styles: Potent forces behind them. *Educational leadership*, 36(4), 234-236.
- Gryskiewicz, S. S. (1982). *Creative leadership development and the Kirton adaption-innovation inventory*. Paper presented at the Occupational Psychology Conference of the British Psychological Society, Brighton, England.
- Guilford, J. P. (1980). Cognitive styles: What are they? *Educational and Psychological Measurement*, 40, 715-735.
- Guilford, P. J. (1950). Creativity. *American Psychologist*, 5, 444-454.
- Kaplan, D. E. (2019). Creativity in education: Teaching for creativity development. *Psychology*, 10(2), 140-147.
- Kirton, M. J. (1987). *Kirton Adaptation-Innovation Inventory (KAI) - Manual, 2nd ed.* Hatfield: Occupational Research Centre.
- Kirton M. J. (1999). *Manual: Kirton adaptation-innovation inventory (3rd Ed.)*. Hatfield, UK: Occupational Centre.
- Kirton, M. J. (1994). *Adaptors and innovators: Styles of creativity and problem-solving*. London: Routledge.
- Kirton, M. J. (2000). *Adaption and innovation: Styles of creativity and problem-solving* (Rev. ed.). London: Routledge.
- Kubes, M. (1992). *Kirtonov dotaznik kognitivneho stylu adaptivnost-inovativnost (KAI)* [Kirton's Adaptive-Innovative (KAI) Cognitive Style Questionnaire]. *Prirucka*. Bratislava: Maxman.
- Kubes, M. (1998). Adaptors and innovators in Slovakia: Cognitive style and social culture. *European Journal of Personality*, 12(3), 187-198. [https://doi.org/10.1002/\(SICI\)1099-0984\(199805/06\)12:3%3C187::AID-PER302%3E3.0.CO;2-9](https://doi.org/10.1002/(SICI)1099-0984(199805/06)12:3%3C187::AID-PER302%3E3.0.CO;2-9)
- Lin, Y. S. (2011). Fostering creativity through education—a conceptual framework of creative pedagogy. *Creative education*, 2(3), 149-155.
- McHale, J. & Flegg, D. (1986). Innovators rule OK—or do they. *Training and Development Journal*, October, 10–13.
- Meyer, L. (1988). Research on implementation: What seems to work. In S. J. Samuels, & P. D. Pearson (Eds.), *Changing School Reading Programs* (pp. 41-57). Newark, DE: International Reading Association.
- Mudd, S. (1996). Kirton's A-I theory: Evidence bearing on the style/level and factor composition issues. *The British Journal of Psychology*, 87, 241-254. <https://doi.org/10.1111/j.2044-8295.1996.tb02588.x>
- NACCCE (1999). *All our futures: creativity, culture and education*. London: DfEE.
- Nunaki, J., Damopolli, I., Kandowangko, N., & Nusantri, E. (2019). The effectiveness of inquiry-based learning to train the students' metacognitive skills based on gender differences. *International Journal of Instruction*, 12(2), 505-516. <http://dx.doi.org/10.29333/iji.2019.12232a>
- Parkhurst, H. (1999). Confusion, lack of consensus, and the definition of creativity as a construct. *Journal of Creative Behaviour*, 33, 1-21. <https://doi.org/10.1002/j.2162-6057.1999.tb01035.x>
- Parnes, S. J. (1963). Education and creativity. In P. E. Vernon (Ed.), *Creativity: Selected readings*. Middlesex: Penguin Books Ltd.
- PROFILES (2015). PROFILES project. Retrieved from <http://www.profiles-project.eu/>
- Puccio, G. (1999). Creative problem solving preferences: Their identification and implications. *Creativity and Innovation management*, 8(3), 171-178.
- Raymond, A. M. (1997). Inconsistency between a beginning elementary school teacher's mathematics beliefs and teaching practice. *Journal for research in mathematics education*, 550-576. <https://doi.org/10.2307/749691>
- Reeves, T. C. (2006). Design research from a technology perspective. *Educational design research*, 1(3), 52-66.
- Robinson, K. (2001). *Out of Our Minds: Learning to Be Creative*. John Wiley & Sons.
- Robinson, K. (2006). Do schools kill creativity? In *Presentation at TED2006 conference*, Monterey, CA.

- Robinson, K. (2012). *Why schools kill creativity?* Huffington Post.
- Rocard, M., Cesrmlay, P., Jorde, D., Lenzen, D., Walberg-Herniksson, H., & Hemmo, V. (2007). *Science education NOW: A Renewed Pedagogy for the Future of Europe*. Brussels: Office for Official Publications of the European Communities.
- Runco, M. A. (1994). Conclusions concerning problem finding, problem-solving and creativity. In M. A. Runco (Ed.), *Problem-finding, problem-solving, and creativity* (pp. 271-290). Norwood, NJ: Ablex Publishing Corporation.
- Stallings, J., & Krasavage, E. M. (1986). Program implementation and student achievement in a four-year Madeline Hunter follow-through project. *The Elementary School Journal*, 87(2), 117-138. <https://doi.org/10.1086/461483>
- Sternberg, R. J. (1999). *Handbook of creativity*. Cambridge: Cambridge University Press.
- Šorgo, A., Lamanuskas, V., Šašić, S. Š., Kubiato, M., Prokop, P., Fančovičova, J., & Erdogan, M. (2012). A cross-national study of prospective elementary and science teachers' creativity styles. *Journal of Baltic Science Education*, 11(3), 285-292. <https://doi.org/10.33225/jbse/12.11.285>
- Tekmen-Araci, Y., & Mann, L. (2019). Instructor approaches to creativity in engineering design education. *Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science*, 233(2), 395-402. <https://doi.org/10.1177/0954406218758795>
- Torrance, E. P. (1963). *Education and the creative potential*. Minneapolis, MN: The University of Minnesota Press.
- Torrance, E. P. (1974). *The Torrance Tests of Creative Thinking-Norms-Technical Manual Research Edition-Verbal Tests, Forms A and B- Figural Tests, Forms A and B*. Princeton: Personnel Press.
- Torrance, E. P., & Myers, R. E. (1970). *Creative learning and teaching*. New York, NY: Dodd, Mead & Company.
- Trna, J., Trnova, E., & Sibor, J. (2012). Implementation of inquiry-based science education in science teacher training. *Journal of educational and instructional studies in the world*, 2(4), 199-209.
- Trnova, E., Kopecka, N., & Trna, J. (2014). Science Teacher-Leader: Role of Creativity in the Multidimensional Development of a Teacher's Professional Competence. In C. Bolte, J. Holbrook, R. Mamlok-Naaman, & F. Rauch (Eds.), *Science Teachers' Continuous Professional Development in Europe. Case Studies from the PROFILES Project*. (pp. 207-219). Klagenfurt: Freie Universität Berlin/Klagenfurt: Alpen-Adria-Universität Klagenfurt.
- Trnova, E., & Trna, J. (2012). Development of Science and Technology Gifted Students through Inquiry-Based Science Education. In *Proceedings of the 8th International Conference on Education* (pp. 838-844). Samos, Greece: Research and Training Institute of East Aegean.
- Trnova, E., & Trna, J. (2014). Implementation of creativity in science teacher training. *International Journal on New Trends in Education and Their Implications*, 5(3), 54-63.

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Appendix 1.

A list of core characteristics of adaptors and innovators (Ee & Tan, 2009, p. 59).

Adaptor	Innovator
Characterized by precision, reliability, efficiency; seen as methodical and disciplined.	Seen as thinking tangentially, approaching tasks from unsuspected angles; undisciplined, unpredictable.
Concerned with resolving problems rather than finding them.	Tends to discover problems as well as less expected avenues of solution.
Seeks solutions to problems in tried and understood ways.	Tends to question a problem's concomitant assumptions; manipulates problems.
Lessens problems through improvement and greater efficiency with maximum of continuity and stability.	Is catalyst to settled groups, irreverent of their consensual views; seen as abrasive, creating dissonance.
Disciplined in solving problems with minimum of risk.	In solving problems, seeks to explore untested areas that may be risky and jeopardize the situation.
More loyal to policy of consensus.	Shows less respect for others' views, more abrasive in presenting solutions.
Seen as conforming and dependable.	Seen as ingenious, unsound, impractical.
Does things better.	Does things differently.
Liable to make goals of means.	In pursuit of goals, liable to challenge accepted means.
Seems impervious to boredom and able to maintain high accuracy in long spells of detailed work.	Usually unable to stay on detailed routine (system maintenance) work for longer than short bursts, quick to delegate routine tasks.
Is an authority within given structure.	Tends to take control in unstructured situations.
Challenges rules rarely, cautiously, when assured of strong support and problem solving within consensus.	Often challenges rules; may have little respect for past customs.
Has high self-doubt when system is challenged, reacts to criticism by closer outward conformity; vulnerable to social pressure and authority; compliant.	Appears to have low self-doubt when generating ideas, not needing consensus to remain steadfast in face of opposition; less certain when placed in core of system.
Essential to the functioning of the institution all the time, but occasionally needs to be "dug out" of the current systems.	Ideal for tackling unscheduled crises in the institution, or for helping to avoid them, if can be trusted by adaptors.
When collaborating with innovators, provides stability, order, and continuity to the partnership	When working with adaptors, provides task orientations and the break with past and accepted theory.
Sensitive to people, maintains group cohesion and cooperation; can be slow to overhaul a rule.	Appears insensitive to people when in pursuit of solutions, hence often threatening group cohesion and cooperation.
Provides a safe base for the innovator's riskier operations.	Provides the dynamics to bring about periodic radical change, without which institutions tend to become rigid.
Has a conscientious personality trait.	Has an extroverted personality trait.
Tends to adopt ego avoidance orientation.	Tends to adopt mastery goal orientation.

Impact of teacher creativity styles on science teacher training in inquiry-based science education

Appendix 2.
Scores of the comparison of the PROFILES CPD activities of teachers-participants (N = 1-25) and teachers-innovators characteristics.

	No of teacher	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
No of PROFILES CPD activity																											
1		x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	-
2		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3		x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x
4		x	x	x	-	x	-	-	x	-	x	-	x	-	x	-	x	x	x	x	x	x	-	x	x	x	x
5		x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	-	x	x	x	x	x	x	x	x	x
6		x	x	-	x	-	x	x	-	x	-	-	x	-	x	x	x	x	x	-	-	-	x	-	-	-	-
7		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
8		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
9		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
10		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
11		x	x	x	x	x	x	x	x	x	-	x	x	x	-	x	-	-	-	-	-	-	x	-	-	-	-
12		x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x	x	-	x	-	-	-	-	x	x
13		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
14		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
15		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16		x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	-	x	-	-	x	-	-	x	-	-	x
TOTAL		16	16	15	15	15	15	15	15	15	14	14	14	14	14	14	14	14	14	14	13	13	13	13	13	13	13
Percentage		100	100	93.8	93.8	93.8	93.8	93.8	93.8	93.8	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	81.3	81.3	81.3	81.3	81.3	81.3	81.3	

Appendix 3.
Scores of the comparison of the PROFILES CPD activities of teachers-participants (N = 26-50) and teachers-innovators characteristics.

	No of teacher	26	27	28	29	30	32	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
No of PROFILES CPD activity																											
1		x	-	-	x	x	-	x	x	x	x	-	x	-	x	-	x	x	-	x	x	-	-	-	-	x	
2		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
3		x	x	x	x	x	-	x	-	-	x	-	x	x	x	x	x	x	x	-	x	x	-	-	-	-	
4		-	x	-	-	-	x	-	-	-	x	x	-	x	-	x	-	x	-	-	-	-	-	x	-	-	
5		x	x	x	x	x	x	-	-	x	-	x	-	x	x	-	x	-	x	x	x	x	-	-	x	-	
6		-	x	-	-	-	x	x	-	-	x	x	-	x	-	x	-	-	-	-	-	-	-	x	x	-	
7		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
8		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
9		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
10		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
11		x	-	x	x	x	x	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
12		x	-	x	x	x	x	x	x	x	-	x	x	-	x	-	x	x	x	-	x	x	-	-	-	-	
13		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
14		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
15		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
16		-	x	x	-	-	-	-	x	-	-	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	
TOTAL		13	13	13	13	13	13	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	10	9	9	
Percentage		81.3	81.3	81.3	81.3	81.3	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	68.8	68.8	68.8	68.8	68.8	62.5	56.3	56.3		

Section 3
Teaching and Learning

Chapter # 34

MEDIA, LANGUAGE AND THEIR IMPACT ON THE DEVELOPMENT OF YOUNG CHILDREN'S POLITICAL AWARENESS

Thoughts and Preliminary Research Results of an Interdisciplinary Research Project

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ABSTRACT

The interdisciplinary project PoJoMeC, funded by The Federal Agency for Civic Education (Bundeszentrale für politische Bildung) in Germany, examines the political awareness and understanding of preschool and elementary school children. Thereby the interdisciplinary approach takes place from the perspective of political didactics, literature and media didactics, and journalism. The main research goal is to survey how political awareness of young children is expressed. Therefore, we draw on qualitative approaches, in which we focus (a) on the children's explicit knowledge, and (b) concepts of rule-based behavior. The different levels of abstraction of these concepts are based on a modification of the ecological model of human development according to Uri Bronfenbrenner (1979). This article outlines, on one hand, an interdisciplinary investigation for a viable concept of politics for research with children between the ages of 4 to 8 years. Therefore, we consider areas such as political didactics, literature and media studies, and philosophy, and introduce a research framework that does not start with terms and concepts but considers more fundamental forms of social perception. On the other hand, this chapter explains methodological approaches and evaluation methods and presents the preliminary results of a pretest with a sample of German preschool children.

Keywords: political thinking, political literacy, early education, early education research, global citizenship education.

1. THE PEDAGOGICAL QUESTION

Climate change, world peace, sustainable development, inclusive education, and participation of diverse groups in our society are tasks that politics must deal with today and tomorrow. The UNESCO (2019, 2021) outlines these tasks in the 17 Sustainable Development Goals, which are strongly normative. They not only deal with the environment but also with its protection, health maintenance, and social diversity in general. This diversity shall not only become a binding aspect, but human rights shall also follow. If such goals become a reality, the acceptance of these goals by the entire society is required. However, active participation in social reality depends above all on the political understanding from the citizens. This requires not only knowledge but also general political awareness, which must be conveyed and acquired from an early age.

We understand "politics" as human communication and action to create and enforce generally binding regulations and decisions in and between people. Therefore, it is a central educational goal to create an awareness of what this responsibility means and what role the

individuals should play. Since political attitudes, beliefs and stereotypes already develop in early childhood and are difficult to change throughout life (Weißeno, 2022), political or civic education must begin in early childhood (cf. Goll, 2021).

The media, however, plays a central role in conveying and developing a worldview and thus also in securing and sustaining democracy (cf. Marci-Boehncke, Rath, Delere, & Höfer, 2022). Language is just as important as pictures, movies, and other forms of communication. For this reason, we advocate a broad concept of media that goes beyond a purely technical perspective in which the world, and thus potentially every citizen, is internationally networked. The task of "Global Citizenship Education" is to teach children how to behave politically responsibly in this world. In our digital age, this education depends on the knowledge of the political concepts (cf. Dudley & Gitelson, 2002).

Formally, these questions seem to be answerable from the perspective of developmental psychology (cf. Wegemer & Vandell, 2020). In terms of content, however, understanding what impact political awareness has on political education is a desideratum, especially for early childhood. There is still little knowledge of what children understand about politics and whether or which political skills they bring with them to elementary school and develop by the time they move on to secondary school. Empirical research on political awareness and participation is extremely difficult in this age group as this topic is very abstract for young children. In addition, due to a lack of reading and writing skills, it is hardly possible to study this with larger cohorts of participants (cf. van Deth, Abendschön, Rathke, & Vollmer, 2007). In contrast, there is a large body of research on older children (cf. Hunter & Rack, 2016; Rowe, 2005; Flanagan, 2014).

From the perspectives of the three different research areas, political didactics, literature and media didactics, and journalism, we want to examine the understanding of "the political" in the PoJoMeC project (cf. Goll, 2022), funded by The Federal Agency for Civic Education (Federal Agency for Civic Education/bpb) in Germany. The heterogeneities of the research, the target group, the scientific questions, and the wide range of objects initially suggest a multi-method approach. However, we need to take precautions in advance due to the limited research in this area. Therefore, the first task of our project was to develop a viable political concept for research with children in preschool (age 4-6) and elementary school age. This concept had to accomplish three elements,

- (a) be broad enough to capture different phenomena,
 - (b) abstract enough to be able to connect interdisciplinary research as a common basis,
- and
- (c) finally, be conceptualized anthropologically to do justice to test subjects and their social perception before any political partisanship emerges.

2. BASIC CONCEPTUAL ASSUMPTIONS

From a philosophical point of view, the question of "the political" can be understood through an anthropological concept that, at least in the Western world, goes back to Aristotle's definition of man. In the *Politeia* he determines the human being as a "political animal" (*πολιτικὸν ζῷον*, Pol. 1.1253a), as a being that lives in a community. The definition of the human being as an "animal sociale et politicum" de regno I,1) was taken over by Thomas Aquinas and thus transmitted to the Christian Occident, where it continues to have an effect to this day. The practice of gathering into communities varies historically and regionally. It takes place concretely, like all practices, not through "the living", an instinct, or a certain form of perception. "There remains therefore what may be called the practical life of the rational part of man" (*λόγον ἔχοντος*, Nic. Eth. 1098a), as Aristotle describes it in the

Nicomachean Ethics. Zoon politikon and zoon logon echon are, therefore, the classic definitions of an individual as a human being that organizes itself socially with other people and, in doing so, draws on a more fundamental competence, namely the logos, which means reason as well as language and spirit. The human capability of reason enables him to independently acquire and implement the regularity that determines his practical life.

We follow this line of tradition in its modern understanding as the functionality of the human to recognize rules, develop them, and shape them independently. Thereby we leave the viewpoint of the ancient world. The regularity of the logos is the basis of rule-governed human action in general. Since the 1970s, the various fields of human activity (besides politics, for example, economics, medicine, education, work, or art) have related to each other in different ways in the educational sciences (cf. Derbolav, 1975; Benner, 1987). They all have in common that the basic acquisition of rules is tied to language. That is, the ability to acquire language means nothing other than recognizing, imitating, and shaping regularities. Reciprocal and cooperative interactions, as well as empathy resulting in shared intentionality as well as the development of a language, are the prerequisites for human community. (cf. Räska-Hardy, 2011; Duncker, 2011; Carpenter & Tomasello, 2011). For us, this also represents the basic skills of humans. In this way, we also draw on Ludwig Wittgenstein's so-called private language argument (1958, § 243). It says that no one can learn a language without using public rules. No one can follow a rule only once and only alone. Rule acquisition, like language acquisition, always takes place publicly and thus socially. Thyen (2006), considering this private language argument and Wittgenstein's question of what it means to "obey a rule" (Wittgenstein, 1958, § 199), has made it clear that from this perspective, the human being is an "intersubject". This means that humans are individuals for whom the learning of language rules stands paradigmatically for obeying regularities. In this way, the human being is always socially integrated and oriented towards sociality.

The anthropological research (Carpenter & Tomasello, 2011) and the political didactic research (Goll, 2021, p. 41) support this perspective. From a social point of view, the first rule of communicative action is linguistic "turn-taking" (Carpenter & Tomasello, 2011, p. 92) through which infants share their emotional states with others.

In the same way, this linkage back to a rule (which reveals both grammar and semantics from pragmatics) can also be reconstructed as human's ability to reflexively access the world through symbols. In his "Essay on Man", Ernst Cassirer (1944) brought this basic ability, which Aristotle defined as logon echon, into the modern form of the human being as animal symbolicum (Cassirer, 1944, p. 26), as a symbol-using creature. This definition, however, should not be understood as pre-modernly substantial, but as "functional" (ibid., p. 68).

At the same time, an important phylogenetic connection is made to an ontogenetic metaprocess. Friedrich Krotz calls this process mediatization since the year 2000. In his work, he shows that during their cultural evolution, humans have used new media techniques to change their communicative practice. The mediatization theory thus offers itself as a "conceptual framework" (Krotz, 2007) to reconstruct the political process of social change. Under the impression of new communication possibilities, the rules of individual communication have changed. This has not only changed social communication but has also triggered a societal change. If one links this media-sociological perspective again philosophically to the anthropological thesis of the animal symbolicum, then mediatization as a media practice (whose first expression is, of course, language) becomes a historical one. This is modified in each case, but at its core, it is permeated by the fundamental "mediality" (cf. Rath, 2019) of the human being's symbolic appropriation of the world through rule acquisition and rule competence. Language acquisition is the beginning of individual mediatization as the acquisition of rules and thus the basis of political consciousness in general.

3. “THE POLITICAL”

Against this philosophical-conceptual background, the question now needs to be raised as to what we mean by "becoming political". So what is "the political" that we hope to see children already aware of? However, the phrase "political", which is taken for granted in German and the Romance languages, is difficult to translate into English. Valentine (2006, pp. 505-506) rightly states:

"It is worth remarking that in the English language the notion of the political is an awkward grammatical formulation. The transformation of an adjective into a noun suggests that the notion is detached from its proper enunciation as if to prompt the question 'the political what?' to complete it. The awkwardness has arisen from the translation of a distinction commonly found in Germanic and Romance languages for which precise equivalents are not available in English. Thus, the distinctions between "die Politik" and "das Politisches" in German, between "la politique" and "le politique" in French, and between "la politica" and "il politico" in Italian are rendered in English as the distinction between politics and the political without any obvious reference for the latter term “.

"The Political" (in the following, we will write this formulation with a capital letter at the beginning) is not easy to integrate into the common political science triad of politics, policy, and polity (cf. Kaid & Holtz-Bacha, 2008). These dimensions of the concrete political reality of a society can be recorded and inquired about in terms of political knowledge. In the following, however, we understand the political to mean an awareness of the fundamentally regular organization of the human community. On the one hand, this awareness is not tied to a specific social or even political system. It requires neither knowledge of a concrete polity, nor an orientation as to which politics must be organized and designed for which policy; nor is the social frame of reference necessarily at the level of a concrete polity. With a social frame of reference, we emphasize the different social systems that people develop for themselves in the course of their development. These reference systems expand in the context of ontogenetic development.

Uri Bronfenbrenner (1979) differentiated between five levels or systems. He started with the microsystem, which is directly surrounding the child, through the mesosystem, exosystem, macrosystem, and chronosystem. The macro- and exosystem include, among other things, the political organizations or governments and the associated ideological attitudes and beliefs that determine policies. The mesosystem creates the institutional bridge between the micro and the macro systems. It determines the institutional framework of the microsystem and its actors. The microsystem is the narrowest social framework that goes directly beyond the individual, such as the family, the closest nested educational institutions such as kindergarten and school, and later the peers. These systems, conceived by Bronfenbrenner as concentric, each offer material/resources of varying complexity for the development of a child's political awareness/consciousness. However, the politically relevant aspects, the increasing social integration of the child into existing social structures and their regularity, remain strictly separated in the systems. Although these systems are intended to be permeable, they appear to be differentiated. Vélez-Agosto, Soto-Crespo, Vizcarrondo-Oppenheimer, Vega-Molina, and García Coll (2017), following Bronfenbrenner's revisions to his own theory, were able to construct a less restrictive model of human development. Culture, in its various manifestations, has a comprehensive function in the expanding structure of social relationships. Language and communication are the central practices of culture. Drew Lichtenberger (2012) expands this system model by

Bronfenbrenner significantly. He directly supplements the innermost circle of the microsystem with a "ring" of media communication that encloses the individual. This "ring" shall show, "how technology can now mediate many of our direct interactions with our world and one another". As Marci-Boehncke and Rath argue, this medial ring symbolizes the medial presence in early childhood (2013). In the microsystem, which is characterized by media, symbols and thus language become the central medium of regularity. In other words, the mastery of linguistic rules offers the model for human rule awareness in general.

These rules can then be used sovereignly and thus only become functional as a communication medium when they have become explicitly conscious. As already mentioned, awareness does not only mean "knowledge". Here, awareness shall be defined as a conscious, explicit orientation towards systematically relevant rules, that also can be linguistically expressed. It is not only the rules that have a chance, but always and inevitably the actors who set, represent, sanction, and, if necessary, relativize or revoke these rules. Different levels of media distribution are also one part of it. Beyond this microsystem, journalism plays a central role in raising and sharpening the awareness of civic problems, and in negotiating and communicating rules.

In our opinion, it should be emphasized that a child with political awareness can take a reflective position. This means that the rule has been recognized in terms of its validity for the child. Furthermore, the child experiences its behavior based on the rule and can also explicitly align its actions with the rules or consciously break these rules. This political awareness requires a receptive civic literacy, i.e. the ability to recognize such regular political communication in everyday life (cf. Detjen, Massing, Richter, & Weißeno, 2012, p. 7). This distinguishes these rules of social practice from other laws that children also learn in their lives. Such communicative-social regularities include rules that can limit or extend our behavior. For example, we can refer to locked or open doors or technical and functional necessities such as the flicking of a switch. But also practical irritations, for example, a confrontation with incomprehensible but rule perceived languages or linguistic rule breaking belong to this.

4. POLITICAL AWARENESS

The Political – like the basic anthropological concepts – is to be understood functionally. It is an idea of social regulation that, as a model (cf. Heidemeyer & Lange, 2010, p. 221) of the social order, already has a normative effect in the microsystem. It thus precedes the development of specific political knowledge (cf. Weißeno, Götzmann, & Weißeno, 2016) or even concrete "political competence" (Weißeno, 2012), which is measurable as the result of knowledge, skills, and behavior.

The disciplinary perspectives of our project thus focus on various relevant phenomena of the Political. Awareness of rules can be grasped above all as practice-based, concrete everyday experience in dialogue. The political knowledge can be captured and measured using various quantitative methods. These methods, however, need to consider the fact that the target group is - due to its age - largely unable or only very poorly able to read. Therefore, action-oriented, media-practical settings are also available to capture the awareness of rules in forms of expression other than language media. But the active component is not just a consequence of the target group lacking reading literacy. Rather, the competence that includes political awareness is not solely based on cognitive knowledge. Alscher, Ludewig, and McElvany argue in their recent article on the theory and measurability of competence in school-based civic education (2022) that political education has to differentiate between the components of political knowledge and motivational, attitudinal, and volitional dispositions

of young children and young adults. After reviewing the relevant theoretical and empirical concepts of competence in political education, they describe their framework model of "civic literacy", which differs in its scope from a primarily cognitive-knowledge-based political literacy. Alscher et al. state that civic literacy expands the cognitive domain of political knowledge to include "action dispositions in the areas of motivation, attitude, and volition" (2022, p. 7, own translation). The motivation includes the "political interest" as well as the "political sense of effectiveness" (ibid., p. 14). "Attitude towards democracy" and "attitude towards a plural society" (ibid., p. 15) are the decisive aspects of political attitude. "Willingness to participate in politics" and "willingness to participate in civil society" are ultimately the facets of political volition. These aspects and facts together determine the components of civic literacy. Regarding our question about "The Political", this perspective of action is significant.

5. METHODOLOGICAL CONSIDERATIONS: INTERVIEWS WITH PRESCHOOL CHILDREN

However, these aspects can again be captured by Alscher and colleagues within the framework of a purely cognitive text survey. However, unlike Alscher and colleagues, we cannot capture the active components in our target group in a cognitive-text-based manner as motivation, attitude, and volition. However, we will take up their components, which are designed for K7 to K10, via an action-based setting. In dialogue, the rule is in the foreground. As stated above, the rule is not a solipsistic phenomenon. Nobody can follow a rule alone and only once - but above all no one can design, enforce, and follow a social rule alone. Rules are observed behavioral controls whose social dimension is at the heart of political consciousness. Only when the concrete observation of compliance with the rules has led to a model of compliance with the rules can one speak of explicit awareness of the regularity. Here, too, language acquisition serves as a blueprint for the awareness of rules. However, the ability to use linguistic expressions reactively and appropriately to the situation is not yet a sign of explicit awareness of rules. Rather, the rule must be recognized as a rule and actively applied in practice.

In the same way, political awareness is reflected in the concrete, active addressing of rule-specific requirements for all members of a social group. At this point, the reference to journalism becomes clear because it is precisely this community-building function that is emphasized in their definitions of journalism: "Journalism research selects and presents topics that are new, factual and relevant. He creates publicity by observing society, making this observation available to a mass audience via periodic media, and thereby constructing a shared reality. This constructed reality offers orientation in a complex world" (Meier, 2018, p. 13). As a level of discourse between politics and society, professional journalism in democratic societies offers an opportunity to negotiate the need for cooperation and to reach broad social circles quickly.

Through media and language impulses we try to evoke statements about rules, their validity, their legitimacy, and their sanctions. Image material in the setting of simplified "picturizing maps" is used as a reason for discussion in early education (Tkotzyk & Marci-Boehncke, 2022, cf. also Novak & Cañas, 2008) as well as the child-friendly, classic method of questioning as a puppet interview (cf. Marci-Boehncke & Rath, 2013, pp. 58-59; Weise, 2012, 2019) or the encouragement of one's narration.

It is important to remember that research with young preschool children has several limitations. These include linguistic (expression of skills and vocabulary), interactive and cognitive skills, and competencies (Butschi & Hedderich, 2021, p. 104; Vogl, 2021, p. 143).

In addition, young children usually have no points of contact with survey situations (Vogl 2021, p. 154). Accordingly, our research process must be geared toward the child participants, because research methods cannot be adopted unquestioningly from adult research (Mey 2003; Paus-Hasebrink 2017; Weise, 2021). In research with and on young children, it is important to consider that it is not possible to "equate children's resources with those of adults" (Butschi & Hedderich, 2021, p.104). Therefore, we must develop child-friendly methods that engage children according to their level of development and abilities, and childlike perspectives. If we do so, we can research topics, which we usually consider adult topics, and therefore, anchor primarily in the area of the adult world.

The Picturizing Strategy, previously introduced as "Picture Concept Map" (Tkotzyk & Marci-Boehncke, 2022), is a method that we can use to gain access to the child's environment and children's awareness of complex issues about social or political structures (PS). It describes a novel interview method that activates and challenges the reflective capacity of the child participants in a playful way. The basic idea is based on the method of concept mapping according to Novak (1990) and Novak and Cañas (2008). Concept maps are viewed as schematic tools or "cognitive maps" (Stewart, van Kirk, & Rowel, 1979, p. 172) that represent a set of concept meanings, which in turn are embedded in a framework of claims or theses (Novak & Gowin 1984). Put simply, these maps represent a graphical representation that visualizes a system of existing knowledge, its scope, and the connections between different concepts (Graf, 2014). When concept maps are used as a cognitive strategy, they help to sharpen the participants' critical thinking and stimulate self-reflection about their thinking and belief system because participants are repeatedly encouraged to question themselves and their statements.

It is precisely this aspect in which we see the positive effects of our research with young children. In this way, we can minimize less meaningful yes-no answers in interviews and learn more about the processes of children's ways of thinking and their view of the children's living environment in a more complex context (Tkotzyk & Marci Boehncke, 2022). However, the challenges mentioned above concerning the group of very young participants require a child-friendly adaptation of this mapping concept. This is where tools in the form of picture cards come into play. The pictures are selected according to the research topic and assigned to three main categories based on Bronfenbrenner's ecosystem. In terms of content, in this case, we are guided by the basic idea of the awareness of rules. This leads to three main questions,

- (a) Who determines rules?
- (b) Why are there rules? and
- (c) What influence do children have on the regulatory system?

To connect with the children's living environment, we offered topics with which the children are familiar from both media and family (sometimes also peer-based) communication.

1. The first topic, which shapes the child's world to varying degrees at the micro, meso, and macro levels, is "Corona". We are thus building on practical and media experiences during the global pandemic, which, since spring 2020, has changed the life of our society extensively. From the obligation to wear masks to hygiene and regulatory requirements over lockdowns and travel restrictions to vaccinations that have been discussed and experienced, for example, in one's own family, grandparents, or the obligation to vaccinate caregivers in daycare centers or schools.

2. The second field is the "Ukraine war", which has been familiar to the children since February 24, 2022, primarily from the media and primarily affects the meso and macro levels.

Conversations with adults or among friends, which often come up out of fear, give rise to discussion on rule-based questions. How and why was action taken in a specific case of war? How should action be taken in a fictitious conflict affecting the meso and macro systems?

3. The last subject area, which is not only current but has been running through decades and thus the entire lifetime of the respondents, is the complex concepts of environment and nature. This topic is also present in all systems that Bronfenbrenner named. Currently, the global focus is increasingly on questions of climate change and energy generation.

At the same time, all three themes are always micro-systematically medial and run through them, thus allowing the connection to the macro-systematic medial ring of Drew Lichtenberger (2012).

To carry out a child-friendly survey, corresponding picture cards are created for the three areas mentioned (see Fig. 1), which offer the children opportunities for discussion, and which have to be assigned based on to the Bronfenbrenner system, while the participating children let us participate in their thoughts by explaining why they chose the image and the corresponding layer. With the specification of the different levels, the participating children are given possible strategies for making decisions (see Fig. 2).

Figure 1.
The Three Upper Categories "micro-", "meso-" and "microlevel" according to Bronfenbrenner (1979) (© R.Tkotzyk).

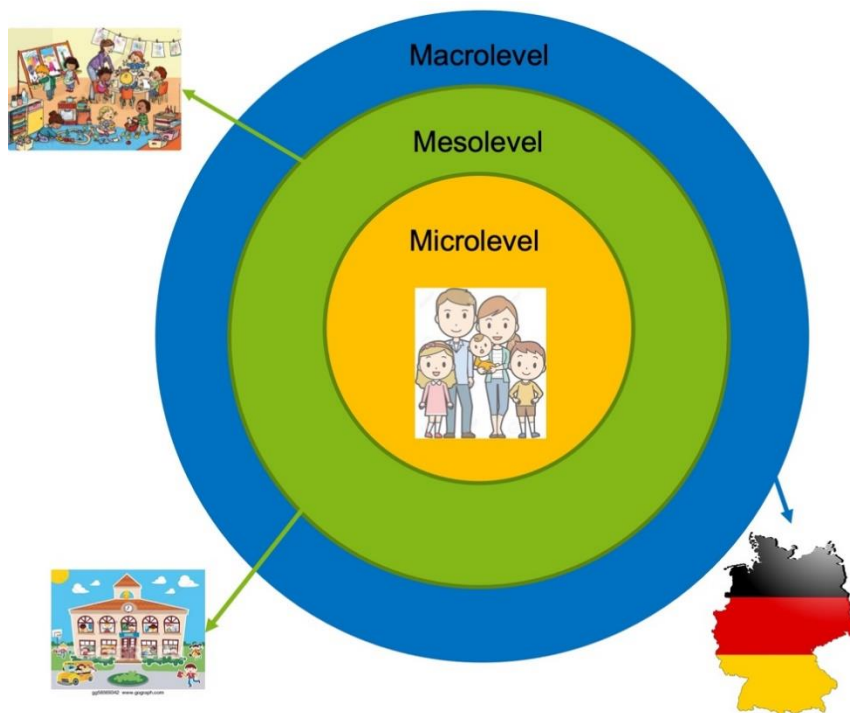


Figure 2.
The Game Board with the Three Upper Categories and Child-Appropriate Pictures
(© R.Tkotzyk).



The second part of the name "Picturizing Strategy" is derived from this game-theoretical approach. An extension is made here in that the participants can choose the pictures from a previously defined number of a larger scope. This not only adds a playful element to the survey situation but also gives the children the opportunity to experience more success because they are given more opportunities. For example, younger children may not be familiar with the nasal swab of the SARS-COV2 test but know the lollipop test from daycare. The presence of both images thus increases the probability that a conversation will take place. At the same time, it offers the opportunity to find out whether both types of testing are known and whether the child can recognize them, explain, and assign them to specific levels. Furthermore, the interviewer can ask specific questions and, thereby, draw conclusions on whether the child has acquired their knowledge actively or passively. It is also possible to integrate a hand puppet into this survey process as a puppet interview (Roth, Dadds, & McAloon, 2004, for Germany cf. Paus-Haase, 1998; Weise, 2012, 2019) to offer a fictitious conversation partner "at eye level" with the children. The children are allowed to make their own decisions about the discussion situation. These situations are recorded and the children's statements on the individual subject areas are transcribed. The qualitative evaluation is then carried out using MAXQDA, a software program for computer-assisted qualitative and mixed methods analysis. In this way, the individual statements are categorically coded and networked. We developed the codes, which were used in the MAXQDA analysis, from Bronfenbrenner's ecological model of Human Development and from a philosophical didactic concept that considers the argumentative depth and social reach which is called the TRAP-Mind-Matrix.

6. EVALUATION MATRIX

It is precisely the interdisciplinary structure of the project that allows at least some of Bronfenbrenner's systems of social integration, as described above, to be recorded. Onwuegbuzie, Collins, and Frels (2013) make it clear that quantitative, qualitative, and mixed methods research like ours can very well consider several systems or levels of Bronfenbrenner's concept. However, the evaluation of the children's answers about the expression of political awareness as an awareness of rules poses a particular challenge. The question arises as to which categorization allows this expression to be determined. From this follows the task of formally categorizing the very different preferences and attitudes of the children, because we are not concerned with the content of a child's response. We are concerned with the type of argument and the social weight of the arguments that are put forward for a political analysis.

Therefore, we use a current system from philosophy didactics, the TRAP mind theory. In his theory, Frank Brosow (2020) distinguishes four levels of justification for normative ideas, similar to the social rules we examined (see Fig. 3).

Figure 3.

The TRAP-Mind-Matrix: Areas, Levels, and Fields of Contemplation (Brosow, 2020, p. 15).

Area:	Level:	Thinking	Reflecting	Arguing	Philosophizing
Understanding		Idea (description/association)	Concept (justified idea)	Definition (justified set of concepts)	Theory of Meaning (justified justification)
Evaluating		Opinion (believe/attitude)	Judgment (justified opinion)	Argumentation (justified set of judgments)	Theory of Quality (justified justification)
Acting		Impulse (motive)	Decision (justified impulse)	Stance/Praxis (justified set of decisions)	Theory of Behavior (justified justification)

The theory combines two essential aspects. On the one hand, it is based on current empirical results of cognitive psychology. On the other hand, it aims at the fundamental ethical criterion of the universalizability of an argument. She wants to make it understandable what happens when we give more and more generalizing reasons when working on problems rationally to make our preferences or judgments plausible. "The TRAP-Mind-Theory has a functionalistic understanding of reasons. A reason is not a consideration of its kind. Any thought that is deliberately used to support or attack a consideration is considered a reason by the TRAP-Mind-Theory" (Brosow, 2020, p. 26). In practical analysis, the TRAP mind theory offers a matrix of rational argumentation.

It consists of three areas of contemplation (understanding, evaluating, and acting). These define the concrete nature of the problem we are dealing with. At the same time, the TRAP Mind Matrix consists of four levels of contemplation (thinking, reflecting, arguing, philosophizing), which determine how we deal with these topics. "Thinking" remains on the level of description, "Reflecting" focuses on a conception, here on fair regulation. At the "Arguing" level, definitions and contexts of justification are offered. Finally, "philosophizing" includes the ability to develop theories and substantiate them based on theories.

The content presented in our survey is purely exemplary and ultimately understood as random political fields of action and decision-making. We are not interested in the specific positions of the respondents. Therefore, the levels of increasingly generalized justification

("for ourselves, others or all people", Brosow, 2020, p. 15) of preferences are of particular importance for our evaluations (cf. Fig. 4). The test procedure provided in the TRAP-Mind-Matrix is primarily intended for the quality of the argument. This aspect is also not relevant to our question.

Figure 4.
The TRAP-Mind-Matrix: Levels, and Reasons (Brosow, 2020, p. 15).

Thinking	Reflecting		Arguing		Philosophizing	
Intuition	+ Reasons for me		+ Reasons for others		+ Reasons for everybody	
	before testing	after testing	before testing	after testing	before testing	after testing

With the TRAP-Mind-Matrix we have an instrument at our disposal to capture the cognitive appropriation of social rules as a basis for an understanding of the Political in general, independent of a concrete political system conception.

7. FIRST RESULTS OF A PRETEST

In our limited first research sample with five children aged four to five (preschool, K4, and K5), we examined the methodological considerations, especially the "picturizing maps", for their suitability. At the same time, we, as researchers, made our first experiences with the TRAP-Mind-Matrix too. Our analysis showed that:

- The playful implementation of the picturizing strategy was suitable as a conversation starter for all children. In particular, children who found a puppet interview too "childish" were easily reached with the above explained method of picturizing strategy.

- In our opinion, the attention span is particularly important. As in an earlier study (Marci-Boehncke, & Rath, 2013), experiences with child interviews showed that there is no reason to worry that children would not be able to respond long enough and not communicatively to questions. Interviews with children can be successful if they adjust to the children's levels and abilities. In this way, it is possible to obtain a relatively long attention span. In our pretest, this was about 15-20 minutes.

- Of the subject areas offered, the "Corona" focus has proven to be particularly fruitful in our pilot phase between November 2021 and March 2022. The children were able to link directly to Corona and give clearer, more detailed, and more differentiated answers compared to the other topics. The medial and the immediate level of experience are most closely linked here. The subject of environment and nature could be addressed to a lesser extent, although this will be the focus of the next phase of the study.

- For all surveys, Bronfenbrenner's systemic model of human development proves to be suitable for differentiating the political levels.

The analysis with the TRAP-Mind-Matrix made it clear that the respective cognitive awareness of rules as the basis of political awareness reaches different levels of generalization.

- As expected, based on the level of justification for rule specifications, none of the children surveyed reached the "philosophizing" level.

– At least "reflecting" is achieved in the microsystem. The children can offer conceptual ideas of rule-making (e.g. the family picture) that justify the validity for themselves (e.g. as a child).

– In terms of the mesosystem, the children's statements reach the "Arguing" level. The children interviewed can develop definitions of regularity that justify a validity for "myself and others".

– For the macro system, on the other hand, most of the statements remain on the "thinking" level and are, therefore, exclusively descriptive. Our pretest respondents have no concepts or even definitions of the political justification of rules of action in the strict sense of the term. However, the children also show that they perceive the macro system and its rules but are less able to question them critically than the rules in the other two systems, in which they perceive themselves as conscious actors. In this way - one could interpret it - they unconsciously place themselves in the group of addressees of the rules and thus "practice" initial, albeit unintended, political participation. This integration is, at the same time, the decisive starting point for an explicit institutional democracy education, as many German educational guidelines require it.

Overall, these preliminary results already give grounds for optimism but could give a more definitive answer if we had a larger sample size. From K4/K5 children we did not expect an understanding of the political system in the strict sense. But it turned out, however, that there is already a "political awareness", which is found in the close family environment and above all at the peer level, as we described at the beginning of the article. However, this political awareness cannot be ascertained through the political knowledge of the target group. Rather, it can be assumed that the content-filled knowledge of political institutions, rules, and actors (not just naming) still requires political awareness. Our findings indicate that this political awareness develops from the structural awareness of rules that is imparted in the course of socialization, especially language socialization: language acquisition is rule acquisition and leads to a political, because of rule-based, awareness.

We are curious to see what results of our overall study will allow beyond the social references and what conclusions we can then draw from these results for strengthening institutionalized political and democratic education in early education.

REFERENCES

- Alscher, P., Ludewig, U., & McElvany, N. (2022). Civic Literacy – zur Theorie und Messbarkeit eines Kompetenzmodells für die schulische politische Bildung [Civic Literacy - on the Theory and Measurability of a Competence Model for Civic Education in Schools]. *Zeitschrift für Erziehungswissenschaft*, 25, 1221-1241. <https://doi.org/10.1007/s11618-022-01085-0>
- Benner, D. (1987). *Allgemeine Pädagogik. Eine systematisch-problemgeschichtliche Einführung in die Grundstruktur pädagogischen Denkens und Handelns* [General Pedagogy. A systematic-problem-historical introduction to the basic structure of pedagogical thought and action]. Weinheim, Germany: Beltz.
- Bronfenbrenner, U. (1979). *The Ecology of Human Development: Experiments by Nature and Design*. Cambridge, MA: Harvard University Press.
- Brosow, F. (2020). TRAP-Mind-Theory. Philosophizing as an Educational Process. *Journal of Didactics of Philosophy*, 4(1), 14-33. Retrieved from https://www.philosophie.ch/attachment/272/download/JDPh_2020_Volume_4_Number_1

- Butschi, C., & Hedderich, I. (2021). Kindgerecht forschen. Ein Überblick [A child-oriented research approach. An overview]. In I. Hedderich, J. Reppin & C. Butschi (Eds.), *Perspektiven auf Vielfalt in der frühen Kindheit. Mit Kindern Diversität erforschen* [Perspectives on diversity in early childhood. Exploring diversity with children] (pp. 101-119). Bad Heilbrunn, Germany: Verlag Julius Klinkhardt.
- Carpenter, M., & Tomasello, M. (2011). Geteilte Intentionalität [Shared intentionality]. In L. Hoffmann, K. Leimbrinck & U. Quasthoff (Eds.), *Die Matrix der menschlichen Entwicklung* [The matrix of human development] (pp. 83-95). Berlin, Germany, Boston, MA: De Gruyter.
- Cassirer, E. (1944): *An Essay on Man: An Introduction to a Philosophy of Human Culture*. New Haven, CT: Yale University Press.
- Derbolav, J. (1975). *Pädagogik und Politik. Eine systematisch-kritische Analyse ihrer Beziehungen. Mit einem Anhang zur "Praxeologie"* [Pedagogy and Politics. A systematic-critical analysis of their relations. With an appendix on praxeology]. Stuttgart, Germany: Kohlhammer.
- Detjen, J., Massing, P., Richter, D., & Weißeno, G. (2012): *Politikkompetenz – Ein Modell* [Political competence – a model]. Wiesbaden, Germany: Springer VS.
- Dudley, R. L., & Gitelson, A. R. (2002). Political Literacy, Civic Education, and Civic Engagement: A Return to Political Socialization? *Applied Developmental Science*, 6(4), 175-182. https://doi.org/10.1207/s1532480xads0604_3
- Duncker, H.-R. (2011). Die Entwicklung der Menschen zu Sprach- und Kulturwesen [The development of human beings into linguistic and cultural beings]. In L. Hoffmann, K. Leimbrinck & U. Quasthoff (Eds.), *Die Matrix der menschlichen Entwicklung* [The matrix of human development] (pp. 15-58). Berlin, Germany, Boston, MA: De Gruyter.
- Flanagan, C. A. (2013). *Teenage Citizens: The Political Theories of the Young*. Cambridge, MA: Harvard University Press.
- Goll, T. (2021). "Die Grenzen meiner Sprache bedeuten die Grenzen meiner Welt" – sprachliche Herausforderungen für politisches Lernen im Sachunterricht ["The boundaries of my language mean the boundaries of my world" - linguistic challenges for political learning in Sachunterricht (non-fiction teaching)]. In U. Franz, H. Giest, M. Haltenberger, A. Hartinger, J. Kantreiter & K. Michalik (Eds.), *Gesellschaft für Didaktik des Sachunterrichts (GDSU), Bd. 31: Sache und Sprache* (pp. 40-47). Bad Heilbrunn, Germany: Verlag Julius Klinkhardt.
- Goll, T. (2022). Political Literacy von Kindern. Befunde, Implikationen, Herausforderungen [Children's Political Literacy. Findings, Implications, Challenges]. In A. Becher, E. Blumberg, T. Goll, K. Michalik & C. Tenberge (Eds.), *Sachunterricht in der Informationsgesellschaft* [Non-fiction teaching in the information society] (pp. 131-138). Bad Heilbrunn: Verlag Julius Klinkhardt. Retrieved from <https://doi.org/10.25656/01:24209>
- Graf, D. (2014). Concept-Mapping als Diagnosewerkzeug [Concept mapping as a diagnostic tool]. In D. Krüger, I. Parchmann & H. Schecker (Eds.): *Methoden in der naturwissenschaftsdidaktischen Forschung* [Methods in science didactics research] (pp. 325-335). Berlin/Heidelberg, Germany: Springer VS.
- Heidemeyer, S., & Lange, D. (2010). Wie sich Schülerinnen und Schüler Demokratie vorstellen. Zur didaktischen Rekonstruktion von Politikbewusstsein [How pupils imagine democracy. On the didactic reconstruction of political consciousness]. In D. Lange & G. Himmelmann (Eds.), *Demokratiedidaktik: Impulse für die Politische Bildung* [Didactics of Democracy: Impulses for Political Education] (pp. 221-240). Wiesbaden, Germany: Springer VS.
- Hunter, P., & Rack, J. (2016). Advancing young citizens' political literacy through social-sciences curricula. *Research Information for Teachers*, 3, 23-28. Retrieved from <https://dx.doi.org/10.18296/set.0053>
- Kaid, L. L., & Holtz-Bacha, C. (2008). Politics, policy, polity. In L. L. Kaid & C. Holtz-Bacha, (Eds.), *Encyclopedia of Political Communication*, vol. 1 (p. 621). Thousand Oaks, CA: SAGE Publications.
- Krotz, F. (2007). The meta-process of "mediatization" as a conceptual frame. *Global Media and Communication*, 3(3), 256-260. <https://doi.org/10.1177/17427665070030030>
- Lichtenberger, D. (2012, August 2). *Shaping influences – human development*. Message posted to <https://drewlichtenberger.com/6-shaping-influences-human-development/>

- Marci-Boehncke, G., & Rath, M. (2013). *Kinder – Medien – Bildung: Eine Studie zu Medienkompetenz und vernetzter Educational Governance in der Frühen Bildung* [Children – Media – Education. A study on media competence and networked educational governance in early education]. München, Germany: KoPaed.
- Marci-Boehncke, G., Rath, M., Delere, M., & Höfer, H. (2022). Medien – Demokratie – Bildung: Normative Vermittlungsprozesse und Diversität in mediatisierten Gesellschaften [Media – Democracy – Education: Normative mediation processes and diversity in mediatised societies]. In G. Marci-Boehncke, M. Rath, M. Delere & H. Höfer (Eds.), *Medien – Demokratie – Bildung: Normative Vermittlungsprozesse und Diversität in mediatisierten Gesellschaften* [Media - Democracy - Education: Normative Mediation Processes and Diversity in Mediatized Societies] (pp. 1-10). Wiesbaden, Germany: Springer VS.
- MAXQDA | All-In-One Tool for Qualitative Data Analysis & Mixed Methods (<https://www.maxqda.com/>).
- Mey, G. (2003). *Zugänge zur kindlichen Perspektive. Methoden der Kindheitsforschung* [Approaching the child's perspective. Methods of childhood research]. <https://doi.org/10.23668/psycharchives.8808>
- Meier, K. (2018). *Journalistik* [Journalism] (4th ed.). Stuttgart, Germany: UTB.
- Novak, J. D. (1990). Concept maps and Vee diagrams: two metacognitive tools to facilitate meaningful learning. *Instructional Science*, 19(1), 29-52. <https://doi.org/10.1007/bf00377984>
- Novak, J. D., & Gowin, D. B. (1984). *Learning how to learn*. New York, NY: Cambridge University Press.
- Novak, J.D., & Cañas, A. J. (2008). *The Theory Underlying Concept Maps and How to Construct Them*. (Technical Report IHMC Cmap Tools 2006-01, Rev 01-2008). Florida, EUA: Florida Institute for Human and Machine Cognition. Retrieved from <http://cmap.ihmc.us/Publications/ResearchPapers/TheoryUnderlyingConceptMaps.pdf>
- Onwuegbuzie, A. J., Collins, K. M. T., & Frels, R. K. (2013). Foreword: Using Bronfenbrenner's ecological systems theory to frame quantitative, qualitative, and mixed research. *International Journal of Multiple Research Approaches*. 7(1), 2-8. <https://doi.org/10.5172/mra.2013.7.1.2>
- Paus-Haase, I. (1998). *Heldenbilder im Fernsehen. Eine Untersuchung zur Symbolik von Serienfavoriten in Kindergarten, Peer-Group und Kinderfreundschaften* [Hero images on television. An investigation into the symbolism of television favorites in kindergarten, peer groups, and children's friendships]. Wiesbaden, Germany: Springer VS. <https://doi.org/10.1007/978-3-663-07689-6>
- Paus-Hasebrink, I. (2017): Langzeitstudie zur Rolle von Medien in der Sozialisation sozial benachteiligter Heranwachsender. Lebensphase Jugend. [Longitudinal study on the role of media in the socialization of deprived young people. Life Phase Adolescence.] Mannheim, Germany: Nomos.
- Rath, M. (2019). Ethics of the Mediatized World. In T. Eberwein, M. Karmasin, F. Krotz & M. Rath (Eds.), *Responsibility and Resistance. Ethics in Mediatized Worlds* (pp. 53-68). Wiesbaden, Germany: Springer VS.
- Räska-Hardy, L. (2011). Der Erwerb der theory of Mind-Fähigkeit – Entwicklung, Interaktion und Sprache [Acquiring of the theory of mind skill - development, interaction and language]. In L. Hoffmann, K. Leimbrinck & U. Quasthoff (Eds.), *Die Matrix der menschlichen Entwicklung* [The matrix of human development] (pp. 96-142). Berlin, Germany, Boston, MA: De Gruyter.
- Roth, J. H., Dadds, M. R., & McAloon, J. (2004). Evaluation of a Puppet Interview to Measure Young Children's Self-Reports of Temperament. *Behaviour Change*, 21(1), 37-56. <https://doi.org/10.1375/bech.21.1.37.35973>
- Rowe, D. (2005). The Development of Political Thinking in School Students: An English Perspective. *International Journal of Citizenship and Teacher Education*, 1(1), 97-110.
- Stewart, J., Van Kirk, J., & Rowel, R. (1979). Concept Maps: A Tool for Use in Biology Teaching. *The American Biology Teacher*, 41(3), 171-175. <https://doi.org/10.2307/4446530>
- Thyen, A. (2006). *Moral und Anthropologie: Untersuchungen zur Lebensform "Moral"* [Morality and Anthropology. Studies on the "Moral" Form of Life]. Weilerswist, Germany: Velbrück Wissenschaft.

- Tkotzyk, R., & Marci-Boehncke, G. (2022). Research with young children: Do picture concept maps work as interview tool in early childhood research? In L. Gómez Chova, A. López Martínez, & I. Candel Torres (Eds.) *Proceedings of INTED 2022 (7258-7267)*. Valencia: Spain. <https://doi.org/10.21125/inted.2022.1836>
- UNESCO (2019). *Futures literacy: anticipation in the 21st Century*. Paris, France: UNESCO. Retrieved August 8, 2022, from <https://unesdoc.unesco.org/ark:/48223/pf0000372349.locale=en>
- UNESCO (2021). *Future Literacy. An essential competency for the 21st century*. Paris, France: UNESCO. Retrieved from <https://en.unesco.org/futuresliteracy/about>
- Valentine, J. (2006). The Political. *Theory, Culture & Society*, 23(2-3), 505-511. 10.1177/026327640602300295
- van Deth, J. W., Abendschön, S., Rathke, J., & Vollmer, M. (2007). *Kinder und Politik. Politische Einstellungen von jungen Kindern im ersten Grundschuljahr* [Children and Politics. Political Attitudes of Young Children in the First Year of Primary School]. Wiesbaden, Germany: Springer VS.
- Vélez-Agosto, N. M., Soto-Crespo, J. G., Vizcarrondo-Opppenheimer, M., Vega-Molina, S., & García Coll, C. (2017). Bronfenbrenner's Bioecological Theory Revision: Moving Culture from the Macro Into the Micro. *Perspectives on Psychological Science*, 12(5), 900-910. 10.1177/1745691617704397
- Vogl, S. (2021). Mit Kindern Interviews führen: Ein praxisorientierter Überblick [Conducting interviews with children: A practice-oriented overview]. In I. Hedderich, J. Reppin, & C. Butschi (Eds.), *Perspektiven auf Vielfalt in der frühen Kindheit. Mit Kindern Diversität erforschen* [Perspectives on diversity in early childhood. Exploring diversity with children] (pp. 142-157). Bad Heilbrunn, Germany: Verlag Julius Klinkhardt.
- Wegemer, C. M., & Vandell, D. L. (2020). Parenting, temperament, and attachment security as antecedents of political orientation: Longitudinal evidence from early childhood to age 26. *Developmental Psychology*, 56(7), 1360-1371. <https://doi.org/10.1037/dev0000965>
- Weise, M. (2012). *Kinderstimmen. Eine methodologische Untersuchung zum multiperspektivischen Erfassen kindlichen Mediennutzungsverhaltens und Medienerlebens. Ein Beitrag zur frühkindlichen Medienbildungsforschung* [Children's voices. A methodological study on the multi-perspective recording of children's media use behavior and media experience. A contribution to early childhood media education research.] (Doctoral dissertation, Technische Universität Dortmund, Germany). Retrieved from https://eldorado.tu-dortmund.de/bitstream/2003/30136/1/Dissertation_30.11.2011_Weise_DruckfassungPublikation.pdf
- Weise, M. (2019). Kindern eine Stimme geben!? Methodischer Diskurs zu (Un)Möglichkeiten von Puppent Interviews mit Kindern im Alter von vier bis sechs Jahren [Giving children a voice!? Methodological discourse on the (im)possibilities of puppet interviews with children aged four to six years]. In T. Knaus (Ed.), *Forschungswerkstatt Medienpädagogik. Projekt – Theorie – Methode* [Research Workshop Media Education. Project - Theory - Method] (pp. 849-879). München, Germany: Kopäd. 10.25656/01:17385
- Weise, M. (2021). Es ist noch jemand mit uns hier. Puppent-Interviews in der Forschung mit Kindern [There is someone else here with us. Puppet interviews in research with children]. In I. Hedderich, J. Reppin & C. Butschi (Eds.), *Perspektiven auf Vielfalt in der frühen Kindheit. Mit Kindern Diversität erforschen* [Perspectives on diversity in early childhood. Exploring diversity with children] (pp. 158-171). Bad Heilbrunn, Germany: Verlag Julius Klinkhardt.
- Weißeno, G. (2012). Dimensionen der Politikkompetenz [Dimensions of political competence]. In G. Weißeno & H. Buchstein (Eds.), *Politisch Handeln: Modelle, Möglichkeiten, Kompetenzen* [Political Action: Models, Options, Competencies] (pp. 156-177). Bonn, Germany: Bundeszentrale für politische Bildung. Retrieved from https://www.bpb.de/system/files/dokument_pdf/Politisch-Handeln_111124_X3.pdf
- Weißeno, G. (2022). Beliefs im Politikunterricht [Beliefs in the politics classroom]. In G. Weißeno & B. Ziegler (Eds.), *Handbuch Geschichts- und Politikdidaktik* [Handbuch Geschichts- und Politikdidaktik] (pp. 359-374). Wiesbaden, Germany: Springer VS.

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Weißeno, G., Götzmann, A., & Weißeno, S. (2016). Politisches Wissen und fachspezifisches Selbstkonzept von Grundschüler/-innen [Political knowledge and subject-specific self-concept of primary school pupils]. *Transfer Forschung – Schule*, 2, 162-172. Retrieved from <https://nbn-resolving.org/urn:nbn:de:0168-ssoar-65865-1>

Wittgenstein, L. (1958). *Philosophical Investigations* (G. E. M. Anscombe, Trans.). Oxford, England: Basil Blackwell (1st edition published 1953).

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Chapter # 35

TEACHING TOWARDS JOY AND INVOLVEMENT WITH WESTERN AND ARAB CLASSICAL MUSIC

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ABSTRACT

Listeners at concerts of classical music, both Western and Arab, are dwindling. Educational policy does not invest enough to preserve the gifts of previous generations. We will argue that what prevents teachers from introducing their pupils to this music is the absence of teaching methods that make listening to unfamiliar music challenging, engaging, and fun. This chapter introduces new pedagogy and a program of prepared concerts for teaching classical music in primary schools and preschools. One of the innovative methods of teaching is the "Musical Mirror" approach, based on the principle that movement gestures are the source of musical gestures and their use aids in the individual's cognitive and affective identification with the music. Conclusions drawn from the study are based on responses to questionnaires and interviews of practicing teachers, both those who are teaching Western and those who are teaching Arab music. The use of Musical Mirrors and Graphs raised teachers' confidence for teaching complex music because it deepens their understanding and generates excitement and identification with the music which they then transfer to their students. Furthermore, the concert program provides a professional framework with opportunities for collaborative learning both for themselves and their pupils.

Keywords: musical mirrors/graphs, active listening, Constructivism, music cognition, Arab/ Western Classical Music.

1. INTRODUCTION

Educational policy in the Western world does not appear to invest enough effort in preserving the arts. Arts education in schools is often relegated to outside the core curriculum (Dewey, 1919; Dewey, 1934; Heilig, Cole, & Aguilar, 2010; Jorgensen, 2003; Katona, 2016). Even though one of the functions of education should be the transmission of culture from generation to generation (Taba, 1962), schools most often fail to fulfill this obligation in general, and very often in the case of transmission of musical culture. School music teachers prefer to teach other styles so that Western classical music is pushed to the margins. The music taught in schools is increasingly focused on teaching popular music, folk music, rock, etc. It seems that educational policy does not invest enough in preserving the gifts of previous generations. In many schools, teachers prefer to please their students by focusing on music that the students listen to (with great enjoyment and expertise without any need for guidance from their teachers) rather than challenging them to become acquainted with musical worlds that are closed to them. Thus complex, classical music of most cultures is marginalized.

A survey in four countries (England, Germany, USA [in the state of North Carolina], and Finland) found that only in one place (North Carolina) was general music taught in elementary schools by music specialists (Shvadron, 2019). In many, if not most, European countries (France, Holland, Italy, Poland, Croatia, Kosovo, Macedonia, Montenegro) music in early grades is taught by the classroom (homeroom) teacher (Girdzijauskienė &

Sakadolskienė, 2016). It is likely that general teachers who are not musicians do not have the ability to teach complex music and use methods for teaching music that require above-average musical skill (Shvadron, 2019). We believe that the main reason why children are not exposed to classical music is the lack of appropriate, profound, interesting, and creative teaching methods and learning strategies.

In this chapter we examine the impact on teachers of using the “Musical Mirrors” approach developed by Veronika Cohen (1997; 2015) in teaching Western and Arab classical music. We also examine the impact of the Israeli “Touch the Music” live concerts program on music teachers.

It is important to note that in music education classes in Arab society music teachers used to teach the songs of the Lebanese singer Fairuz and the songs of Palestinian folklore. This means that in the past they only used light vocal music. However, when they began to use the approach of musical mirrors, they were also able to present more complex instrumental Arab music that they had not previously been exposed to in elementary school music classes. Examples include works of Muhammad Abd al-Wahab and Umm Kultum, and complex forms of Turkish music such as al-Samai and al-Langa.

1.1. Pedagogic Approach

The goals of music education are to enable students to derive meaning from a musical experience and to use music as a means of self-expression. Wiggins (2001) explains that in order to learn one needs opportunities to construct personal understanding. In schools where the principles of constructivism are applied students' original ideas are valued, along with those of their teachers.

Studies show that when children listen to a musical work, they perceive the music as whole gestures and not as a collection of separate sounds (Cohen, 1980).

The teacher must engage in musical activities with a holistic approach that presents musical gestures in their entirety. Musical concepts should be taught in the context of the specific musical piece in which they appear (Wiggins, 2001). The method that Cohen developed to meet this need is the Musical Mirrors approach (Story Time Production, 2020).

1.2. Musical Mirrors and Graphs

Cohen created an approach that she calls “Musical Mirrors”, for learning music through movement that allows a holistic perception and response. A “Musical Mirror” is the movement analog of the cognitive and emotional process of the listener. Mirror movements express an analysis of all the important aspects of a musical piece and reflect the organizing action of the listener. The approach is based on the principle that movement gestures are the source of musical gestures (Cohen, 1997; 2015).

This belief in movement gestures as the source of musical gestures was based on observation and analysis of kindergarten children's musical play (Cohen, 1980). Filippa et al. (2020) argue a similar point namely that “music cognition is not just a matter of perception, but involves the whole human body” (Filippa et al., 2020, p.3). Recent research in embodied music cognition validates the principles that guides the development and use of Musical Mirrors.

For about a decade, embodied music cognition has become an influential paradigm in music research. The paradigm holds that music cognition is strongly determined by corporeally mediated interactions with music. They determine the way in which music can be conceived in terms of goals, directions, targets, values, reward (Leman, Maes, Nijs, & Van Dyck, 2018, p.2).

Musical Graphs can serve as alternatives for Musical Mirrors. Cohen defines Musical Graphs as capturing the movement of the Musical Mirror on the page. A Graph is not a notation of discreet auditory events- but representation of the mind's organizing activity that turns sounds into music.

When the teacher makes use of a Musical Mirror the musical piece is presented to the learner as a gestalt and he/she intuitively grasps its details from the movements. Next, the teacher asks questions that raise awareness of what the student has intuitively understood. At the end of the process the student is invited to present his/ her creative response through a dance, a graph, his/her own mirror, or a piece of music that he or she composed. Each of these creative responses are based on the musical ideas the student has learned to recognize in the piece.

1.3. Concert Programs

Various scholars review live concerts for school children, but only a minority describe significant preparation for them. Brand (2000) writes: "Concerts of live music in various ensembles are perceived as part of music education around the world, and are considered as an effective way to develop musical appreciation, musical perception and appropriate behavior" (Brand, p.2). Wasiak (2005) recommends deepening and exploring the educational effectiveness of children's concerts, as well as comparing different teaching methods. He also recommends close collaboration between music educators, musicians, and researchers - to maximize the educational value of children's concerts. The study presented below on the "Touch the Music" program exemplifies such collaboration.

The role of preparing the children for the concert is entrusted to the music teachers, while the selection of the repertoire and the preparation of the teachers are the responsibility of the academic team from the Jerusalem Academy of Music and Dance. The performance is entrusted to professional artists. The preparation and ongoing support the teachers receive is an integral part of the program. The latter includes written booklets that contain in-depth analysis of the pieces, suggested activities for each piece for different age groups and workshops.

Open Window- program created by Noga Fox, Jerusalem supervisor of music, created a space for cooperative learning and opportunities for sharing the experience of teaching various pieces amongst teachers who participate in the program. The rationale underlying the concert preparation is that

children should prepare for this active (mentally active) musical encounter with the same intensity and clarity of purpose with which they prepare for other musical events, such as a school concert where they themselves perform. The principal of one of the schools where such an active partnership exists summarized the value of the project as follows: "The lessons give meaning to the concert; the concert in turn gives direction and meaning to the music curriculum (Cohen, 2004, p. 47-48).

While this program has been continuously on going for 30 years in West Jerusalem and 18 years in the North of Israel it has been only sporadically present in East Jerusalem schools and the Arab sector in the North.

1.4. Music Education in Arab Society in Israel

Israeli schools (with a very few exceptions) are divided according to the child's primary cultural background (Jewish or Arab), each with its own curriculum. In this chapter we explore the impact of using Musical Mirrors as a teaching approach in both sectors.

In the last decade we have witnessed a change in music education in Arab society. More parents than in the past began to send their children to study music in community centers and music conservatories in various localities. Resources for music studies in the northern region for the Arab society have been increased, but the programs are still not adapted to the Arab population and the Arab musical culture (Ben-Zeev, 2006).” It is desirable that there be an Arab musical education that is different from any other music education, that reflects Arab qualities, the uniqueness of Arab musical culture” (Touma, 1974, p.370).

Cohen and Laor (Cohen & Laor, 1997) also support the need for a curriculum for music education that is based on a thorough acquaintance with Arab musical culture, along with an acquaintance with Western music. Since the aesthetics and material of Arab music are quite different from those of Western music, emphasis in Arab schools should be on imparting Arab music culture. This should include: acquaintance with the repertoire of classical Arab instrumental music, songs from Arab folklore, the history of Arab music (composers and genres), and aspects of Arab music theory (the theory of Maqam, Arab rhythms, etc.).

2. OBJECTIVES

The purpose of the study is to examine whether and how Musical Mirrors can provide an appropriate teaching tool for in-depth listening to Western and Arab classical music. The research questions were:

- 1) Does the “Musical Mirrors” approach encourage and support teachers in teaching classical music as an integral part of their lessons?
- 2) How does the “Musical Mirrors” approach affect teaching of Arab music? Is its effect different from the effect in the teaching of Western music?
- 3) Does the format of written materials, workshops, and live concerts prepare and support teachers so that they feel comfortable teaching complex music that expands their pupils’ musical horizons?
- 4) What is the effect over time of the concert program “Touch the Music” on teachers?

3. METHOD

The study was conducted in a mixed method, which poses an advantage to mutual strengthening of the qualitative and quantitative aspects of the study. Data were collected from various sources using diverse data collection methods: interviews, questionnaires, and written evaluations. The qualitative (interviews and open questions) and quantitative results (questionnaires) were analyzed separately on the same phenomenon in order to validate the findings, confirm them and draw wide conclusions (Creswell & Plano Clark, 2007).

3.1. Sample

In the first phase of the study 42 music teachers participated from two districts (the Jerusalem and the North District). The teachers' sample was based on the analytical induction method, according to which the researcher selects interviewees who he believes will contribute to the theory (Sabar Ben-Yehoshua, 1990). They were chosen because they participated in the “Touch the Music” Concert Program for several years. In the second phase of the study 28 music teachers from the Jewish sector participated. Some participants participated in the “Touch the Music” program for many year; others were younger teachers who have joined more recently. From the Arab sector 23 experienced music teachers who use the “Musical Mirrors” approach participated.

3.2. Procedure

The research reported here took place in two phases. Phase I was conducted in 2011-2012 (Shmuelof, 2012). Phase II, involved two parallel studies conducted in 2022 - one in the Jewish sector and one in the Arab sector. In the 2011-2012 study 12 teachers from Jerusalem and the northern district of Israel were interviewed. In addition to interviews, written evaluations, and personal reactions by teachers who participated in the program were examined. Following the interviews and conversations with the teachers, the principles that distinguish the program and methods of teaching emerged and were clarified. In order to obtain as complete a picture as possible, questionnaires were sent to teachers asking about the contribution of the program to their teaching. Thirty teachers answered the questionnaires.

Ten years later the authors felt that there was a need to reexamine how teachers evaluate the effectiveness and impact of the use of “Musical Mirrors” and the “Touch the Music” program on their teaching today. For this purpose, questionnaires were distributed through digital platforms using WhatsApp teachers’ groups in the Northern District and in Jerusalem. In parallel to this research, Arab music teachers were also sent questionnaires to assess their evaluation of the use of the “Musical Mirror” approach and its effect on the teaching of Arab classical music. These teachers were invited to also participate in phone interviews, or express their thoughts at the end of the questionnaire.

3.3. Data Analysis

The interviews were analyzed for common themes regarding teacher satisfaction with the program, perceived success, suggestions for improvement, etc. Following the interviews, the principles that distinguish the plan became clearer: what in it contributes to the teachers’ satisfaction, as well as questions about how best to conduct future workshops.

4. FINDINGS

4.1. First Phase

The first phase of the research (Shmuelof, 2012) revealed that participating in the “Touch the Music” program put listening to complex artistic music at the center of the music lesson and that in order to do this music teacher needed the support of a program and framework of professional training. Dana (pseudonym) reported that after 20 years of teaching the program reminded her of goals that she had forgotten over time. Over the years she focused more on singing, and did not devote time and resources to quality listening. In addition, participation in the program improved the professional self-esteem of the teachers. In the words of one teacher: “It upgraded me as a teacher” [and] brought interest and something new in active listening to classical pieces.” What are the experiences that made the teacher feel “upgraded”? The interviews revealed two significant aspects that contributed to upgrading the lessons. One is procedural and the other relates to pedagogical approach. From the procedural aspect defined goals and clear stages in the teaching/learning process gave teachers a sense of direction and purpose. A teacher explained: “When you have something organized - Step-by-step, you know what you are going to do, it gives you confidence and a better feeling – that I am more significant – I know where I’m leading my students”. The pedagogical aspect relates to the inclusion of activities that were experiential and creative. As another teacher explained:

Most significantly the children in my class had a personal connection to the music. Before [participating in the program] I taught in a frontal manner, I gave very little room for the experiential way to be manifested.

The program gave place to the child – the creative and the experiential part of the child.

This teacher recognized that teaching using the methods (Musical Mirrors, graphs and creative work) that she learned in the workshops involved her students in the music lesson and the pieces she introduced to them.

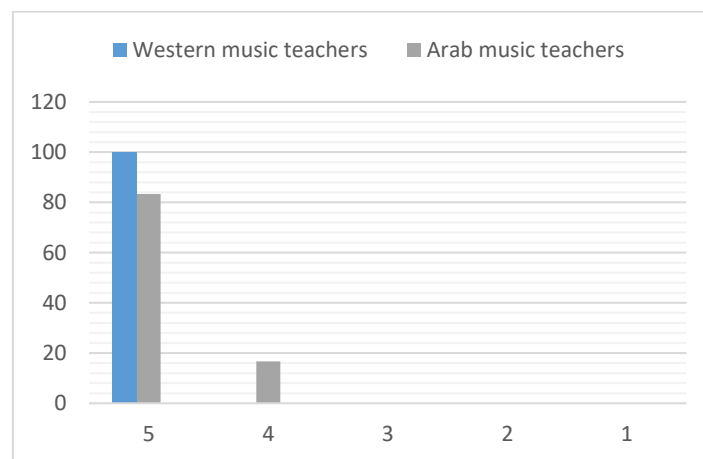
An important finding that emerged from the interviews was the inspiration the program offered for teacher's creativity. Miriam (one of the teachers) noted: "[The program...] has a lot of space for my creativity - which I really liked." She had to adapt the activities to the special needs of her students, at different ages. According to her, this was a big challenge. In addition, she adapted each activity to the changing nature of the class (in one class students might like to discuss musical concepts, while in another students are more involved in creativity). One of the exciting and surprising stories she reported was about her choice to teach "Mirrors" through the experience of a blind girl:

I liked to start a new topic in a certain class where there was a blind girl who was very musical. It raised the challenge that it would suit everyone - even for those who can't see. It [this approach] always justified itself - lessons that were successful for her I was sure would be successful for others as well. I demonstrated "Mirrors" with her. I stood behind her and made the movements through her [...] It was clear to me that I was not giving up the "Mirrors" because of her. On the contrary.

4.2. Second Phase

We will now turn to analysis of responses to questionnaires in 2022. When teachers of Western music were asked to evaluate the impact of the program "Touch the Music" on their teaching, 100% of the teachers chose the answer "it has a very significant effect on my teaching". When teachers of Arab music were asked to evaluate the impact of the use of "Musical Mirrors" on their teaching, 82.6% answered that it has a very significant effect while 17.4% felt it has a significant effect.

Figure 1.
Evaluation of impact of concerts/musical mirrors.

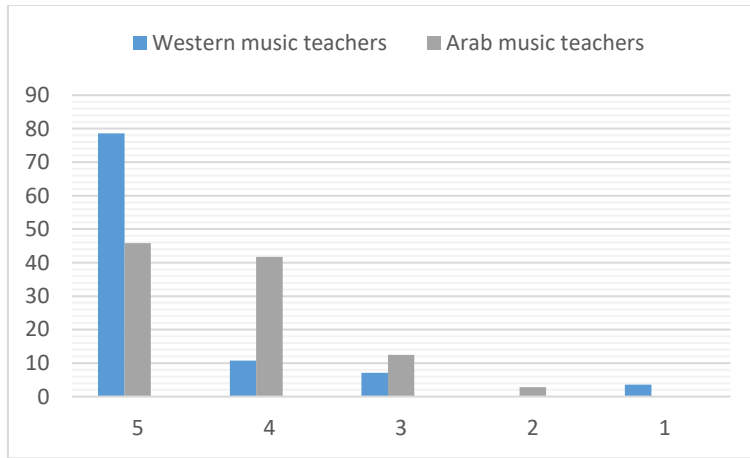


The questionnaire was designed to reveal the impact of “Musical Mirrors” on the teacher as a musician and a pedagogue. Furthermore, we looked at how she perceived the impact of “Musical Mirrors” and the “Touch the Music” program on the children.

For the following statements teachers were asked whether they strongly agree (5), agree (4), somewhat agree (3), disagree (2), or strongly disagree (1):

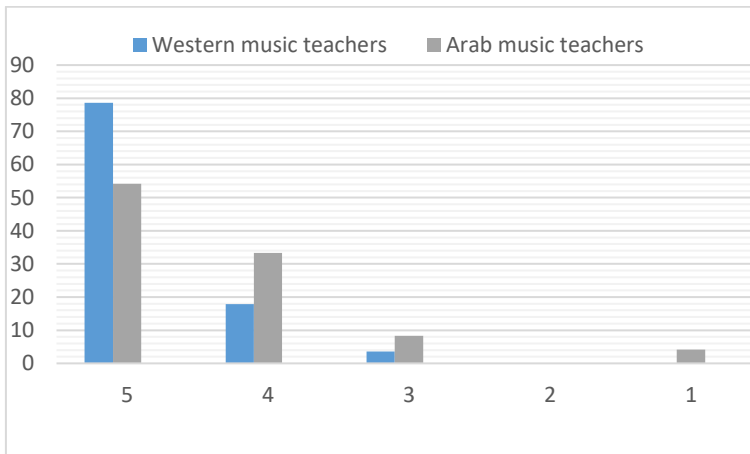
A) “Learning Musical Mirrors/ Graphs also brings me personally closer to music I did not know/ like previously.”

Figure 2.
Musical Mirrors and the teacher as a listener.



B) “I feel confident in including listening to classical music in my teaching because of the suggestion of activities presented in the workshop/ booklet of the program (teachers of Western music)” / “because of the use of Musical Mirrors “(teachers of Arab music).

Figure 3.
Feeling of confidence in teaching classical music.

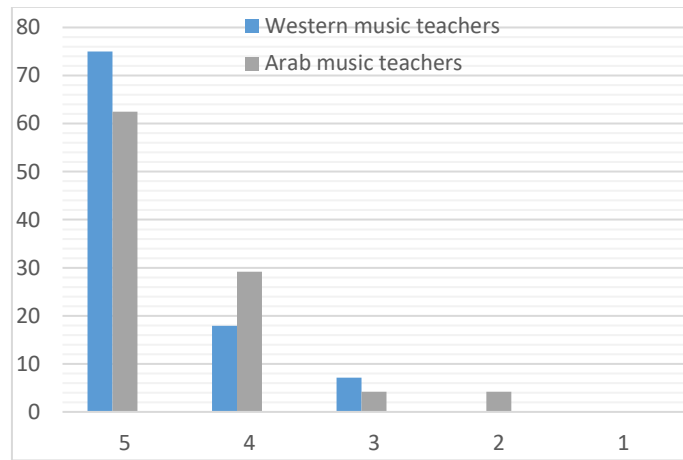


The results in the figures above attest to the willingness of music teachers to engage with complex music, which gives them confidence to encourage the children to be open to listen and respond to unfamiliar music.

In the following figure we see the teachers' sense of professional self-esteem revealed. Using "Musical Mirrors" allows them to deal with music in a significant professional manner.

C) "Teaching with Musical Mirrors makes me feel that I teach music in a meaningful and deep way"

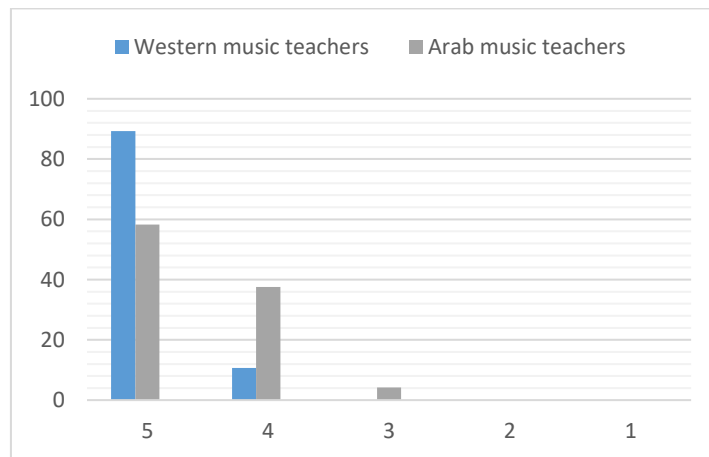
Figure 4.
Teaching in a meaningful and deep way.



The value of active learning is appreciated by teachers since it contributes to the positive **classroom atmosphere** and we see in the figure below that "Musical Mirrors" are ideally suited to such a goal.

D) "Musical Mirrors enable children to be active listeners".

Figure 5.
Children as active listeners.



Teachers interviewed in the Arab sector indicated a number of reasons for using mirrors/graphs:

1) Enjoyment, motivation “When I do a mirror it draws the children into the lessons, raises interest, and I also feel comfortable and happy in class”.

2) Concentration that contributes to conducting a class in a successful atmosphere: “I believe that this tool makes the students listen more and stimulates interaction and concentration”.

3) Cognitive and emotional tie to the music: “It is an intuitive tool that develops deep musical understanding. It is simply a way to draw both the children and the teacher closer to music”.

Teachers remarked that "Mirrors need to be delivered correctly". To this end, one of the teachers requested a site with more mirrors so that they could renew themselves. It is interesting to note that the use of this educational tool was incorporated in the lessons of both younger and experienced teachers. A veteran teacher reported: the mirror method expanded the possibilities and musical horizons in her lessons: “it changed the entire course of the lesson, and especially how I play pieces of music for the students, especially pieces of Western music that I had a hard time teaching before”.

5. DISCUSSION

The uniqueness of teaching through mirrors is the direct and deep experiential connection of the teachers and students to music. The findings revealed that in both the Jewish and the Arab sectors teaching through musical mirrors allowed pupils to connect to complex artistic music - both from Western and Arab culture. This method of teaching is valid for different cultures because it makes use of the unique movement gestures that gave rise to the musical gestures. (Cohen, 1997; 2015). Recent research by Simones (2019) supports this conclusion:

music teachers' gestures embody music and teaching, and play an important role in how effectively teachers promote enactment of music and music learning in these contexts. Such being the case, gestures should be considered from an Embodiment Theory perspective. At the heart of Embodiment Theory is the idea that knowledge is generated through the experience of an individual in her/his world which arises and evolves primarily through the sensing body in interaction with the environment. Accordingly, cognition is understood to be inseparable from corporeal existence—the ‘mind’ is therefore necessarily and essentially embodied. (p.2).

The first and second stages of the research with the teachers of Western music also pointed out the importance of a curriculum that involves active listening and creative experiences which culminate in live concert attendance. We found that teachers who participated in the "Touch the Music" concert program experienced improvement in their professional abilities to engage their pupils in in-depth listening experiences with complex music and in their students' attitude to the music lessons. What are the components that contribute to the success of the project?

5.1. The Workshops

Our findings confirm that the learning process is a social act (Vygotsky, 1978). A teacher explained: "There is a great importance in mutual learning, sharing, and creating experiences in the workshops by all the teachers who teach the program." In the workshops the atmosphere of enthusiasm affects the attitudes of the teachers who otherwise may find learning new pieces and new teaching methods difficult. In addition to sharing ideas with each other, participants become convinced that it is possible, fun, and worthwhile to teach complex music.

5.2. The Concerts

What is the role and importance of the live concert at the end of the program? This is where the need for a 'visible goal' arises in a program focused on musical listening. A visible goal defines the path - the learning process, and gives meaning to lessons" (Rusinek, 2008). Indeed, one of the teachers explained: "When there is preparation of the children for something, and they are waiting for it, it creates a fertile and fun learning atmosphere. Not only do children need a 'visible goal', so do teachers".

The concert itself is the goal towards which the learning is oriented. One of the teachers said that the concerts created a time frame and commitment to the entire curriculum, including the more challenging pieces. The very fact that the piece would be performed at the concert did not allow her to give up on herself and the children: "Before that if something did not work in a certain class, I would give up. Here I must look for and find something that will work."

This finding underscores the importance of the concert program for preserving the "classical" artistic content of music lessons. The concert is an opportunity for the teacher to exhibit the success of her work in the classroom. By observing the level of engagement of the children with the music supervisors and organizers of the program can gauge the quality of the work done in the classroom and provide teachers with feedback and appreciation.

5.3. The use of "Musical Mirrors" and Graphs

In the third part of the research investigating the response of music teachers in the Arab Sector, it could be seen that even without a concert program, teaching using the Musical Mirrors method contributed to the confidence of the teachers in regard to teaching complex artistic music.

The teachers make their own use of the materials they received in their training. Their request for more professional development and an online data base of mirrors and graphs indicates how much they value Musical Mirrors and Graphs as teaching tools. All the teachers reported that they have experienced a process of gaining deeper understanding of musical works through the mediation of "Musical Mirrors". Once the teachers are engaged with complex music, they are able to engender a similar process for the children: "the children in my class had a personal connection to the music ". Another teacher reported that "the program gave place to the child – the creative and the experiential part of the child."

6. CONCLUSIONS

In a field where innovations come and go with great frequency our research has revealed that the "Musical Mirrors" approach and the concert program are effective over time and meet a genuine need. The responses to our recent questionnaire were as positive as the responses of teachers ten years ago. Our research shows that participation in such a program

is essential for teachers as it refreshes and strengthens their sense of professionalism and their confidence in teaching complex classical works in an experiential way. It is important to constantly keep an open channel of communication between the organizers of the program and participating teachers and allow a place and time for exchanging ideas and experiences from the field.

As we saw from both the in-depth study ten years ago and the recent study, the teaching of complex music is a worthy challenge that can be met with a program that is sensitive to both children's and teachers' needs.

The teaching approaches discussed above provide means for multicultural teaching, which in countries with a diverse population is important ethically, pedagogically, and musically. Our experience and research confirms our belief that classical music can be relevant and meaningful to children's lives. In order to be so they need to encounter it in a way that is joyful, respectful both of the listener and the music taught, and rests on solid musical, cognitive and pedagogic foundations.

Future research should involve interviewing pupils to gain their perspective on these projects and to investigate whether their perception of complex music has been affected by these methods and projects.

REFERENCES

- Ben-Zeev, N. (2006). *Horaat Hamusika Bebeit Hasefer Shel Hauchlusiya Haaravit-Palestitit BeIsrael: Historia Vehebetim Achshaveem*. [Music teaching in the Arab-Palestinian school's population in Israel: History and contemporary aspects]. (Unpublished Master's Thesis). Tel-Aviv University, Tel-Aviv, Israel.
- Brand, M. (2000). Music teachers' role in preparing students for live symphonic experiences. *Research Studies in Music Education*, 15(1), 24-30. <https://doi.org/10.1177/1321103X0001500104>
- Cohen, V. (1980). *The emergence of musical gestures in kindergarten children*. (Unpublished Doctoral dissertation). University of Illinois Urbana- Champaign, IL.
- Cohen, V. (1997). Explorations of Kinesthetic Analogues for Musical Schemes. *Bulletin of the Council for Research in Music Education*, 131, (Winter 1997), 1-13.
- Cohen, V. (2004). *Western Art Music: An Endangered Species?* Paper presented at the annual meeting of the Music Education Entering the 21st Century, ISME, (Ed), P.M. Shand. Retrieved from <https://www.isme.org/sites/default/files/documents/proceedings/2000-2002%2BMISTEC%2BProceedings.pdf>
- Cohen, V. (2015). Musical Mirrors and Mirror Neurons. *International Scientific Conference Art and Education – Traditions and Contemporaneity*, 1, 61-72.
- Cohen, V., & Laor, L. (1997). Struggling with pluralism in music education: The Israeli experience. *Arts Education Policy Review*, 98(3), 10–15.
- Creswell, J., & Plano Clark, V. (2007). Designing and conducting mixed methods research. *Central European Journal of Public Policy*, 3, 92-95. <https://doi.org/10.1111/j.1753-6405.2007.00096>
- Dewey, J. (1919). Imagination and expression. *Teachers College Bulletin*, 10(10), 7–15.
- Dewey, J. (1934). *Art as experience*. New York: Penguin.
- Filippa, M., Monaci, M. G., Young, S., Grandjean, D., Nuti, G., & Nadel, J. (2020). Shall we play the same? Pedagogical perspectives on infants' and children's imitation of musical gestures. *Frontiers in psychology*, 11, 1087.
- Girdzijauskienė, R. & Sakadolskienė E. (Eds.) (2016). *Looking for the unexpected: Creativity and innovation in music education*. Proceedings of the 24th EAS Conference, Vilnius, Lithuania. Retrieved from https://easwebsite.files.wordpress.com/2015/11/conference-proceedings_eas_2016.pdf

- Heilig, J.V., Cole, H., & Aguilar, A. (2010). From Dewey to no child left behind: The evaluation and devolution of public arts education. *Arts Education Policy Review*, 111, 136–145. <https://doi.org/10.1080/10632913.2010.490776>
- Jorgensen, E. R. (2003). Western classical music and general education. *Philosophy of Music Education Review*, 11(2), 130-140. <https://doi.org/10.1353/pme.2003.0012>
- Katona, J. (2016). *What Factors Influence urban school leaders' arts programming decisions?* (Doctoral dissertation). Retrieved from https://academicworks.cuny.edu/cgi/viewcontent.cgi?article=2281&context=gc_etds
- Leman, M., Maes, P.J., Nijs, L., & Van Dyck, E. (2018). What is embodied music cognition? In: Bader, R. (Ed.) *Springer Handbook of Systematic Musicology* (pp. 747-760). Berlin, Heidelberg: Springer. https://doi.org/10.1007/978-3-662-55004-5_34
- Rusinek, G. (2008). Disaffected learners and school music culture: an opportunity for inclusion. *Research Studies in Music Education*, 30(1), 9-23. <https://doi.org/10.1177/1321103X08089887>
- Sabar Ben-Yehoshua, N. (1990). *Hamehkar Haichutany Behoraa Uvelemida* [Qualitative Research in Teaching and Learning]. Ben-Shemen: Modan Publication.
- Shmuelof, S. (2012). *The influence of "Touch the Music" program on music teachers in Jerusalem and the Northern District*. (Unpublished Master's thesis). The Jerusalem Academy for Music and Dance, Jerusalem, Israel.
- Simones, L. (2019). Understanding the meaningfulness of vocal and instrumental music teachers' hand gestures through the teacher behavior and gesture framework. *Frontiers in Education*, 4, 1-13. <https://doi.org/10.3389/educ.2019.00141>
- Shvadron, Y. (2019). *Skirat TochniofT Limudim Bemusica Berachave Haolam* [Curriculum overview in music around the world]. Yozma - Center for Knowledge and Research in Education.
- Story Time Production (2020, March, 3). *Professor Veronika Cohen- Musical Mirrors- Life Time Achievement Award-Ministry of Education Israel* [Video file]. YouTube. <https://youtu.be/JXaB8rAFLq4>
- Taba, H. (1962). *Curriculum development: theory and practice*. New York, NY: Harcourt, Brace & World.
- Touma, H. (1974). *Music education in Arabian society: Its implementation, efficacy, handicaps and dangers*. In F. Calloway (Ed.), *Challenges in Music Education: Proceedings of the XI International Conference of the International Society for Music Education Held in Perth, Western Australia, 5 to 12 August, 1974* (p. 370). The Department of Music, The University of Western Australia.
- Vygotsky, L. S. (1978). *Mind in society: the development of higher psychological processes*. Cambridge: Harvard University.
- Wasiak, E. B. (2005). Iitaohkanao'pi – The meeting place project: an alternative approach to young people's concerts. *International Journal of Music Education*, 23(1), 73-88.
- Wiggins, J. (2001). *Teaching for musical understanding*, 1st ed. Boston: McGraw-Hill.

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Teaching towards joy and involvement with western and Arab classical music

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Chapter # 36

DEEPER CONCEPTUALIZATION AND ANCHORING OF KNOWLEDGE IN SECOND LANGUAGE LEARNING

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ABSTRACT

There are increasing concerns around the teaching and learning of French, Canada's second official language, due to a lack of proficiency in the language by future teachers in the English-speaking provinces. The main question is around how to improve this situation and find specific answers for some of the major problems, especially to increase deep learning. To investigate this, instructor teaching notes were analyzed to uncover what was deemed most efficient, as for example noting how the instructor drew attention to knowledge to be mastered and how metacognitive strategies were implemented. Various categories were looked at including ways involving the affective domain, through emotions and using innovative ways to see if they provided a further impact for the crystallization of thoughts and anchoring of knowledge. Overall results show that students reported that they appreciated the corrective feedback the way it was dispensed. A variety of issues were also uncovered.

Due to page limitations, in this chapter we present overarching aspects.

Keywords: conceptualization, anchoring knowledge, self-awareness, emotions, and creativity.

1. INTRODUCTION

Canada has a bilingual status, yet there is a decrease in speakers of French. Lepage and Lavoie (2022) report the impact this had on Universities' French Departments, with 69 university programs and 110 faculty positions eliminated in 2021. In addition, a major problem identified in Canadian French language programs in English language (L1) speaking provinces was the fact that many students have inadequate levels of French. Some of the difficulties stem from the controversy over error correction, a topic that has been widely investigated during the 80s and 90s but paid little attention more recently due especially to an emphasis on communication over accuracy. In addition, one needs to consider the differences in correction protocols for oral and written language. Psychological findings point to the need to access awareness to operate change and for some repeated applications for consolidation. Moreover, the Ontario Ministry of Education advocates, in addition to an emphasis on interaction, to resort to mediation which implies the use of translation and the mother tongue to help understanding, problem solving and improved conceptualization.

The most recent tendency has been to fall back on multi-linguaging in order to bring about paying more attention to language use and correction. Using the mother tongue to clarify aspects in L2 can help improve consciousness raising around problems. The danger with this strategy is talking about the language rather than using the language to be learned. However, more recent research (Piccardo, 2010) and recommendations in the Common European Framework for Reference for languages (CEFR) (Council of Europe, 2018) advocate for resorting to any language at one's disposal to ameliorate problem solving and

better learning while also aiming at developing the second language through its use in interactions.

Another problem has to do with the fact that explicit error correction is very controversial and has been found to be ineffective or even constitute an obstacle (Krashen 1982; Prabhu 1987). Schmidt (1992) advocates for getting the students to ask their own questions. However, they must be aware of their errors before they can try to do something about them.

Similar processes are applicable in regular classrooms. How people learn is a core concern (Caine, & Caine, 1997). Simultaneous activity occurs very differently and at various levels.

Within the currently widely used action-oriented approach to teach French, the emphasis is on the use of language for task completion. Instructions for task completion must be clear and require proficient use of the language on the part of the teacher. When in addition there is a disconnect (Rogalski, 2003) between the task assigned and the completed task, which is often the case, situations become more complicated as the students redefine tasks in their own words which impacts the actual completed task and, in this way determines student's activity. It is about mental representation. In the process, intentions come into play and no matter what the actual student activity turns out to be, learning will take place when this student activity is compared to the instructor's given model according to Rogalski. So, a model should be given in addition to instructions, then students judge the distance between the two, i.e., their work and the given model, and can fill in the learning gap with instructor's help. A further displacement of interest is based on the instructor envisioning the student's potential activity and the preparations the instructor carries out to compensate for difficulties. Whatever gaps are anticipated, as needing to be filled, would be indicative of remedial work that should be prepared, which allows to expand upon didactic possibilities (Perrin-Glorian, & Robert, 2005). Different steps need to be taken for language awareness and the implementation of corrective measures.

Effort is necessary to improve students' outcomes. Myers (2004) suggests considering socio-pragmatic and pragma-linguistic aspects in intercultural trans-linguistic language use. The idea to improve communication through a socio-semiotic approach (Halliday, 1985), also has a lot of merit, however, the challenge is to make working groups in classrooms, into well-functioning interactional communities using adequate French.

For successful exchanges, a variety of factors based on the respect and awareness of persons' developmental needs, including linguistic, academic, cognitive, emotional, social, and physical, require consideration in the negotiation of persons' socio-cultural identities (Duff, & Uchida, 1997). This is in-line with the new equity, diversity, inclusion, indigenization, and decolonization (EDIID) policy put in place at the university. Considering these factors and making provision for a natural learning environment bears fruit according to these researchers. Presenting students with real world problem solving, having them work together, making available media-rich communication and workplace learning using videos, computer applications, and thematic problem-solving challenges was totally feasible within the flipped pedagogy approach used in these courses. Not only for class discussion but also the completion of assignments, students were also given time to work in groups. More recent statements from the Ontario College of Teachers, the accreditation body in the province, point to a lack of resilience in new teachers leading to burnout. Moreover, studies identified new teachers lacking self-regulation strategies related to how stressors are handled. Teachers are often found to be insufficiently resourceful in ways to manage and regulate their energy states, their emotions, thoughts, and behaviors in acceptable ways with positive results to be well, have loving relationships and effectively learn. That means they lack self-awareness,

emotional intelligence, an efficient way to filter sensory stimulation, relate to others and sustain focus to cope well with stress. Also, the awareness of their lack of quality of language is an additional stressor.

2. BACKGROUND

The instructor journal notes were based on observations at a site called a Faculty of Education where teacher preparation programs are offered. These future teachers in Canada are required to have two teaching subjects, a major and a minor with fewer courses in that second subject. Participants were students enrolled in French teacher specialization and there were six courses under scrutiny with a total of approximately 130 students with some drop-outs and irregular attendance.

This study took place in the context of French Second Language teacher training as an ever-increasing number of teachers of French will be needed. Given this situation all the students recruited for training do not have equal knowledge of the language. In the Faculty of Education, it centres round how people learn in new contexts, and how they develop professional skills. Entrance into the program is highly competitive, and students' statements of prior experiences are attributed as much value as academic criteria. The program has two components, with one consecutive stream i.e., students who had just decided to become teachers, and a concurrent stream with students carrying out their regular academic studies along with introductory education courses during all the university years, including class observations and some teaching practice. Both groups are, however, in the fifth or sixth year of academic studies.

Over the years, many strategies were advocated for error correction. The literature reviewed also included an examination of ways to mediate in the French as a second language classroom by using both groupings around students' mother tongue and allowing the use of multiple languages to discuss difficulties and share strategies that worked best (Ontario Ministry of Education, 2007). There are fluctuations in the background knowledge of teachers in their areas of specialization as in Canada secondary school teachers need to be specialized in two subject matters. During a country-wide consultation session of teacher trainers for future teachers of French, Canada's official second language (L2), given the problematic situation of unprepared candidates with questionable proficiency in the language, some instructors even retreated to a position stating that these students need to be encouraged although they are struggling with French. However, given an already problematic situation with language accuracy, what is to be avoided at all costs, is placing role models in classes with inaccurate French, repeating the same situation if not making it even worse as indeed early French immersion is still the chosen protocol by Canadian non-French speaking parents. Young children absorb language like sponges repeating their teacher and if their French is inaccurate, learning the mistakes. This is a concern for school age children. There are graver problems where teacher education is at stake.

It is of more crucial importance not to replicate language program delivery, from which learners emerge without sufficient proficiency to make themselves understood, because of inaccurately learnt language forms from their teachers. Therefore, we must uncover remedies to guide all learners, through strategies and techniques for their individual management of the language they are trying to acquire-learn. We want to ensure an economy of time in teaching programs with efficient contact times. The Ministry of Education advocates adding mediation as a facilitating feature in language classrooms, with the idea of resorting to groupings around a first language to ease tensions and help understanding while also creating a context of belonging and as well to include multi-linguaging to help with problem solving

using other languages students know. Hence, future teachers must be familiar with implementations, and make efforts to improve upon their own language use.

To provide awareness of the need for error correction, a review of various strategies was presented. The study shows that the instructor decided to present all the diverse views on student correction to the class to familiarize them with a variety of possibilities from which they could choose. They looked at corrections through actional attention (Ellis, 1992), work on noticing (Fotos, 1992, 1993, 1994), markedness (Larsen-Freeman, 2018), interference (Abdullah, & Jackson, 1998), interlanguage theory (Selinker, 1972), the monitor model (Krashen, 1982) and recent types of approaches, namely notional functional, communicative, and action-oriented. As well, insights were gleaned from a review of the literature on strategies and techniques, including Raab (1982) on spectator hypothesis with feedback to the whole class; through peer correction by Chenoweth, Day, Chun and Luppescu (1983); with other innovative techniques suggested by Edge (1983); techniques advocated by Vigil and Oller (1976) for oral correction; and correction across modalities (Rixon & Erwin, 1999). The instructor also resorted to multi-linguaging. These more recent approaches are undermining the importance of the correction techniques mentioned above, by advocating a heavy reliance on the first language to support second language development such as language switching (Ramirez, 2012; Woodall, 2002). Jabeen (2023) also recommends looking at the instructional techniques used when the students were first taught the language to redress inadequacies and cultural influences. This new focus could well be integrated during group work and allowed to alleviate difficulties during group discussions.

3. METHOD

We used a qualitative approach as we were interested in finding out a lot of detail about lived experiences (Creswell, & Poth, 2018).

The study consisted of the analysis of an instructor's teaching journals and class notes, and it was decided to investigate over two academic years as the problems seemed to increase over time and additional strategies had to be applied. Observational notes in a professional journal were confronted to relevant theoretical underpinnings to gain insights to improve upon the students' language accuracy and further develop future teachers' awareness on how to give appropriate language feedback to their pupils. A few results will be reported along with steps taken.

The analysis consisted in textual analysis highlighting emergent themes and experiences to uncover how these students' language barriers were overcome, what strategies were used, what prompted what reactions etc. A description of the elements behind the instructor's decisions included the fact that several complex aspects were involved especially when having to deal with fossilized language forms, anglicized uses of French or French influenced by Spanish due to South American population movements to the North.

To remedy some of these aspects we examined how concept attainment was used. Concept attainment exercises are based on identifying a concept through binary eliminations using identifiers. These were written on small pieces of paper and handed to students to be placed on a 'yes versus no' chart, making hypotheses as to whether the qualifier applies. Throughout, students discuss possibilities and end up discovering the concept. This activity was centered around language forms and lexical items.

Dicto-gloss activities were also investigated. These consist of note taking with the objective of reconstituting a text. Students were to draw three columns to allow note taking after listening to an oral text three times. After each listening phase, they worked on one

column, they shared and completed their notes with a peer with the idea that for the completion of the last column there would be more discussion as the text had to be recreated.

In addition, notes on a gaming approach were also considered. As an example of gaming activities, for one activity type they could not use certain words, or there was a time limitation, or instead of a written answer they had to produce a graph, using a summarizing strategy. There were also 20 question group competitions based on explanations of language use and definitions.

We also noted where the instructor decided that to prevent anxiety and the blockage of the affective filter (Krashen, 1982) a subtle combination of strategies was deemed to be more effective considering the accumulation of complex issues to be faced.

Anonymity was maintained and pseudonyms used when names are mentioned in the analysis.

4. FINDINGS

The data analysis yielded interesting aspects pointing to the effort made by students to better understand concepts which leads to deeper conceptualization and anchoring of knowledge.

Several findings help uncover different perspectives around several issues. In terms of improved learning there are the questions of learner readiness and progression, storage into memory, the most effective use of prior knowledge and concerns around interlanguage development. As regards instructional design in support of the targeted objectives we uncovered the roles of sequencing, format and presentation, balancing skills, and additional practical aspects.

The idea was to uncover remedies to properly guide all learners in the courses, through strategies and techniques for their individual management of the language they were trying to improve upon and learning ways to implement these strategies in their own future classroom. Given the collapse of the teacher preparation program at this university into 16 months rather than the two full years mandated by the Ministry, there had been the need to ensure an economy of time in teaching programs with more efficient acquisition of knowledge during contact times.

Results indicate that even with a model given, some students have trouble in figuring out tasks, and this, beyond difficulties they might have had with language comprehension. This has also been identified in the teacher qualification program. The underlying reasons for these difficulties in teacher education programs include switching from academic to professional training. Resorting to using the steps with increased interaction and mediation has shown to bring about an added advantage. Nevertheless, even students experiencing major difficulties managed to complete the program successfully with on-going support from the instructor.

By the end of the courses, students were thankful for all they had acquired and appreciated the various reflections and designed activities embedded with correction techniques. The success of the strategies could be measured by the superior quality of the students' assignments. Moreover, the positive social climate created in the class through a more relaxed use of different languages when the time was appropriate for this, added to students' confidence and helped with self-regulation (Bandura, 1977).

The analysis of instructor's notes allowed to tease out the following major themes: the need for various strategies, the need to alleviate strong emotional upsets (anger, blame, fatigue), how to ease anxiety and the impacts of preparedness and confidence.

We identified how through group interactions, transactions took place, allowing transitioning across various questions and assignments as students came to understanding involving their different social systems through group work. These students did not start on 'common ground' (Olson, 2003); however, it appears that through articulating diverse factors, they were in a sense finding common ground across the materials prepared for class, from sometimes a closed mind-set to a productive discussion. In this context of inclusive teaching, multifarious skills, and ways of being came into play and this constituted a great richness. Some unusual innovative ideas were brought forth, adding crucial information for education. These sometimes emerged from more relaxed conversations.

4.1. Articulating a wide variety of strategies

In line with the notion of progression, researchers point to learner readiness. However, no one seems to know, besides the consecrated way of students learning the letters ABC in the known order according to Pienemann's study (1988), how students' learning progresses. The impact this has on the future teachers is important. It points to a greater need to be thoroughly informed about the functioning of language as their pupils might require explanations on various usages at any given time and the teachers should be able to provide the requested help. This is especially important in the action-oriented approach and requires more knowledgeable teachers.

The idea of progression is no longer palatable for language development. Learners learn differently so one needs to monitor individual developments. Indeed, after a concept attainment activity aiming at reinforcing the students' knowledge on past participle agreements in French, a concept they should all have mastered, the instructor identified that a significant number of students still did not make the agreement during oral use of language, therefore their awareness should be raised on identifying the need to reflect their grammar knowledge in oral production. The instructor saw that with concept attainment activities. It would appear therefore that task orientation if based on direct learner needs and interests might be more effective, so grouping students according to the type of error that needs to be corrected would be more useful. So, several concept attainment activities were devised with each catering to a specific group.

Following the presentation of concepts, the idea was to find correction possibilities across many practical activities. Through their interactions, students were made more aware of language use, and interacted to give corrective feedback or asked questions. These activities involved group work.

To further develop grammatical awareness, they also carried out dicto-gloss activities as described above. Students really engaged in these and as a result metacognitive strategies were developed.

Disruption in class routine also allowed for better concentration. For instance, gaming aspects were added to regular activities wherever possible. Activity centers were devised to increase the pace of activity completion with a rotation every seven to 10 minutes. This entailed a fair number of negotiations around language forms. It was clear that many of these future teachers were close to bilingual language use, some of them were even French native speakers, however a fair number of them were still at an interlanguage stage. The instructor saw the need to provide corrective explanations and used a variety of approaches.

Researchers such as Givon (1990) and Larsen-Freeman (2018) believe that it is necessary to teach the marked forms and that the others will be acquired subconsciously. Marked forms are the ones that stand out as being different with the addition of a special meaning, so there is an additional requirement where these are concerned. Other standard

forms do not require such special attention and are learned easier, like for instance 'walk' in the present tense is different from 'walked' where 'ed' is a mark for past tense.

Due to the involvement of affective factors, for errors in oral language use, the instructor used individual index cards, to write the notes needed to which an explanation was added at the end of the class before being handed out. This way, students were required to reflect upon the error made and use metacognition to find answers or ask for instructor's help.

Another non-threatening approach used was "spectator hypothesis" (Raab, 1982). The instructor provided corrective feedback to the whole class, not making an example of the student who made the mistake. This was also followed with a specific reinforcement activity for errors commonly made by several students in the class. The most effective aspect which was observed was when after the activity, the instructor allowed students to discuss some additional difficulties they might have had with the work required in the activity in their mother tongue, either English or another language that was shared in a group. This created a relaxed atmosphere with peers helping one another.

Edge (1983) supports the peer correction process. Chenoweth, Chun and Lupescu (1983) advocated for corrections among peers without instructor's interference, except when output is sought. To facilitate that possibility in class, the instructor used the dicto-gloss activities as described above. It is a note taking activity that consists of the instructor reading a given text three times and students write notes in three columns, each time adding more to reconstitute the text and after each reading students in pairs consult to see what each one understood. The instructor chose a text with common difficulty students experienced to make them notice language use and discuss the difficulties especially when having to reconstitute the text as they had to make sense of it. Creating the final product was very instrumental in getting students to notice the difficulties and interest them in the new or correct forms they were supposed to learn. They also liked the activity.

Creativity and originality were encouraged, like for instance having students draw their emblem on language learning situations, or having them draw their week-end activities, exchanging drawings with a partner who was to glean the information from the drawing and by asking questions.

Contact with L2 products was initiated, for instance through treasure hunts in real museums virtually. In this case, students could choose activities suited to their level of proficiency.

All the examples above showed students engaging with some of the techniques presented, they were consciously active, and questions were dealt with at the metacognitive level.

In addition to group work, the instructor also resorted to whole class feedback based on spectator hypothesis. This was achieved through presentations in front of the whole class, and 'four corner activities. In the latter case, a controversial topic, or an item from the daily news, became the object of discussion and students had to place themselves in the correspondingly labelled corner, according to whether they totally agreed or disagreed. Then in turn, each person had to justify their choice, and all this resulted in a final discussion. This required several language manipulations and increased students paying attention to the language forms used.

Through all the diverse practices, students remained aware of their own and their peers' language uses, engaged in self- and peer-correction and asked relevant questions to get help.

4.2. Expression of anger, blame and overall fatigue

As mentioned earlier, students' backgrounds were diverse in terms of academic training and exposure to practical teaching aspects. The students entering the professional program

after their academic training was completed are the consecutive students, the ones who complete their academic program while also getting initiated to education through a variety of courses over the years are the concurrent students. A small number of consecutive students expressed anger when being confronted to their insufficient knowledge of the French language for classroom use after having spent years studying it, and lack of familiarity with pedagogical terms. This came about during classroom oral activities, especially with the realization that they were lacking many vocabulary items and were stuck more with formulaic expressions than with a communicative ability.

Five of them blamed their schoolteachers for not having pointed out the mistakes they were making and letting them get away with speaking what is termed as 'franglais' in Canada, i.e., French based on English.

In research findings it was identified that this is the main cause of teacher drop-out due to a lack of self-regulation (Bandura, 1982). The activities devised, with encouragement from the instructor, peer support and continuous practice over the five weeks prior to their actual teaching placement in schools appeared to alleviate this anger and feelings of incompetency. The main point was to show them how quickly they could adapt and complete assignments with their peers as all early assignments were based on groupwork, especially during the second year. After having identified the problems over the previous years and their aggravation over time that had been deemed to be a good decision on the part of the instructor.

Three others were upset because they felt that in the university courses, they took there was insufficient practice in the oral language. Therefore, obviously no corrective feedback was available to these students on their oral interactions. This could also be based on contradictory discourses on the effectiveness and efficiency of the diverse types of corrections. Various researchers recommend not interrupting the flow of speech during oral practice, specially recommending not worry about mistakes, but only be concerned with follow-up on errors that are more serious. On the other hand, other research findings point to the need to nip errors in the bud before they become fossilized and recommend immediate intervention. Specific ways of intervening are also subject to controversies when, according to specialists, the only overall acceptable strategy is involving metacognition if one expects results.

Hence, confronting the speakers with a question to have them reflect on what they said, at a metacognitive level, requires them to reflect on language use and attempt to sort out what they are trying to say and adjust it to a form that they can acknowledge as being accurate. Or else the instructor can keep on prompting until an accurate way of expressing a thought is found, even if only in the form of a paraphrase.

Overall, carrying out this correction implies difficult choices, is time consuming and delicate and perhaps if some instructors choose not to do this, they also do not have the required specialized background as an applied linguist in a teacher preparation program would have to have.

This information was unsettling as a prerequisite for entrance into the program is an advanced course in oral French and it did not make sense to find in the instructor's notes that there were so many issues with accuracy. This requires further investigation.

Many students in this group were able to overcome some hurdles due to their level of creativity. They used alternative pathways, resorted to more visual data and creative uses of applications for the classroom. This creativity also helped them keep motivated when facing challenges.

4.3. Anxiety and the affective filter

Given the difficulties some students experienced, it was of utmost importance to design activities to reduce anxiety and hence to avoid blockage of the affective filter (Krashen, 1982). Hence devising action-oriented communication around a gaming approach, activities for the development of motivation by choosing topics of interest to students or adding an interesting aspect to topics had to be explored.

Multi-linguaging is a technique used to reduce anxiety by allowing students who share a heritage language to use it to help better understand their work in L2, separately practicing specifically for fluency and accuracy. The most recent trend to bring more attention to language use and more efficient and effective correction is using the mother tongue. So, in addition to multi-linguaging during group work, it was deemed useful to also have students grouped around their L1 especially when difficulties increased.

The lack of differentiation between correcting for accuracy and developing fluency also causes confusion. Without this separation, there can only be uncertainty as regards students' progress. In addition, without the distinction, when teachers try to conflate the two into just productive or receptive abilities, there are too many aspects that must be left unexplored. Recently in Ontario with the push on communication, accuracy was often left by the wayside, and this could account for some gaps in the present student population in the teacher preparation program.

According to the instructor's notes, despite all the attempts at alignment and fine-tuning when faced with their first school placement assignments, many students became very anxious. Although most of them displayed a certain degree of confidence the students from the consecutive program all indicated that they felt apprehensive. A few of them got their placement in French changed to the second term, hoping to develop more confidence over time and to get better acclimated. Nevertheless, two students dropped out of the program at that time, one in each year. Mark, although feeling uncertain, had an acceptable level of communicative competence and an excellent accent in French, having a French grandmother, however he felt unable to face students in the classroom. He was given an opportunity to reenter the program in the following year. Paul's fluency in French was not adequate and he withdrew totally from the program despite the instructor's help with plans in getting him to use readymade materials during his teaching practice placement in a school, thus minimizing his direct involvement in directionality, for him to only provide facilitation in front of his classes.

As most of these students were new to the pre-service program when directed to find their own resources, in addition to instructor provided materials, to enrich their learning and make contents more accessible to their own learning styles and preferences, a few discrepancies were noticed. Autonomous search for their own resources also implied self-regulation. They were to identify the gaps between instructor recommended materials and finding their own 'digestible' resources around the class topic for discussion. One student was especially instrumental at doing this and could identify what was needed for their own learning style. In this case, the instructor placed the links to the resources online for all students to access for improved learning. Most students had accessed the English versions of the French materials they were required to read ahead of class. This demonstrated their effort to understand the materials and clearly the positive impact of multi-linguaging. They shared these accesses to information in their own group platform. This cooperation also helped manage anxiety.

4.4. Preparedness and confidence

Of 130 students, the majority were confident and took everything in stride. They had a good knowledge of French, and there were French native speakers included, plus based on the criteria in the program selection process, these students also had excellent teaching capabilities. Nevertheless, a stark contrast could be identified between the French first language (L1) speakers and the overconfident French Immersion (FI) students with less than adequate proficiency.

As another example, one student from a private university, accepted for high grades, displayed a total lack of preparedness in terms of language background, as they were unable to express themselves in French without seeming to take time to translate from English. Peer support allowed the student to manage during the initial five weeks. Following that, the development of a satisfactory level of confidence showed that the student had acquired self-regulation and appeared to be resilient.

Two students had graduated from an on-line university with all their French courses on-line and no opportunity to really interact orally. Although their communicative ability was hesitant initially, not necessarily fraught with mistakes, it appeared that their maturity and a solid basis that they eventually managed to reactivate, placed them in good stead. These two students developed a proper way of channeling their abilities and had the willingness to explore all avenues, which in turn enabled deeper learning and crystallization of knowledge.

5. DISCUSSION AND CONCLUSION

According to the instructor's journals, toward the end of the year, many of the strategies had become second nature and students ensured they had properly grasped the concepts and that they had acquired the knowledge necessary for classroom teaching and felt confident using the different approaches, besides self-correction, and peer correction. Some students also appeared to have sought help with corrections from specialized resource personnel like the University Writing Centre staff with help available for the review of assignments. Overall, this developing awareness and the commitment to produce professional quality of language will place these students in good stead in their career if they continue with the habits that were practiced in consciousness raising for quality language use during class.

Better yet, it is hoped, as the strategies were found useful and interesting, that in turn these will also be implemented in their own classrooms as they monitor their own students' progress in using the French language.

Where major problems were identified we have to remember that language plays an essential role in the distortion of meaning (deGramont, 1992), hence the problems might be aggravated due to the use of L2, however the problems could be clarified through the use of L1 in mother tongue groupings where applicable, and also eased through time given for multi-languaging. Also, more complex issues come into play, and it would be useful to investigate them in future research, namely the importance of the more specific contexts that shaped these students' experiences (Baars, 1997).

Regardless of the variety of language used, the instructor's constant help allowed the students to succeed. This help was provided throughout, not just on the handed in products, the idea was to help them improve. Students learned to constantly monitor their language use, and negotiate meanings, often with their peers' help.

At many levels, it is considered that if the students fail, there is something wrong with the course or the teacher. Exceptionally, it is due to the student's lack of work or other circumstances.

Given the importance of interlanguage theory, it makes sense that some students who have not reached a level of bilingualism yet still make many errors. It also explains their need for code switching and code mixing. Moreover, research on written language has now also identified a need for language switching when working on written production in a second language (Ramirez, 2012; Woodall, 2002) moving between dialects or registers. This is further elaborated upon by Jabeen (2023) calling for more interaction between first language habits and first language culture in second language learning, especially when writing is concerned. In addition, investigating how the students were taught the second language brings added insights on how to provide corrective feedback and compensate for erroneous previous teachings (Jabeen, 2023).

For course development the instructor had to keep in mind to work on professional skill and knowledge development as courses unfolded for the targeted audience and develop awareness of the ways of gatekeepers in textbook publishing companies. These future teachers have a responsibility to maintain a sense of control over the learning environments they create and ensure that these remain powerful, otherwise only meanings attached to practical experiences, especially in the context of teacher qualification courses, will constitute the backbone of what these students as teachers in training think and believe. In fact, courses should have a strong impact on students' cognition and actions in order to prepare them for the unforeseeable future. In this case, the objective is increased bilingualism for all.

While interacting, people influence each other with an effect on future actions and on-going interactions. In group work, the instructor needed to develop skills, expertise and commitment for students to succeed. They had to be able to recognize the patterns in their field of practice (Barton, & Tusting, 2005). Top-down instruction was not used a lot, students were given plenty of materials to peruse and students had to engage in reflexivity from the bottom-up relative to aspects to be mastered. Hence in addition to discussions, the students also needed to complete practical assignments thus demonstrating what they had acquired. This involved several processes.

According to Luhmann (1995, p.136), to grasp a lot of complexity, a system selects, and the process requires a reduction of complexity. Keeping these notions in mind, the instructor had understood that it was important to design learning units to get and hold students' interest and encourage them to take advantage of the richness of their backgrounds to help them bridge new knowledge for the duration of the course (Renninger, & Hidi 2016). In the process of sorting through all the complexity however, students had to make appropriate selections and use language accurately and this added difficulties for the instructor because of a considerable number of inconsistencies in their productions.

This points to shifts in language use and past practice, especially since students did not practice speaking the language in communicative situations in their previous university courses. Indeed, researchers suggest that bilingual language production and recognition rely on different processes and report that this is influenced by whether the language switch is active like for production or passive as for recognition. Language switching (Ramirez, 2012; Woodall, 2002) causes competition when similar and dissimilar words are activated and compete, and we can assume the same for language forms. L1 interferes more when switching into the L2 than the other way round. Production requires top-down attention which requires effort whereas recognition relies on bottom-up attention which is more automatic. Shiffrin and Schneider (1977) however point to the fact that top-down attention is more flexible than bottom-up attention. Perhaps because of fewer constraints the students are more apt to make mistakes. Overall, it requires a lot of effort to do well.

In addition to these aspects, we are also faced by a trend among multicultural people in Canada, having to juggle several languages and cultures. Local forms of French, whether these are stemming from Quebec, northern Ontario and other Canadian provinces with French minorities or other forms of French from African countries, or past French colonies from South America or other regions, are colouring the French usage of these diverse persons bringing French to the classroom.

Given all these impacts, the main question remains as regards to the shifts in French the parents of these future teachers' pupils are willing to accept.

In this chapter we investigated the impact of different instructor's decisions tied to second language learning for future teachers of French. We looked at various aspects to uncover which ones yielded better support in language development. Results show overall success as all students passed the courses. Findings were reported on strategies used, support in dealing with emotional aspects, anger, blame, fatigue, anxiety and the affective filter, and personal attributes namely preparedness and confidence.

Recommendations for further research include exploring the roles played by the L1 influences in order to mitigate them in the context of multi-languaging and how to increase the future teachers' self-regulation.

REFERENCES

- Abdullah, K. & Jackson, H. (1998). Idioms and the language learner: contrasting English and Syrian Arabic. *Languages in Contrast* 1(1), 83-108. <https://doi.org/10.1075/lic1.1.06abd>
- Baars, B. (1997). *In the theater of consciousness: the workspace of the mind*. Oxford: Oxford University Press.
- Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review* 84(2), 191-215.
- Bandura, A. (1982). Self-efficacy mechanism in human agency, *American Psychologist*, 37(2), 122-147. <https://doi.org/10.1037/0003-066X.37.2.122>
- Barton, D., & Tusting, K. (2005). Introduction. In Barton, D., & Tusting, K. (Eds.), *Beyond communities of practice*, 1-13, Cambridge University Press. <https://doi.org/10.1017/CB09780511610554>
- Caine, G., & Caine, R.N. (1997). *Education on the edge of possibility*. Alexandria, VA: ASCD.
- Chenoweth, A., Day, R., Chun, A., & Luppescu, S. (1983). Attitudes and preferences of ESL students to error correction. *Studies in Second Language Acquisition* 6(1), 79-87. <https://doi.org/10.1017/SO272263100000310>
- Council of Europe (2018). Common European Framework of Reference for Languages (CEFR): learning, teaching, assessment. Companion volume with new descriptors. Strasbourg: Council of Europe.
- Creswell, J., & Poth, C. (2018). *Qualitative inquiry and research design. Choosing among five approaches* (Fourth edition). Thousand Oaks, Cal.: SAGE.
- deGramont, P. (1992). *Language and the distortion of meaning*. New York: New York University Press.
- Duff, P.A., & Uchida, Y. (1997). The negotiation of teachers' sociocultural identities and practices in postsecondary EFL classrooms. *TESOL Quarterly* 31(3), 451-486 <https://doi.org/10.2307/3587834>
- Edge, J. (1983). Reading to take notes and to summarize: a classroom procedure. Retrieved from: https://scholarspace.manoa.hawaii.edu/bitstream/10125/66969/1/1_2_10125_66969-rf112edge.pdf
- Ellis, R. (1992). Learning to communicate in the classroom: study of two language learners. *Studies in second language acquisition* 14, 1-23. <https://doi.org/10.12691/education-4-4-9>

- Fotos, S.S. (1992). *Grammar consciousness raising tasks: negotiating interaction while focusing on form*. (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI 9227461).
- Fotos, S.S. (1993). Consciousness-raising and noticing through focus on form: grammar tasks versus formal instruction. *Applied Linguistics* 14(4), 385-407. <https://doi.org/10.1093/applin/14.4.3.385>
- Fotos, S.S. (1994). Integrating grammar instruction and communicative language use through grammar consciousness-raising tasks. *TESOL Quarterly* 28(2), 323-351. <https://doi.org/10.2307/3587436>
- Givón, T. (1990). *Syntax; a functional-typological introduction*, vol.2. Amsterdam: John Benjamins.
- Halliday, M.A.K (1985). *An introduction to functional grammar*. London: Edward Arnold.
- Jabeen, R. (2023). *The culture behind writing: an inquiry into the challenges and cultural influences on second language writing in the Canadian academic context*. Unpublished doctoral dissertation, Queen's University, Kingston, Ontario, Canada.
- Krashen, S. (1982). *Principles and practice in second language acquisition*. Oxford: Pergamon Press Inc. <https://doi.org/10.4236/ce.2012.326151>
- Larsen-Freeman, D. (2018). Second language acquisition W.E., and language as a complex adaptive system (CAS). *World Englishes* 37(1), 80-92. <https://doi.org/10.1111/weng.12304>
- Lepage, E, & Lavoie, C. (2022). French-Language research and post-secondary education: pillars of Canadian bilingualism. *Bulletin, Canadian Association of University Teachers* 69(7), 22-23
- Luhmann, N. (1995). *Social systems*. Stanford University Press.
- Myers, M.J. (2004). *Modalités d'apprentissage d'une langue seconde* [Modalities of second language learning]. Duculot.
- Olson, D. R. (2003). *Psychological theory and educational reform: how schools remake mind and society*. Cambridge: Cambridge University Press. <https://doi.org/10.1075/pc.12.2.14tur>
- Ontario Ministry of Education (2007). *English Language Learner. ESL and ELD programs and services*. Toronto, Canada: The Queen's Printer.
- Perrin-Glorian, M.J., & Robert, A. (2005). Analyse didactique de séances de mathématiques au collège [Analysis of didactic sequences of mathematics in college]. *Les dossiers des sciences de l'éducation* 14, 95-110.
- Piccardo, E. (2010). From communicative to action-oriented: new perspectives for a new millennium. *CONTACT TESL Ontario* 36(2), 20-25.
- Pienemann, M. (1988). *Language processing and second language development: processability theory*. John Benjamins. <https://doi.org/10.1075/sibil.15>
- Prabhu, N.S. (1987). *Second language pedagogy*. Oxford: Oxford University Press.
- Raab, L.M. (1982). Conflict centered on the cultural concepts that were not anticipated. *North American Archeologist* 2(4), 331-343.
- Ramirez, P.J.M. (2012). *Language switching: a qualitative clinical study of four second language learners' composing process*. (Doctoral dissertation). Available from ProQuest Dissertations and Theses database (UMI3516666).
- Renninger, K., & Hidi, S. (2016). *The power of interest for motivation and engagement*. Routledge. <https://doi.org/10.4324/9781315771045>
- Rixon, R., & Erwin, P.G. (1999). Measures of effectiveness in a short-term interpersonal problem-solving program. *Counselling Psychology quarterly* 7, 305-310. <https://doi.org/10.1080/09515079908254080>
- Rogalsky, M. (2003). Maintaining radio silence: listening to the gaps between the words. *Digital Creativity* 14(2), 115-118. <https://doi.org/10.1076/digc.14.2.115.27861>
- Schmidt, F.L. (1992). What do data really mean? Research findings, meta-analysis, and cumulative knowledge in psychology. *American Psychologist* 47(10), 1173-1181. <https://doi.org/10.1037/0003-066X47.10.1173>
- Selinker, L. (1972). Interlanguage. *IRAL* 10, 1-4, 209-232. <http://dx.doi.org/10.1515/iral.1972.10.1-4.209>
- Shiffrin, R., & Schneider, W. (1977). Controlled and automatic human information processing: II. Perceptual learning, automatic attending and a general theory. *Psychological Review* 84(2), 127-190. <https://doi.org/10.1037/0033-295X.84.1.1>

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- Vigil, N., & Oller, J. (1976). Rule fossilization: a tentative model. *Language Learning* 26, 281-296. <https://doi.org/10.1111/j.1467-1770.1976.tb00278.x>
- Woodall, B.R. (2002). Language switching: using the first language while writing in a second language. *Journal of Second Language Writing* 11, 7-28. [https://doi.org/10.1016/S1060-3743\(01\)00051-0](https://doi.org/10.1016/S1060-3743(01)00051-0)

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Chapter # 37

"MY DANCE AREA - YOUR DANCE AREA": Metaphors of Nursing Trainee Identity in the Context of Virtual Communities of Practice

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ABSTRACT

Virtual Communities of Practice (vCOP) in the context of nursing education evolve their significance in the case of professional identity development. "What does it mean to be a nursing student?" is a central question in the nursing education context, in which the foundation for a professional identity is laid. Since communication in virtual communities of practice is predominantly text-based, there are often rich descriptions of one's own view as well as reflections on what has been experienced. Studies indicate, that linguistic peculiarities are evident in the expression of nurses in the form of frequent metaphorizations. Against this background, this research addresses the question of what metaphors nursing trainees use in the context of virtual communities of practice to describe their perceptions of being a nursing trainee. The goal of the study is to describe the core characteristics of nursing scholar identity and derive curricular consequences. Within the framework of a netnographic research design, data collection is done through field observations. In the context of data evaluation, Schmitt's metaphor analysis is used. Preliminary results show, that nursing trainees describe their identity in terms of metaphorical expressions, which manifest themselves in *Being a Nursing Trainee* and *Being a Prospective Nurse*.

Keywords: virtual communities of practice, nursing education, professional identity, metaphors in nursing.

1. INTRODUCTION

In the context of nursing education, various learning sites exist, that influence the development of a professional identity. Against the backdrop of increasing digitization, the importance of learning venues that manifest themselves in the digital space and offer a supplement to nursing learning in school, practice, and the skills lab is growing. Virtual communities of practice represent such a learning opportunity, as they enable the exchange of professional knowledge and professional experience already in the context of nursing education (Rolls, Hansen, Jackson, & Elliott, 2019, p. 1382). The establishment of these communities in the healthcare sector has national and international significance, as evidenced by the initiation of various research projects (Bermejo-Caja et al., 2019; Struminger, Arora, Zalud-Cerrato, Lowrance, & Ellerbrock, 2017). Participation in these communities can provide manifold benefits such as working together on professional problems to find alternative solutions as well as interpretative perspectives. Furthermore, researching professionally relevant information, supporting theory-practice transfer through the exchange of evidence-based knowledge, conducting collegial consultations and promoting interprofessional work are important (Bermejo-Caja et al., 2019, p. 403; Rolls et al., 2019, p. 1393; Struminger et al., 2017, p. 633; Terry, Nguyen, Peck, Smith, & Phan, 2019, pp. 372-375). The aforementioned aspects also refer to processes of nursing professional identity development (North, Franz, & Lembke, 2004, p. 9; Terry et al., 2019, p. 372).

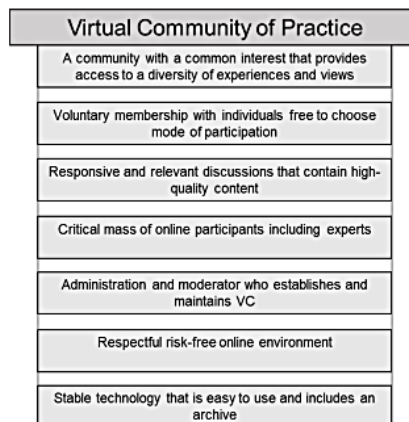
Since communication in virtual communities of practice is predominantly text-based, there are often rich descriptions of one's own view as well as reflections on what has been experienced. Studies indicate, that linguistic peculiarities are evident in the expression of nurses in the form of frequent metaphorizations (Luft, 2022; Rolfe, 2019; Rolfe, 2018; Watson, 1987; Winslow, 1984; Wurzbach, 1999). In the nursing context, metaphors can help to reflect on nursing practice, gain new perspectives, and identify oneself as a nurse (Sharoff, 2009, p. 312). Currently, it is not clear, how the identity of nursing students unfolds in the context of virtual communities of practice and in what way previously existing identity concepts can be extended against this background.

2. BACKGROUND

2.1. The Virtual Community of Practice as a Professional Learning Place

The term "community of practice" was coined in 1991 by Lave and Wenger in their monograph "Situated learning. Legitimate peripheral participation." Communities of practice are groups of people who have existed over a long period, have an interest in a common topic, and want to build and share knowledge together (North et al., 2004, p. 8). Learning in said communities is understood as a social, participatory process that is closely interwoven with the identity formation of the community members (Lave & Wenger, 2008, p. 4). Communities of Practice in general are self-organized, dynamic systems that can be located both within and outside of organizations and have an informal character (Wenger, 1998, p. 2). According to Wenger (2011, p. 1-2), they are also characterized by the fact that their members share a common area of interest ("domain"), exchange information about it ("community"), and thus build up a common culture of practice ("practice"). The implementation and design of communities of practice are not tied to a certain format, which means, there is no definition of a fixed number of members and contacts within the community do not necessarily have to be face-to-face. According to an assessment by North et al. (2004, p. 91), most communities of practice exist virtually. Meanwhile, virtual communities of practice can be found in a variety of professional sectors, such as health care. There, they are referred to as "common online platform[s] to provide healthcare professionals with the opportunity to access highly specialized knowledge, build a professional support network, and promote the translation of research evidence into practice." (Shaw, Jazayeri, Kiegaldie, & Morris, 2021, p. 1) *Figure 1* summarizes central characteristics of these communities:

Figure 1.
Key characteristics of vCOP (in accordance to Rolls et al., 2019, p. 1385).



The interaction of the community members usually takes place independently of time and space via internet forums or mailing lists, which means communication is primarily text-based (Winkler & Mandl, 2005, p. 4).

As part of a research project, Zinke and Fogolin (2004, p. 1-2) investigate virtual communities as a place of learning in vocational education. They address the question, how informal professional learning can be supported with new media and what role participation in virtual communities plays in this context. The active users of communities state that they are strongly motivated to learn and identify to a high degree with their profession (Zinke & Fogolin, 2004, p. 9-10). Similar findings can also be found in Wenger (1998, p. 1), who describes professional work in this context as follows: "learn the intricacies of your job, explore the meaning of your work [...], and develop a sense of yourself as a worker." This is expressed, among other things, through the discussion of practical problems as well as processes of finding and representing one's own points of view, for example, in the context of professional innovations. In the case of training-oriented communities, the focus is also on questions of efficient exam preparation (Zinke & Fogolin, 2004, p. 6). Participation in such communities loses significance if opportunities for collegial exchange are available and organized within the workplace. At the same time, the acceptance and recommendation of a particular community within the company is conducive to its use (Zinke & Fogolin, 2004, p. 5-6).

2.2. Nursing Professional Identity in Virtual Communities of Practice

To date, few studies can be found in the literature that examine the topic of nursing identity in the context of virtual communities of practice, but rather primarily illuminate identity development in connection with nursing school and nursing practice (Altmeyden, 2022; Bohrer & Walter, 2015; Fischer, 2013).

Sibbald, Burnet, Callery, and Mitchell (2022) analyze a virtual community of practice ("Policy Circle") (Sibbald et al., 2022, p. 4), which connects mid-career professionals from health policy and practice, including nurses, across Canada. Using a mixed methods design, the researchers explore the question of what value the aforementioned community holds from the members' perspective (Sibbald et al., 2022, p. 4). The results of the study show, that in addition to the exchange of knowledge, the members' sense of belonging to the community and the associated development of a support network are perceived as particularly enriching (Sibbald et al., 2022, p. 5-9). Feelings of belonging and being connected point to identity-building potential.

Terry et al. (2019) use a systematic review to demonstrate the informal use of online communities by nursing students, as well as the benefits and drawbacks of participation in such communities. Based on the results of the studies included in the systematic review, it can be concluded that nursing students consider virtual communities of practice as places for the exchange of experiences as well as generators of job-related knowledge, and that especially the mutual support in the community is conducive to building a professional identity (Terry et al., 2019, pp. 372-375).

Rolls et al. (2019) examine knowledge sharing practices in virtual communities using the public forum "ICUConnect", which anyone working in an ICU can join. The researchers formed the key category "Virtual Community Work" (Rolls et al., 2019, p. 1393), which includes the main activities of members. Interaction knowledge was related to the exchange of technical information and best practice examples. In addition, community members discussed the implementation or omission of certain nursing measures and demanded appropriate justifications for them (Rolls et al., 2019, pp. 1393-1395). The professional exchange and finding and defending one's own points of view refer to professionally relevant processes of identity formation. In this context, professional identity development thus takes place as a gradual integration into the respective professional community of practice.

2.3. Metaphorical Expressions of Nursing Professional Identity

Since communication in virtual communities of practice is predominantly text-based, there are often rich descriptions of one's own view as well as reflections on what has been experienced (Ullrich & Schiek, 2014, p. 466). Studies indicate that linguistic peculiarities are evident in the expression of nurses in the form of frequent metaphorizations (Luft, 2022; Rolfe, 2019; Rolfe, 2018; Watson, 1987; Winslow, 1984; Wurzbach, 1999). Based on Lakoff and Johnson's (1980) Cognitive Metaphor Theory, metaphors are understood as transfers of meaning from one domain to another.

In a research study, Yesilbalkan, Cinar, and Karadakovan (2021) examine metaphors to describe, understand, and explore the nursing profession. In their mixed-method study, the researchers involved 85 postgraduate nursing students who answered the statement "A nurse is like ... because ..." (Yesilbalkan et al., 2021, p. 423-424). Because of their analyses, 50 metaphors emerged, which were clustered within 13 categories. The metaphorical phrases expressed by the postgraduate nurses had mostly positive connotations, for example, "mother" or "angel" (Yesilbalkan et al., 2021, p. 426). However, the associations also include expressions such as "computer" or "robot" (Yesilbalkan et al., 2021, p. 426), which tend to be associated with negative emotions in the nursing profession.

While Yesilbalkan et al. (2021) focus on postgraduate nurses, Kokturk Dalcali and Kaya (2020) turn to nursing students and set the goal of describing their perceptions of the nursing profession using a metaphor analysis (Kokturk Dalcali & Kaya, 2020, p. 1621). The data collection included 239 nursing students who were asked to complete the statement, "Nursing is like... because ..." (Kokturk Dalcali & Kaya, 2020, p. 1622). Using a combination of descriptive and content analysis, the researchers formed six main categories: "human," "non-living thing," "hero-abstract one," "illuminating-guide," "living creature," "connects to life" (Kokturk Dalcali & Kaya, 2020, p. 1624). Similar to Yesilbalkan et al.'s (2021) study, most of the students used positive connotative metaphors to describe the nursing profession, such as "mother," "friend," or "heart" (Kokturk Dalcali & Kaya, 2020, p. 1624). Nevertheless, negatively associated metaphors like "robot" or "machine" were also shown (Kokturk Dalcali & Kaya, 2020, p. 1624).

McAllister and McLaughlin's (1996) phenomenological study examines nursing students' metaphors, but from the perspective of what their previous experiences have been with their teachers. The researchers address the following question: "What are the metaphors students use to describe teaching?" (McAllister & McLaughlin, 1996, p. 1110). Data collection was based on interviews and participant observations that were contextually analyzed. As a result, 52 metaphors were extracted, which were then grouped into larger categories, for example, "Teaching as sensing", "Teacher as guide", "Teacher gives direction," or "Teaching the big picture" (McAllister & McLaughlin, 1996, p. 1112).

In the aforementioned research studies, statements can be found that establish a connection between students' identification with the nursing profession and the metaphors used in this process. However, the studies to date primarily refer to nursing students' perceptions of the profession they aspire to or their perceptions of other actors involved in the study, such as teachers, and less to their identity as students in the field of nursing. Virtual communities of practice represent places of written exchange and reflection and thus greatly facilitate the explication and analysis of metaphors used.

3. OBJECTIVES

In the context of nursing education, learners are particularly challenged to initiate the development of a professional identity. Current changes, such as the introduction of a new nursing law in Germany (Bundesministerium der Justiz und für Verbraucherschutz, 2017) with modifications to the job title and the focus of activity, as well as the increasing digitalization of nursing learning, are leading to the establishment of new learning venues. One such place of learning in nursing is the virtual community of practice, which has an influence on the trainees' identity in the nursing profession and should therefore be examined in more detail under this focus. In virtual communities of practice nursing trainees talk about their experiences and explicate their thoughts in written form. As shown in the theoretical background of the research work, metaphors play a special role in the expression of identity. As a result, a link can be assumed between the language used about the training and the actual actions taken during the training (Lakoff & Johnson, 2021, p. 9). Because of that, it is necessary to analyze the contributions of the nursing trainees, which they write in virtual communities of practice with regard to their linguistic characteristics. Therefore, this research explores the question of *what metaphors nursing trainees use in the context of virtual communities of practice to describe their perceptions of being a nursing trainee*. The aim is to find out, how nursing trainees talk about nursing and their training in order to make statements about their professional identity. Through the formation of metaphorical concepts, pre-existing characteristics of nursing professionals' identities characteristics can be expanded. These findings can give those involved in vocational nursing training an insight into the experiences and perceptions of nursing trainees. Curricular consequences can be derived from this, and it is possible to plan learning scenarios with the help of the identified metaphors and to stimulate a reflection with the trainees about their current nursing professional identity.

4. DESIGN AND METHODS

4.1. Research Design

Since the focus of this research is on identity-forming moments that affect the group of nursing students on the one hand and each individual nursing student on the other hand, a research approach that meets these requirements is needed. Therefore, an ethnographic approach is suitable, which enables an explorative and interpretative description of ways and means of human interactions (Hitzler & Eisewicht, 2016, p. 63). With the increasing emergence of virtual worlds, approaches to ethnographic research have also evolved. In 1997, the Canadian cultural anthropologist Kozinets founded a format of ethnographic fieldwork that is particularly suited to the study of online communities. "Netnography" (Kozinets, 2019) enables the analysis of computer-mediated interactions within virtual communities. Netnography is primarily understood as a qualitative research approach, as the discovery of human behaviors and interactions within virtual worlds is at the center of the research's interest.

4.2. Data Collection

In the present study, data are collected in the context of the virtual community "krankenschwester.de." The Community is aimed at nurses from Germany, Austria, and Switzerland and was founded in 2004. Currently, about 50,000 members are registered, and about 400,000 contributions are archived. The community sees itself as an open social medium, i.e., contributions can also be read without prior registration. However, registration

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is mandatory for writing your own entries. The community is organized based on various forum lists, which are clustered thematically. For example, there are forums aimed specifically at (prospective) trainees, as well as forums for the professional exchange of information between examined nurses. Based on the research question, observation was limited to the subforums “Training in Nursing” and “Pediatric Nursing” with a focus on “Training Requirements,” “Training Content”, “All around the final exam (examination)” and “Other.”

The data collection is carried out by observing the community activities, which are particularly evident in the context of forum communication. An unstructured, open approach is recommended initially in the research project, which becomes increasingly focused in the course of the research process. The first observations were unstructured and non-participatory, using the archive function and the rubric “latest posts.” In the further course of the research, thematically structured observation units followed with focal points, that, on the one hand, resulted from previous observations and, on the other hand, came from literature-based findings on professional identity. The duration of the observations varied between two and six hours. The time of day and the days of the week on which the observations took place also varied in order to capture a wide range of community activities. To date, 20 observations have been conducted in this manner. As the research continues, the level of participation by the researcher will change, i.e., participant observations, field interviews, and focused individual interviews with community members are planned.

4.3. Data Evaluation

The current data corpus consists of the “Immersion Journal” (Kozinets, 2019, p. 135) with field notes, observation logs, and memos. During the first observations, it became apparent that nursing students frequently use metaphors to describe their experience as trainees. Based on this, Schmitt's (2017) Systematic Metaphor Analysis was chosen as the data analysis method. Within the framework of a multistage procedure, that also takes into account the researchers' own perspectives, metaphorical expressions are systematically recorded and arranged thematically. The MAXQDA software (VERBI Software - Consult - Sozialforschung GmbH, 2022) is used to organize this process.

4.4. Research Ethics

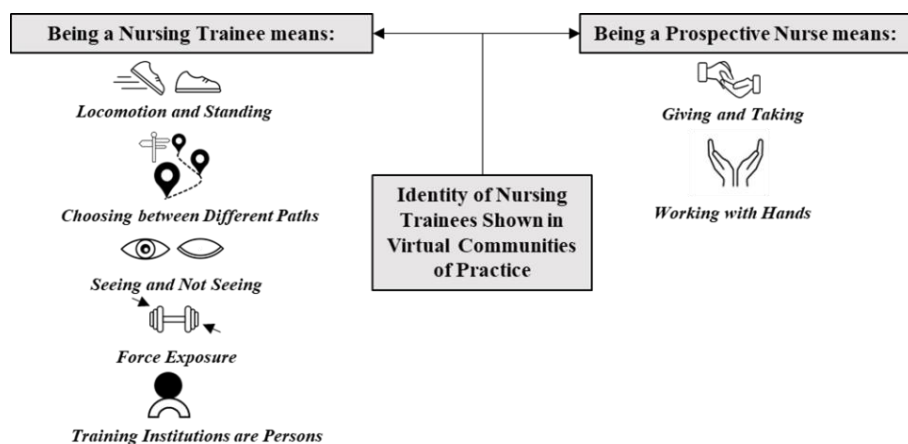
Adherence to ethical principles such as informed consent or unrestricted voluntaries of participation is a particular challenge of internet-based research. Therefore, the research project has been reviewed by the Ethics Committee of the Deutsche Gesellschaft für Pflegewissenschaft e. V. and has received an ethical clearing.

5. FIRST RESULTS

Based on the metaphor analysis, seven metaphorical descriptions have been identified so far, which allow first insights in experiences and events of nursing trainees in relation to their professional identity. During the data analysis, a dual role of nursing trainees emerges, identifying themselves as trainees on the one hand and as future nurses on the other. *Figure 2* summarizes the interim results of this research study:

"My dance area - your dance area" - Metaphors of nursing trainee identity in the context of virtual communities of practice

Figure. 2:
Metaphorical Descriptions of Professional Identity of Nursing Students (own illustration).



5.1. Metaphors Related to the Role of Trainee Nurses

5.1.1. Being a Nursing Trainee means Locomotion and Standing

Nursing trainees describe their experience in terms of various movements, which have different dynamics and range from “walking well” to “walking safely” to “progressing” or to “final sprint.” The expressions of movement come into play above all in narratives about school-based and practical nursing training: Students move from a starting area, often referred to as the “starting point” or “zero point,” which illustrates the beginning of training, to a defined goal, which is shown in formulations of “arriving” or “crossing the finish line.” During this time, safety aspects (“taking a safe route”, “going on the safe side”) play a significant role and refer to the need for orientation and stability. As the duration of the training progresses, the above-mentioned qualities of movement change. Trainees speak, for example of “striding to the goal,” which indicates an upright, self-confident gait. The movement metaphors mentioned above mostly refer to the students themselves and are rarely used in the context of other people. Only the description “trailing behind the examinees” relates the trainees’ own activity to the group of examined nurses. This implies taking a position behind the qualified personnel and being obedient to them.

At the same time, there are also moments in which no movement seems possible, which manifests itself in expressions such as “I can’t get any further” or “there is a boundary for me that I cannot cross.” Moments of waiting and pausing occur for example, when trainees are unable to act independently, for example, when they are unsure of what to do. This leads to a standstill in a certain situation and the continuation of the action is interrupted. This also happens, when learners identify gaps in their knowledge or are uncertain about exam results. Furthermore, this state is significant in the context of reflections, as trainees interrupt or slow down their course of action, which becomes clear in statements such as “I stop mentally.”

5.1.2. Being a Nursing Trainee means Choosing between Different Paths

In reference to the metaphorical concept of locomotion, it becomes clear that the trainees metaphorize their training as a path where they can choose between different directions: “so towards geriatric care” or “I’m going towards pediatrics.” However, uncertainties about the “right way” are also found, which become clear in questions about the “recommended route” or the “right turn.” Teachers have a kind of navigation function

here that becomes apparent, for example, in formulations such as “I’ll ask my teacher for the correct route” or “My instructors know which way to go.” Furthermore, the route is metaphorized in terms of its length, which allows conclusions to be drawn about the current position of the learner: “I’m about to pass my exam” or “I still have a long way to go” are examples of corresponding metaphors. Deviations from the path of education marked out by curricular regulations can also be found within this concept: “I need longer” or “My education must be extended” are metaphors that make this clear. Occasionally, expressions can be found in this context that phrase the training as a connecting path. For example, learners might write: “I have to work my way through” or “I have to get through the training.”

5.1.3. Being a Nursing Trainee means Seeing and Not Seeing

In the descriptions of the nursing students, numerous expressions of visual perception can be found, such as “I have to look at technical language,” “I see a problem,” or “I foresee the error.” These perceptions are predominantly made in school contexts of nursing education, for example, when it comes to the acquisition of technical knowledge. Experienced discrepancies are also visualized metaphorically. These can refer to the trainees themselves but also address their relationship to the nursing team, for example, “I see a conflict there.” Patients also come into focus within this concept, but mainly when it comes to deviations from the norm and less in the context of relationship building, which becomes clear in sentences such as “The blood sugar does not look good.” In the context of practical examinations, a patient reference to this concept can be equally recognized, for example by talking about patients who are “foreseen” for the examination or by asking about their suitability in the context of the examination: “Would you consider such a patient as suitable for my examination?”

At the same time, negations of seeing also occur, which on the one hand demarcate themselves from perfect perception, such as “being blind to the impressions of others.” On the other hand, trainees also take up the probability of seeing errors in their statements, which becomes clear, for example, in formulations such as “That was an oversight” or “I overlooked the mistake.”

5.1.4. Being a Nursing Trainee means Force Exposure

In their reports, trainees state “being under pressure” or “feeling under pressure.” The expression, reminiscent of a container, indicates that forces are acting on the students, due to which they feel constricted and under duress. These expressions are often used in connection with school and practical nursing training, for example, when it is a matter of coping with upcoming performance examinations: “I am under pressure due to learning” or “The teachers are putting pressure on me.” Such states also arise when learners feel they cannot meet expectations. Examples of this are the statements: “I only have pressure because my instructor demands too much,” “My mentor is putting pressure on me because of an upcoming exam.” Phrases such as “putting myself under pressure” or “being put under pressure” make it clear that the force that generates the pressure can come from within, that is, from the student himself, or from outside, like from instructors or registered nursing staff. Patients do not appear in the context of previous descriptions within the current data evaluation status.

5.1.5. Being a Nursing Trainee means Training Institutions are Persons

In the context of the descriptions of the experiences of nursing trainees, it is noticeable that they often personify the institutions involved in the training. Both, the nursing school and the practical institutions are mentioned. For example, the following is said about the newly established training in Germany: “The training is still in its infancy” or “The training

still has to grow." These places the training in the context of a child, which develops over time and matures to a certain extent. At the same time, the childlike visualization suggests an understanding of any difficulties and problems with the new nursing education. The nursing school is also affected by personification, which becomes clear in expressions such as "The grade says"; "The school called"; or "Practice supervision went to the top." While personification in the context of the nursing school mainly concerns performance characteristics, such as grades or interim reports on practice assessments, the personifications of nursing practice often include references to the organizational-institutional level, for example: "The probationary period is running."

5.2. Metaphors Related to the Role of Prospective Nurses

5.2.1. Being a Prospective Nurse means Giving and Taking

Nursing trainees also describe their actions in terms of things they personally give and contribute that are connoted as positive, for example, "Giving them my best." Within this concept, the patients are the central reference points for action. The trainees turn to them and either give something of themselves personally, like "I give them my smile." Something external, which is not connected to their own body, is also expressed in the form of giving: "Then I give her time." However, gifts also occur within the nursing team - for example, patients are "given" to nurses on the next shift or "information is given." Within this concept, the nursing trainees also use phrases such as "I have to admit that" to talk about things that, in their opinion, require a confession. This expression occurs on the one hand with mistakes, concerns and, on the other hand in addition, emotional concern. For example, one trainee writes about a situation she experienced: "I admit that I cried."

On the other hand, the students also take things in the course of their nursing work, which becomes visible through formulations such as "taking time" or in the verbalization of activities. Patients are also "taken" and reified in this way, which is frequently evident in the context of exam preparation: "Taking patients for the exam" is an exemplary expression for this.

5.2.2. Being a Prospective Nurse means Working with Hands

Nursing trainees use terms in their language that refer to working with their hands. The movement of the hands has different qualities and varies according to the amount of force required. For example, there are expressions in the context of social interaction with patients like "I want to hold contact" or "I hold them mentally." Hand metaphors are also used to express the learner's position in the nursing team. For example, learners might write, "They are my hold" or "I prefer to hold back in the team". The hands are also metaphorized in the context of activities that are perceived as unpleasant and require more effort: "I'm pulling this off now" or "I need to shake myself awake" are exemplary formulations in this context.

It is striking that the aforementioned verbalization occurs less in the context of sensing and perceiving but is rather focused on the mechanical movement of the hands.

6. DISCUSSION

The initial results of this research indicate that nursing trainees communicate in the context of virtual communities of practice by using metaphorical expressions, which give a first insight into the identification of nursing trainees.

It should be emphasized that the concepts found in this study are related to existing studies, which mainly focus on metaphorical expressions of already-graduated nurses. In addition to parallels, there are also differences, which should be reflected.

In this context, especially the research work of Luft (2022), McAllister and McLaughlin (1996), as well as Fagin and Diers (1983), should be emphasized.

Contrary to the nursing trainees in this study, the descriptions of nursing activities on the part of registered nurses have different accents. For example, there is a stronger reference to the patients, which becomes clear in the context of metaphorical expressions by registered nurses (Luft, 2022). Nursing students make this connection as well, but their metaphorical expressions are often more strongly rooted in their own person and less related to other people. It can be concluded from this that the shift in perspective from the trainee's own person to other groups of nursing relevant persons occurs only during training and cannot be assumed at the outset. For this purpose, didactic offers must be designed, that gradually stimulate a change of perspectives and points of view.

Furthermore, it becomes clear that trainees, especially at the beginning of the training - need orientation and guidance in order to gain increasing security (McAllister & McLaughlin, 1996, p. 1112). This is also confirmed by the findings within the present study. Teachers should be sensitized to this situation and provide orientation and support, especially at the beginning of the training.

In contrast to registered nurses (Luft, 2022, p. 123-124), it is evident, that the professional identity of trainees is also characterized by the state of waiting and pausing. In this context, enduring the pausing requires "practice," so that this attitude can be viewed as a necessary component of any growing into a profession rather than a disruptive factor. Parallely, the potential of "standing still" should be explored, for example, with regard to opening up opportunities for reflection.

The concept of giving and taking originates from the "helper" metaphor and is not only found within the nursing professions (Schmitt, 1995, p. 54). It is noticeable that trainees contribute with their whole person within this description, which means they also refer to gifts that are related to their physicality. Although patients are a central point of reference within this concept, their objectification in the context of examinations is particularly striking. Patients are thus made the "object" of practical examinations. There is an urgent need for a curricular discourse on how to talk about patients and what effects certain formulations have on our actions. Furthermore, the role of patients should be discussed with the trainees in the context of the final examination so that objectification can be avoided in the future.

While aspects of relationship building and bodily elements of sensing are central to the work on nursing professional identity (Fagermoen, 1997; Fagin & Diers, 1983), the trainees tend to show more craft-oriented formulations that are oriented toward procedures, norms, and rules. Here, following the expert-novice discourse (Benner, 2012), it can be assumed that trainees first have to learn the "handles" of certain activities, and thus the focus is on mechanics. Only with increasing confidence are tactile perceptual moments recognized as part of nursing professional identity. The curriculum should consider this development in its structure and weave in a gradual "feeling" of atmospheres and emotions in the later course of training.

The aspect of the influence of an external force on the trainees, which drives them into a corner and puts them under pressure, is problematic. Although metaphors of force and war are already an empirical finding in the context of nursing interaction (Weaver, 2013; Wurzbach, 1999), this should be questioned with regard to the particular vulnerability of the group of trainees. In this context, curricular protection and coping concepts should be integrated, which can strengthen the position of nursing trainees and promote their self-confidence.

7. CONCLUSION AND FUTURE RESEARCH DIRECTIONS

All metaphorical expressions were identified through contributions made in the context of virtual communities of practice. The virtual community can thus be characterized as a place where nursing trainees comprehensively describe their experiences during training. Special potential is shown not only by reflections, which are stimulated by the feedback and questions of other members, but also by the assessment of one's own professional being. Characteristics of trainees' professional nursing identities are made visible through their descriptions and expressions and can thus be questioned and analyzed. It is advisable to establish a virtual community of practice at the beginning of training in order to promote the possibility of growing into the nursing profession. Furthermore, the potential of metaphor analysis should be explored not only as a research method, but also (in a modified form) as a method for teaching. This opens up the possibility of finding approaches for counseling interviews and talking about what it means to be a nursing trainee.

In the future, these initial findings will be further differentiated and expanded. On the one hand, it would be relevant to extend the metaphorical concepts found so far and to draw a comparison with concepts used in the context of other learning sites. On the other hand, the development of a didactically reflected concept is still pending, which enables teachers to enter into a conversation with their learners via metaphors and thus stimulate reflections on their identification with the nursing profession.

REFERENCES

- Altmeppen, S. (2022). *Identität – Beruf – Bildung. Wie Auszubildende den Pflegeberuf biografisch einbetten und berufliche Identitätsarbeit leisten. Eine qualitative Studie* [Identity - Profession - Education. How trainees biographically embed the nursing profession and perform professional identity work. A qualitative study]. Weinheim; Basel, Germany: Beltz Juventa.
- Benner, P. (2012). *Stufen zur Pflegekompetenz: From Novice to Expert* [Steps to nursing competence]. (2nd ed.). Bern, Germany: Huber.
- Bermejo-Caja, C. J., Koatz, D., Orrego, C., Perestelo-Pérez, L., González-González, A. I., Ballester, M., ... & Martínez-Marcos, M. (2019). Acceptability and feasibility of a virtual community of practice to primary care professionals regarding patient empowerment: A qualitative pilot study. *BMC Health Services Research*, 19(1), Article 403. <https://doi.org/10.1186/s12913-019-4185-z>
- Bohrer, A., & Walter, A. (2015). Entwicklung beruflicher Identität. Empirische Erkenntnisse zum Lernen in der Berufspraxis [Professional identity development. Empirical findings on learning in professional practice]. *Pädagogik der Gesundheitsberufe*, 2(3)2, 23-31.
- Bundesministerium der Justiz und für Verbraucherschutz, No. 49, July 17, 2017 (Germany). Gesetz zur Reform der Pflegeberufe: Pflegeberufereformgesetz (PflBRefG) [Act to Reform the Nursing Professions: Nursing Professions Reform Act]. Retrieved from https://www.bgbl.de/xaver/bgbl/start.xav?start=%2F%2F*%5B%40attr_id%3D%27bgbl117s2581.pdf%27%5D
- Fagermoen, M. S. (1997). Professional identity. Values embedded in meaningful nursing practice. *Journal of Advanced Nursing*, 25(3), 434-441. <https://doi.org/10.1046/j.1365-2648.1997.1997025434.x>
- Fagin, C., & Diers, D. (1983). Nursing as metaphor. *The New England Journal of Medicine*, 309, 116-7. <https://doi.org/10.1056/NEJM198307143090220>
- Fischer, R. (2013). *Berufliche Identität als Dimension beruflicher Kompetenz. Entwicklungsverlauf und Einflussfaktoren in der Gesundheits- und Krankenpflege* [Professional identity as a dimension of professional competence. Developmental course and influencing factors in health care and nursing]. Bielefeld, Germany: W. Bertelsmann Verlag.

L. Hommel

- Hitzler, R., & Eisewicht, P. (2016). *Lebensweltanalytische Ethnographie: Im Anschluss an Anne Honer* [Lifeworld Analytic Ethnography. Following Anne Honer]. Weinheim; Basel, Germany: Beltz Juventa.
- Kokturk Dalcali, B., & Kaya, H. (2020). Mental Images of Nursing Students Regarding Nursing Profession: A Metaphoric Study. *International Journal of Caring Sciences*, 13(3), 1621-1628.
- Kozinets, R. V. (1997). "I Want to Believe": A Netnography of the X-Philes' Subculture of Consumption". *Advances in Consumer Research*, 24(1), 470-475.
- Kozinets, R. V. (2019). *Netnography. The Essential Guide to Qualitative Social Media Research* (3rd ed.). London: SAGE Publications.
- Lakoff, G., & Johnson, M. (2021): *Leben in Metaphern. Konstruktion und Gebrauch von Sprachbildern. Aus dem Amerikanischen übersetzt von Astrid Hildenbrand* [Living in Metaphors. The construction and use of language images. Translated from the American by Astrid Hildenbrand]. (10th ed.). Heidelberg, Germany: Carl-Auer.
- Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: The University of Chicago Press.
- Lave, J., & Wenger, E. (1991). *Situated learning. Legitimate peripheral participation*. Cambridge: Cambridge University Press.
- Lave, J., & Wenger, E. (2008). *Situated learning. Legitimate peripheral participation* (18th ed.). Cambridge: Cambridge University Press.
- Luft, L. (2022). *Von "fleißigen Arbeitsbienen", "Seelenrösterinnen", "Ersatz-Mamas" und Revoluzzer/-innen* [Of "busy worker bees", "soul comforters", "substitute moms" and "revolvers"]. Wiesbaden, Germany: Springer VS.
- McAllister, M., & McLaughlin, D. (1996). Teaching metaphors of student nurses. *Journal of Advanced Nursing*, 23(6), 1110-1120. <https://doi.org/10.1046/j.1365-2648.1996.01416.x>
- North, K., Franz, M., & Lembke, G. (2004). *Wissenserzeugung und -austausch in Wissensgemeinschaften. Communities of practice* [Knowledge creation and sharing in knowledge communities. Communities of practice]. Arbeitsgemeinschaft Betriebliche Weiterbildungsforschung (ABWF), Berlin. Retrieved February 1, 2021, from <https://www.econstor.eu/handle/10419/105480>
- Rolfe, G. (2019). Big Ideas: New metaphors for nursing (3): The nurse as gardener. *Nurse Education Today*, 73, 102-104. <https://doi.org/10.1016/j.nedt.2018.10.015>
- Rolfe, G. (2018). Editorial. Big Ideas: New metaphors for nursing (1): The nurse as musician. *Nurse Education Today*, 72, 97-99. <https://doi.org/10.1016/j.nedt.2018.10.016>
- Rolls, K. D., Hansen, M. M., Jackson, D., & Elliott, D. (2019). Intensive care nurses on social media: An exploration of knowledge exchange on an intensive care virtual community of practice. *Journal of Clinical Nursing*, 29, 1381-1397. <https://doi.org/10.1111/jocn.15143>
- Schmitt, R. (1995). Metaphernanalyse und die Repräsentation biographischer Konstrukte [Metaphor analysis and the representation of biographical constructs]. *Journal für Psychologie*, 1995(4), 47-61.
- Schmitt, R. (2017). *Systematische Metaphernanalyse als Methode der qualitativen Sozialforschung* [Systematic metaphor analysis as a method of qualitative social research]. Wiesbaden, Germany: Springer VS.
- Sharoff, L. (2009). The power of metaphors: images of holistic nurses. *Holistic Nursing Practice*, 23(5), 267-75. <https://doi.org/10.1097/HNP.0b013e3181b66c97>
- Shaw, L., Jazayeri, D., Kiegaldie, D., & Morris, M. (2021). Virtual communities of practice to improve clinical outcomes in healthcare: protocol for a 10-year scoping review. *BMJ Open*, 11, 1-6. <https://doi.org/10.1136/bmjopen-2020-046998>
- Sibbald, L. S., Burnet, M. L., Callery, B., & Mitchell, J. I. (2022). Building a virtual community of practice: experience from the Canadian foundation for healthcare improvement's policy circle. *Health Research Policy and Systems*, 20(1), Article 25. <https://doi.org/10.1186/s12961-022-00897-0>
- Struminger, B., Arora, S., Zalud-Cerrato, S., Lowrance, D., & Ellerbrock, T. (2017). Building virtual communities of practice for health. *The Lancet*, 390(10095), 632-634. [https://doi.org/10.1016/S0140-6736\(17\)31666-5](https://doi.org/10.1016/S0140-6736(17)31666-5)

"My dance area - your dance area" - Metaphors of nursing trainee identity in the context of virtual communities of practice

- Terry, D. R., Nguyen, H., Peck, B., Smith, A., & Phan, H. (2019). Communities of practice: A systematic review and meta-synthesis of what it means and how it really works among nursing students and novices. *Journal of Clinical Nursing*, 29(3-4), 370-380. <https://doi.org/10.1111/jocn.15100>
- Ullrich, C. G., & Schiek, D. (2014). Gruppendiskussionen in Internetforen [Group discussions in internet forums]. *Kölner Zeitschrift für Soziologie und Sozialpsychologie*, 66(3), 459-474. <https://doi.org/10.1007/s11577-014-0279-0>
- VERBI Software - Consult - Sozialforschung GmbH. (2022). *MAXQDA* (standard version) [Software]. <https://www.maxqda.com/de>
- Watson, J. (1987). Nursing on the caring edge: metaphorical vignettes. *Advances in Nursing Science*, 10(1), 10-18. <https://doi.org/10.1097/00012272-198710000-00006>
- Weaver, R. (2013). Games, civil war and mutiny: metaphors of conflict for the nurse-doctor relationship in medical television programmes. *Nursing Inquiry*, 20(4), 280-292. <https://doi.org/10.1111/nin.12023>
- Wenger, E. (1998). *Communities of Practice: Learning, meaning, and identity*. Cambridge: Cambridge University Press.
- Wenger, E. (2011). *Communities of practice. A brief introduction*. Retrieved February, 12, 2021, from <https://scholarsbank.uoregon.edu/xmlui/handle/1794/11736>
- Winkler, K., & Mandl, H. (2005). Virtuelle Communities. Kennzeichen, Gestaltungsprinzipien und Wissensmanagement-Prozesse [Virtual Communities. Characteristics, design principles and knowledge management processes]. *Medienpädagogik: Zeitschrift für Theorie und Praxis der Medienbildung, Occasional Papers*, 1-27. <https://doi.org/10.21240/mpaed/00/2005.08.11.X>
- Winslow, G. R. (1984). From loyalty to advocacy: A new metaphor for nursing. *The Hastings Center Report*, 14(3), 32-40. <https://doi.org/10.2307/3561187>
- Wurzbach, M. E. (1999). The moral metaphors of nursing. *Journal of Advanced Nursing*, 30(1), 94-99. <https://doi.org/10.1046/j.1365-2648.1999.01053.x>
- Yesilbalkan, O. U. & Cinar, D., & Karadakovan, A. (2021): A Metaphorical Analysis of Postgraduate Nursing Students' Perceptions of the Nursing Profession. *International Journal of Caring Sciences*, 14(1), 422-432.
- Zinke, G. & Fogolin, A. (2004). *Abschlussbericht zum Forschungsprojekt 3.4.102: Nutzung von Online-Communities für arbeitsplatznahes, informelles Lernen* (Final report on research project 3.4.102: Use of online communities for informal learning close to the workplace). Retrieved May 1, 2021, from https://www2.bibb.de/bibbtools/tools/dapro/data/documents/pdf/eb_34102.pdf

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Chapter # 38

SHARPEN CRITICAL THINKING SKILLS TO BOOST FUTURE WORKS

The case of engineers from freehand drawing to digital processes

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ABSTRACT

Learning never stops, and neither does teaching. Re-engaging critical thinking learned at an early age and boosting skills within the university setting play a critical role in shaping a generation of professionals capable of meeting the ever-changing challenges of the modern world. The experience is related to the Building Engineering degree program at the Politecnico di Torino, specifically in the first-year Building Drawing course, pointing out the relevance of the approach from the beginning of the curricular path. The discipline of Drawing, understood as a language of communication for the construction industry, is the element around which an active learning path with students is developed. The scheme adopted provided theoretical notions as the knowledge foundation, then methods and tools between tradition and innovation for representing and analyzing the projects with a critical attitude. Real-world (freehand sketching), digital (Computer-Aided Design vs Building Information Modelling), Augmented and Virtual (avatar in the metaverse) practices are presented to provide a synoptic picture of possibilities that the student may choose to self-consciously employ in further academic courses and their working life.

Keywords: building drawing, critical thinking, mind map, building information modelling, virtual reality, avatar.

1. INTRODUCTION

Nowadays, the modern world is faced with increasingly complex challenges related to globalization, climate change, and the resilience of our cities. On the other hand, the growing technological evolution is enabling broader and more exciting scenarios than ever. These factors are very prominent in the construction sector, which is going through a period of structural change to keep pace with the speed of the Industry 4.0 era.

The emergence related to the digitalization of processes and the introduction of new working collaborative tools, such as Building Information Modelling (BIM), required at the European level by Directive 2014/24/EU (European Parliament, 2014), has demanded from the market not only new skills at a technical level but, above all, a flexible engineering mindset capable of adapting to fast-changing contexts. This element takes on even more significant weight since, according to the World Economic Forum, 65% of children enrolled in primary school today will work in jobs that do not yet exist (World Economic Forum, 2020).

Education will therefore play a decisive role in the following years to bridge the gap between the new industry's demands and the training of young university graduates and ease the transition of workers into more sustainable job opportunities. Consequently, in this historical and cultural context, more than at any other time, there is a pressing need to introduce a revision of degree courses (Osello, Del Giudice, De Luca, & Ugliotti, 2022).

Moreover, distance learning associated with the Covid-19 epidemiological emergency measures experienced in the last few years has introduced new difficulties that have required additional investment to turn the limitations of the virtual environment into current and future opportunities for the students (Ugliotti, De Luca, Fonsati, Del Giudice, & Osello, 2021). Technology-enhanced learning leverages technology to maximize learning within an environment of high-quality course design that can offer students the options of time, place and pace, and emphasizes different learning styles (Huang et al., 2020).

This chapter addresses the particular case of the first-year Building Drawing course of the Building Engineering degree program at the Politecnico di Torino as a leading example of innovative and future-proof teaching practice.

2. BACKGROUND

Digital transformation increasingly requires digital and transversal skills by professionals, companies, public administrations, and citizens to benefit from new services. Hence, the development of critical thinking represents an essential skill in 21st-century learning within educational and professional settings. Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to action. Several interpretations can be found in the literature on the subject (Padmanabha, 2018; Paul & Elder, 2010). According to Dewey, critical thinking is a reflective thinking type that consists of turning a subject over in mind and giving it serious and consecutive consideration (Dewey, 1933). It is a purposeful, self-regulatory judgment that results in understanding, investigation, evaluation, and inference (Facione, Sanchez, Facione, & Gainen, 1995). For Ennis, it is meditative, and sensible thinking focused on deciding what to believe or do (Fisher, 2011). When individuals are capable of using their critical thinking skills to act on opportunities successfully, it can be expected that growth and benefits for the knowledge economy should follow, further developing the capabilities and potential of nation-states (Heard, Scoular, Duckworth, Ramalingam, & Teo, 2020).

Indeed it is the university's job to train students to be increasingly competitive and ready for a world of work subject to constant adaptation. Therefore, the focus moves from the selection and quantity of theoretical content to the learning style for the teaching method aimed at raising knowledge quality (Creemers et al., 2013; Biggs & Tang, 2011) and providing engagement opportunities. According to a recent trend, improving teaching practices requires treating them with the same methodological rigour as scientific disciplines. There is a need for a new synthesis of the instructional development literature (Stes, Min-Leliveld, Gijbels, & Van Petegem, 2009; Hattie, 2009; Samuel & Rahman, 2018). Evidence-Based Education (Pellegrini & Vivanet, 2020) adopts a practice based on the best available evidence. According to Hattie, it is necessary to make the learning-teaching process "visible" (Hattie, 2009, 2012): the objectives must be made explicit, the didactic proposals challenging, the feedback provided and sought, the subjects actively, passionately and enthusiastically involved. Learning is best achieved when the individual actively constructs knowledge and understanding (Sanrock, 2001). Individuals must actively participate in the teaching and learning process, thus discovering, reflecting and thinking critically about the knowledge they acquire (Richardson, 2003). Active learning (Brame, 2016) builds on constructivist learning theory (Piaget, 1964), which posits that people learn by connecting new ideas and experiences to what they already know. In light of existing research, teaching structures (Bonaiuti, 2014) are gradually incorporating active learning techniques such as

Participatory Teaching (Concina, 2019), Think Pair Share and Team-Based Learning (Lotti, 2021), Game and Role Playing, Problem-Based Learning, Peer Review, and Mind and Conceptual mapping. Further background and theoretical grounding are provided in the next section concerning the methodological approach used.

3. METHODOLOGY

Now that the necessity to push for innovation in teaching and learning methods has been framed, how to critically and technically explore it? Which role do tools and procedures play in digitalization? This section aims to investigate the strategies that lead to consistent innovation in teaching processes and focuses on the broad theoretical reflection of the current strategies in innovating practices. Promoting innovation in terms of processes and tools in teaching courses is driven by specific and tailor-made strategies that aspire to change the traditional teaching approach profoundly. As mentioned before, preliminary experimentation on the Building Engineering degree program is applied to the Building Design course, which is intended to be the first characterizing teaching of the curriculum. The Building Drawing course tries to embody some of the principles expressed by the cognitivist matrix teaching (Maccario, 2015) and associate the theoretical suggestions with an operative strategy. In fact, the teacher's role (van Dijk, van Tartwijk, van der Schaaf, & Kluijtmans, 2020; Vighnarajah, Luan & Bakar, 2008) both in cognitivism and in the constructivism learning theory is to guide students through the problem-solving process, while allowing them to use their own mental capacities to find solutions. The model adopted seeks to combine teacher-centred teaching, i.e. the didactic approach, and student-centred learning, i.e. the student's active participation. The elaboration of information regarding the connection between topics and matters, individual restitution of results, and critical analysis of process and outcome are fundamental in pushing teaching methods beyond traditional and consolidated procedures. Therefore, the teaching approach of the course takes the following strategic principles into account: (i) supporting the reworking of knowledge, (ii) experimenting with mental strategies, (iii) employing the use of mental resources, (iii) increasing the self-efficiency level of the students.

3.1. Reworking of knowledge

First of all, innovative teaching methods should lean on supporting the reworking of knowledge (De Vecchi, Carmona-Magnaldi, & Della Casa, 1999). The teaching goal is no longer to accumulate knowledge but to structure it, build networks between concepts, and establish a connection between knowledge. What can benefit the development of an articulated network of concepts is addressing a teaching topic by suggesting the employment of several and different technologies to explore from different sides and grade the same object of study. Providing diversified tools and learning strategies can help push students to build critical thinking and cognitive connections. In this context, the Building Drawing course suggests employing several methodologies and techniques in the cross-sectional analysis of a specific object under study, as explained in the following.

3.2. Experiment with mental strategies

Secondly, teachers should encourage students to experiment with mental strategies to push a step beyond mere knowledge transmission. Knowledge is built through a personal work of re-elaborating concepts through which understanding takes place, and knowledge is established. During the Building Drawing course, students are encouraged to elaborate on a personal interpretation of the theoretical topics learned in class and build a concept or mind

map (Tavares, Meira, & Amaral, 2021). Maps are more than a mere graphical representation of concepts and their relationships: they are tools that can help us think better by improving our creative capacity and analytical and reasoning skills. This strategy is aimed at developing meta-cognitive and self-regulatory abilities. Students acquire generative behaviour according to the constructive mode of Michelene Chi's ICAP (Interactive, Constructive, Active or Passive engagement) active learning framework (Chi & Wylie 2014; Chi et al., 2018). In this way, they can generate additional information, which may contain parts of new knowledge compared to the material provided by the lecturer and go beyond what has been presented.

3.3. Employing the use of mental resources

The teacher not only provides the strategies but also helps students employ the use of mental resources (Mazzoni, 2001). It is fundamental that an individual is guided to understand that resources must be dedicated during a study activity and, secondly, how many resources must be dedicated and for how long. It is strategic for a student to ask himself how much (cognitive) effort must be used to tackle a task. How to reach this objective? The teaching course's clear organization concerning topics, objectives, technologies employed, and expected outcomes helps provide a precise reference context. The task of a teacher is not only to organize the resources but also to help students by employing them at different levels at different times. The Building Drawing course is organized to put different organizational, cognitive and technical resources into action to accompany the subject in its growth as an autonomous individual and student. According to the Experiential Learning (Kolb, 1984) process, the "learn by doing" is used to engage students.

3.4. Increasing the self-efficacy level of the students

The weaving of the strategies described must lead to the last point of discussion to consider the needed increase in the self-efficacy level of the students. This aspect represents a crucial and fundamental element because it focuses on nourishing the students' cognitive resources in evaluating themselves. It aspires to help students not so much to understand if they have done well or poorly but because they have achieved a specific result. It can positively affect self-efficacy as it helps to evaluate their performance to recognize functional processes and those that are harmful to increase the possibility of self-regulation and the confidence to better face future difficulties. Concerning this, the pedagogical strategy of Team-Based Learning (Parmelee, Michaelsen, Cook, & Hudes, 2012) provides support with problem-solving, group work, and peer review activities. Students evaluate each other on each other's contribution and intra-group dynamics, reinforcing the importance of both individual preparation and team participation. The Building Drawing course promotes a calendar organized in weekly steps of validations supported by the teacher and tutors at different levels and with different and complementary competencies to help students develop practical activities. Students are accompanied in developing their exercises by weekly reporting difficulties and achievements. They are put into proof to have defined a critical and personal reflection on the practical work.

4. COURSE APPLICATIONS

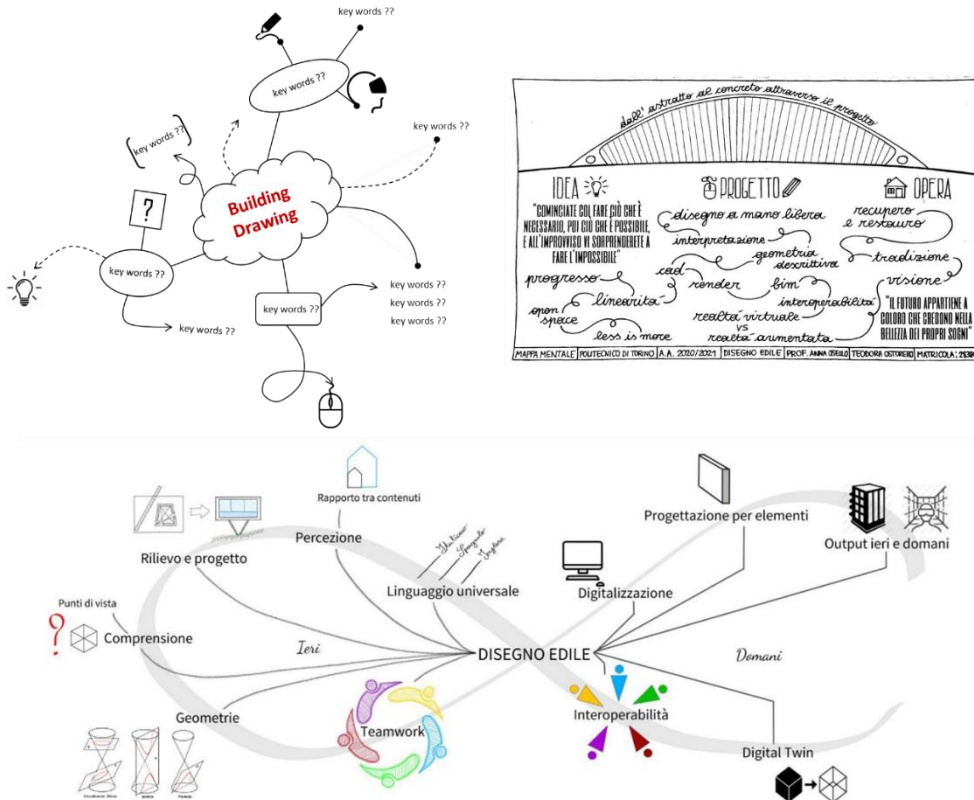
The Building Drawing course aims to set up the methodological elements of drawing as a communication language for the building engineer, providing tools and methods between tradition and innovation for representing both survey and project. The theoretical concepts concerning descriptive geometry are declined in practical exercises, freehand sketches, and technical drawing, including innovative visualization practices. Going into the details of the experience, an attempt was made to implement the strategic principles previously outlined in the teaching by providing an articulated plan of action. As the literature reflects, “Learning involves a combination of discussion, practice and production, working together to practice new skills and creating collaborative work by challenging each other and reaching agreement” (Laurillard, 2012).

In particular, an effort was made to design participatory teaching and interactive learning techniques concerning the theoretical modules. Active reflecting activities on specific topics are offered, asking students to ponder what they already know about a subject. As an example, the launch of the course is handled through a brainstorming activity on the meaning of Drawing, what it expresses and what it helps us communicate in engineering and architecture. At the end of the lectures, on the other hand, the teacher promotes an exercise in summarizing the concepts, highlighting the connection of the new information concerning their real life and how they will apply it to the world through a concrete application. This task also allows a continuous check of the skill gap or mismatch against market needs. Interaction with students is managed through audience response system (Wood & Shirazi, 2020) tools such as Padlet, Kahoot, and Google docs/forms.

To further mark each lesson, students are targeted for a conceptualization activity by self-reflecting on arguments addressed in the course. In this framework, an operative strategy adopted is the development of a mind map to pick representative keywords collected from lesson to lesson, put them in order, and trace connections among the topics, reworking the relationships by using a graphical means. This personal global overview and interpretation of the topics of the teaching formulated by the student are used as the basis for the initial discussion of the oral final examination. Two examples from the Building Drawing course, a.a. 2020/2021, are shown in Figure 1.

The practical exercise involves individual work in the initial weeks of the course, which becomes group work in the predominant part of the course. This choice aims to foster the development of soft skills in university teaching from the early years through experimentation with teamworking, networking, and no less conflict resolution. These skills then become relevant in consideration to the future professional activity of the building engineer, who will always have to collaborate with various other stakeholders for any project’s success. As the students are in their first year, they are asked to reproduce an author’s project to begin to familiarise themselves with the theoretical content and govern the tools. The case study selected should be explored comprehensively by students through a gradual learning path of representation techniques. It involves the employment of freehand sketches, bi-dimensional and three-dimensional digital drawing, parametric design, and Augmented and Virtual Reality. The aim, therefore, is not to make a vertical focus but to investigate the potential and limitations of different instruments. While freehand drawing is well established in scientific social research as a tool for critical reflection, the adoption of advanced digital tools is still underestimated in terms of methodological approach.

Figure 1.
Mental maps outcomes.

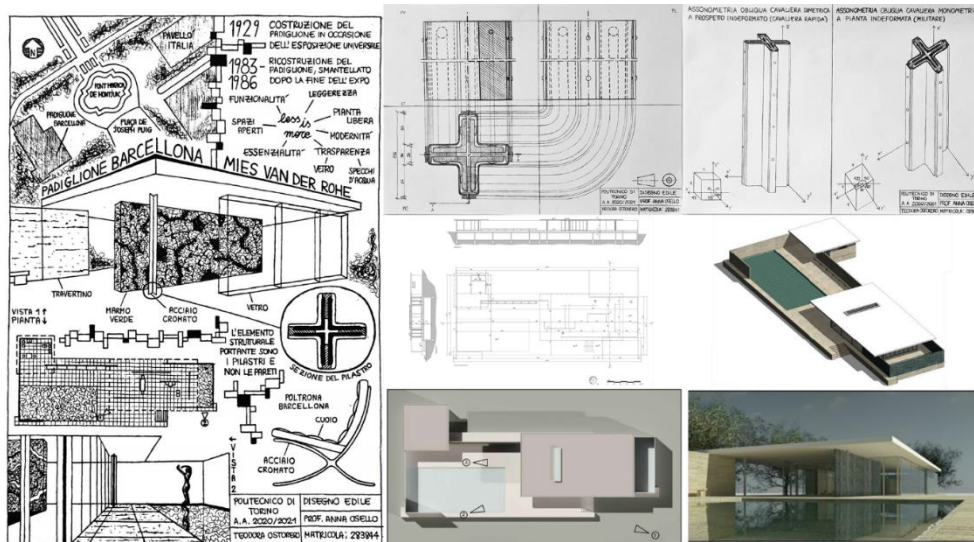


The tools represent a means better to control not only the design but especially the processes. In this sense, it is essential to transfer the method to the students to interface with the instruments rather than merely sharing commands referring to a specific software popular at the time. Using different but complementary operative solutions helps students analyze the object in different scales, perspectives, and technical means. The outcome is deeper learning of the whole object's characteristics, relationships between the parts, and connection with the surrounding. The students are asked to begin the process of investigating the building, starting with the creation of sketches. The anthological drawing is a personal, reasoned, critical reading where the most significant information about the artefact must be selected, drawn, and written down. The theoretical contents relating to orthogonal and axonometric projections are declined in the following practical exercises, always requested freehand, having as object a specific characterizing element of the author's project. Training on digital representation is indispensable nowadays. However, it is the job of university lecturers to select and transfer the most advanced methodologies that find application feedback in the professional and procurement world in addition to the more traditional and established practices. Over the past two decades, in fact, Building Information Modelling (Osello, 2012) understood as the process at the heart of the construction industry for exchanging information during the building life cycle has taken hold. Within this method, BIM tools enable the creation of parametric digital models beyond simple three-dimensional representation by

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setting up a database of information. This software category allows graphic and alphanumeric data to be transmitted to other applications and professionals through technological, procedural, and organizational interoperability concepts. Students must return drawings of the author's projects either through Autodesk AutoCAD, a Computer-Aided Design software universally used for drawing and design, or through Autodesk Revit, a model authoring software specific to the construction sector. This work aims to accustom them to the different demands that may come from the market. The approach and working procedure are entirely different, even though the final output of the design boards must provide the same depth. This activity, conducted on a small project so that it can be governed as best as possible, is intended to have students critically compare the different possibilities the software offers. The Engineer must govern the tools, optimizing the solutions according to the representation objectives. Figure 2 shows the example of the Mies van der Rohe Barcelona Pavilion case study from the Building Drawing course a.a. 2020/2021.

Figure 2.
Gradual learning path of representation techniques.



In the last part of the course, theoretical lectures also glance toward using new Augmented and Virtual Reality technologies to present projects effectively. This aspect is also considered very important to complete the framework of the Building Drawing in the third millennium. Accordingly, applications are encouraged to experiment with this returning. The employment of Augmented Reality is required to provide additional layers of information during the presentation of the drawings at the examination. These may include images, videos, virtual tours made from the realized models, and websites.

Moreover, students experience immersive Virtual Reality for their project reviews using Iris ProspectVR software and HTC Vive and Oculus Rift hardware. As can be seen from Figure 3, the teacher becomes an avatar who can interact with students in cyberspace to verify the project, the correct construction of elements, and their assembly, dimensions, proportions, and construction nodes. User perception is amplified, and discussion becomes interactive among the participants because it is possible to take note of critical points by employing instruments for taking screenshots, writing comments, and highlighting errors

inside the model (Ugliotti, De Luca, Fonsati, Del Giudice, Osello, 2021). Being able to navigate the three-dimensional digital models from the inside at the same time certainly contributed in terms of collaboration and involvement of the students. This experience stems from the needs related to the recent pandemic, which has promoted further opportunities to innovate teaching by adopting tools that stimulate creativity. Given the initiative's effectiveness, it was considered to be a regular activity during the course. The purpose is primarily to evaluate their work from another point of view. In the second instance, students must acquire the elements to evaluate possible further application contexts in the professional field. Today is an interaction with the teacher; tomorrow could be the way to interact with other professional firms, the presentation of a project to a client, or the involvement of stakeholders within a service conference.

Figure 3.
Immersive Virtual Reality experience for project reviews.



5. RESULTS AND CONCLUSION

Learning takes place through the organization of knowledge by the subject. A person learns when s/he can connect the information from outside to her/his own knowledge to build organized structures. The organization of knowledge leads to the construction of concepts or logical categories that are more and more comprehensive, articulated, and related through logical links. Therefore, the student must be helped to manage their own learning in an increasingly autonomous way, developing a strategic attitude. The chapter aims to illustrate how these theoretical reflections can become practical strategies to make teaching principles feasible. The Building Drawing course at Politecnico di Torino is the fieldwork where these teaching and learning objectives are put into action and are experimented into a practical context. The enrichment of the course offering is student-centered who can, on the one hand, benefit from advanced didactic experimentation proposing collaborative tools establishing interactive virtual learning environments and, on the other hand, can develop a strategic attitude and working method to approaching complex problems. The results obtained represent an initial proposal to evaluate the potential of the adopted technologies to support teaching and their impact on students' learning processes based on critical thinking. Through

the introduction of diversified active learning strategies in the course, it has been noticed an increasing involvement of students compared to previous years, both individually and in groups. At the end of the course, students have acquired the competence to critically interpret building form and geometry and the ability to choose the most appropriate representation to achieve a given goal. Student enrichment has been noted through student-teacher interaction improvement, the achievement of final products' quality related to the specific course, sometimes higher than required, and the application of these skills in subsequent student work.

REFERENCES

- Biggs, J., & Tang, C. (2011). *Teaching for Quality Learning at University*. Maidenhead, UK: Open University Press.
- Bonaiuti G. (2014). *Le strategie didattiche*. [Teaching strategies]. Roma, Italy: Carocci Faber.
- Brame, C. (2016). *Active learning*. *Vanderbilt University Center for Teaching*. Retrieved from <https://cft.vanderbilt.edu/active-learning/>
- Chi, M.T.H., & Wylie, R. (2014) The ICAP Framework: linking Cognitive Engagement to active learning outcomes. *Educational Psychologist*, 49, 219-243.
- Chi, M.T.H., Adams, J., Bogush, E.B., Bruchok, C., Kang, S., Lancaster, M., Levy, R., Li, n., McEldoon, K.L., Stump, G.S., Wylie, R., Xu, D., & Yangmourian, D.L. (2018). Translating the ICAP theory of Cognitive Engagement into practice. *Cognitive Science*, 42,1777-1832.
- Concina, E. (2019). Participative Teaching Methods for Sustainable Development. *Encyclopedia of Sustainability in Higher Education*. Cham, Switzerland: Springer. https://doi.org/10.1007/978-3-030-11352-0_411
- Creemers, B., Kyriakides, L., Panayiotou, A., Bos, W., Günter Holtappels, H., Pfeifer, M., Vennemann, M., Wendt, H., Scharenberg, K., Smyth, E., McMahan, L., McCoy, S., Van Damme, J., Vanlaar, G., Antoniou, P., Charalambous, C., Charalambous, E., Maltezou, E., Zupanc, D., (...) Tempridou, A., (2013). *Establishing a knowledge base for quality in education: Testing a dynamic theory for education. Handbook on designing evidence-based strategies and actions to promote quality in education*. Münster/New York/München/Berlin: Waxmann Publishing.
- De Vecchi G., Carmona-Magnaldi N., & Della Casa, C. (1999). *Aiutare e costruire le conoscenze* [Helping and building knowledge]. Firenze, Italy: La Nuova Italia.
- Dewey, J. (1933). *How We Think*. 2nd ed. Boston, MA: DC Heath.
- Directive 2014/24/EU. *Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC*. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0024>
- Facione, P.A., Sanchez, C.A., Facione, N.C., & Gainen, J. (1995). The disposition toward critical thinking. *Journal of general education*, 44(1), 1–25.
- Fisher, A. (2011). *Critical Thinking: An Introduction*. Cambridge, England: Cambridge University Press.
- Hattie, J. (2009). *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*. London, England - New York: Routledge.
- Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning*. London, England - New York: Routledge.
- Heard, J., Scoular, C., Duckworth, D., Ramalingam, D., & Teo, I. (2020). *Critical thinking: Skill development framework*. Australian Council for Educational Research. Retrieved from https://research.acer.edu.au/ar_misc/41
- Huang, R.H., Liu, D.J., Tlili, A., Yang, J.F., Wang, H.H., et al. (2020). *Handbook on Facilitating Flexible Learning During Educational Disruption: The Chinese Experience in Maintaining Undisrupted Learning in COVID-19 Outbreak*. Beijing: Smart Learning Institute of Beijing Normal University. Retrieved from <https://inruled.bnu.edu.cn/docs/2022-04/20220407143301033082.pdf>

- Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*, 1. Englewood Cliffs, NJ: Prentice-Hall.
- Laurillard, D. (2012). *Teaching as a Design Science: Building Pedagogical Patterns for Learning and Technology*. New York, USA: Routledge.
- Lotti, A. (2021) *Il Team Based Learning per le università italiane*. Verona, Italy: QuiEdit.
- Maccario, D. (2015). *Le nuove professioni educative* [The new educational professions]. Roma, Italy: Carocci editore.
- Mazzoni, G. (2001). *I processi cognitivi nell'apprendimento scolastico* [Cognitive processes in school learning]. Roma, Italy: Carocci editore.
- Osello, A. (2012). *Il futuro del disegno con il BIM per ingegneri e architetti*. [The future of drawing with BIM for engineers and architects]. Palermo, Italy: Dario Flaccovio Editore.
- Osello, A., Del Giudice, M., De Luca, D., & Ugliotti, F.M. (2022). Digital Twin. Experimenting drawings (di-SEGNI) between science and technology in teaching. *DIALOGHI / DIALOGUES • visioni e visualità / visions and visuality: Testimoniare Comunicare Sperimentare / Witnessing Communicating Experimenting*, 2716-2723. <https://doi.org/10.3280/oa-832-c168>
- Padmanabha, C. H. (2018). Critical Thinking: Conceptual Framework. *Journal on Educational Psychology*, 11(4), 45-53.
- Parmelee, D., Michaelsen, L.K., Cook, S., & Hudes, P.D. (2012) Team-based learning: a practical guide: AMEE guide no. 65. *Medical Teacher*, 34(5). <https://doi.org/10.3109/0142159X.2012.651179>
- Paul, R., & Elder, L. (2010). *The Miniature Guide to Critical Thinking Concepts and Tools*. Dillon Beach, CA: Foundation for Critical Thinking Press
- Pellegrini, M., & Vivanet, G. (2021). Evidence-Based Policies in Education: Initiatives and Challenges in Europe. *ECNU Review of Education*, 4(1), 25–45. <https://doi.org/10.1177/2096531120924670>
- Piaget, J. (1964). Part I: Cognitive development in children: Piaget development and learning. *Journal Research in Science Teaching*, 2(3), 176–186. <https://doi.org/10.1002/tea.3660020306>
- Richardson, V. (2003). Constructivist pedagogy. *Teachers College Record*, 105(9), 1623–1640.
- Samuel, A., & Rahman, M. (2018). Innovative Teaching Methods and Entrepreneurship Education: A Review of Literature. *Journal of Research in Business, Economics and Management*, 10(1), 1807-1813.
- Santrock, J. W. (2001). *Educational psychology: International edition*. New York: McGrawHill Companies, Inc.
- Stes, A., Min-Leliveld, M., Gijbels, D., & Van Petegem, P. (2009). The impact of instructional development in higher education: The state-of-the-art of the research. *Educational Research Review*, 5(1), 25-49. <https://doi.org/10.1016/j.edurev.2009.07.001>
- Tavares, L., Meira, M., & Amaral, S. (2021). Interactive Mind Map: A Model for Pedagogical Resource. *Open Education Studies*, 3(1), 120-131. <https://doi.org/10.1515/edu-2020-0145>
- Ugliotti, F.M, De Luca, D., Fonsati, A., Del Giudice, M., & Osello, A. (2021). Students and teachers turn into avatars for online education. *INTED2021 Proceedings*, 4556-4565. <https://doi.org/10.21125/inted.2021.0926>
- van Dijk, E.E., van Tartwijk, J., van der Schaaf, M.F., & Kluijtmans, M. (2020). What makes an expert university teacher? A systematic review and synthesis of frameworks for teacher expertise in higher education. *Educational Research Review*, 31. <https://doi.org/10.1016/j.edurev.2020.100365>
- Vighnarajah, Luan, W.S., & Bakar, K.A. (2008). The shift in the role of teachers in the learning process. *European journal of social sciences*, 7, 33-41.
- Wood, R., & Shirazi, S. (2020). A systematic review of audience response systems for teaching and learning in higher education: The student experience. *Computers & Education*, 153. <https://doi.org/10.1016/j.compedu.2020.103896>
- World Economic Forum. (2020). *The Future of Jobs Report 2020*. Retrieved August 8, 2022, from https://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf

Sharpen critical thinking skills to boost future works. The case of engineers from freehand drawing to digital processes

CONTRIBUTIONS

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KEY TERMS & DEFINITIONS

Avatar: graphical representation of a user within a virtual community who can move freely and interact with the virtual environment in which it is immersed.

Building Drawing: means representing thought and expressing a project (architectural or urban planning) by which a design hypothesis is shaped and through which the congruence between formal image and construction technologies and systems is verified.

Building Information Modelling: methodological process for specifying, creating, and managing digital information about a built asset.

Critical thinking: ability to analyze information, situations and experiences independently and objectively, distinguishing reality from personal impressions.

Mind map: a form of graphic representation of a thought or a subject devoted to creativity, memorization, and annotation in a personal key.

Virtual Reality: three-dimensional computer-built simulated Reality within which the user can immersively navigate, move and interact with the recreated digital world through special visors.

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Chapter # 39

TEACHERS PERSPECTIVES OF VIRTUAL PROGRAMS TO PROMOTE STUDENT ENGAGEMENT IN SECONDARY EDUCATION

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ABSTRACT

Households can be very distracting for students, simultaneously teachers are unable to walk around to see if students are engaged or distracted (Farah & Barnett, 2019). In addition, teachers can feel intimidated and overwhelmed by technology (Hertenstein, 2020; Schaffhauser, 2020). Teachers are struggling with virtual learning and have gotten little to no professional development on how to engage students in an online platform (Schwartz, 2020; Williams, 2021). This study will dive into various virtual programs for promoting student engagement. This perspective will help provide professional development direction on which programs could be used to engage students in a virtual setting.

The participants included current teachers enrolled in a master's of education program in southeast Alabama. The participants learned about various free online programs and were able to implement those programs in their classrooms simultaneously. At the end of the semester, students took an online survey asking which programs were least to most helpful for engagement, easiest to implement, and programs they would like to know more about.

Keywords: student engagement, virtual learning, online learning, secondary education.

1. INTRODUCTION

Student engagement is an essential part of learning, they need to be actively engaged in their learning in order to achieve mastery (Linnenbrink & Pintrich, 2010). It can be challenging for teachers to keep students engaged in a physical classroom, however, in a virtual setting it is amplified. Students are uprooted from their school learning environments into their households, most of which are not conducive to learning. Households can be very distracting for students and teachers are unable to walk around to see if students are engaged or distracted (Mobile guardian, 2020; Farah & Barnett, 2019). In virtual learning, the teacher can't be an active stakeholder in the student's learning environment. In addition, most students have no control over their learning situation and the student's home situation plays a large factor in learning. Yet, students are expected to master content to be promoted to the next grade level.

Another issue in virtual learning is the teacher's knowledge and comfort with implementing technology for learning. Teachers can feel intimidated and overwhelmed by technology (Hertenstein, 2020; Schaffhauser, 2020). They are struggling with virtual learning and have gotten little to no professional development on how to engage students in an online platform (Schwartz, 2020; Williams, 2021). Their normal engagement strategies don't translate to virtual learning. As a result, teachers are reverting back to lecture-based models as they are unfamiliar with online platforms to help engage students. Lecture-based learning provides little to no engagement opportunities for students; therefore, they are not active

learners (Terada, 2019). This study will dive into various free online programs for virtual student engagement which will provide perspective from current secondary teachers on the most to least helpful platforms. These perspectives will help provide professional development direction on which online platforms could be used to engage students in a virtual setting.

2. BACKGROUND

Students are technology savvy about gaming and/or social media but lack the technology and academic skills needed for an online class. Teachers often overestimate their student's technology readiness for virtual learning (Clark-Ibanez & Scott, 2008). They assume students can figure out the virtual platform for learning or other technical issues. Home computers and/or Wi-Fi can cause problems in a virtual learning environment. Students lack the technological knowledge to overcome the issues (Clark-Ibanez & Scott, 2008). Students don't always have someone close by or with the knowledge to help troubleshoot issues. Jaggars (2014) stated it is suggested that technical difficulties or the student's commitment to their studies tend to be the cause of dropout. Retention for online courses tends to be lower than for face-to-face classes. Students who lack motivation tend to struggle in online settings (Kahn, Everington, Kelm, Reid, & Watkins, 2017). Online learning requires students to be self-motivators and stay on top of their learning, the teacher can't be in-person to make sure they are completing their work, providing motivation, and keeping districts at a minimum. Students lack the motivation and discipline to work in isolation (TopClass, 2021). As a result, virtual learning environments make it easier for an online student to give up without anyone noticing.

In virtual settings, teachers are unable to read the room to see if students are committed, focused, and engaged. Student engagement is associated with the physical environment classroom (Spencer, 2020). The physical environment of the classroom is a positive learning environment that promotes learning, engagement, and critical thinking. In a virtual setting, it is a challenge for teachers to engage students. Teachers are unable to redirect misbehavior in a virtual setting as easily as they could in a face-to-face setting (Spencer, 2020). With cameras off it becomes even more difficult for teachers to gauge engagement, they have no idea if students are paying attention or even attending the class session. Teachers feel like they are teaching no one. In addition, not every student has a quiet workspace, internet, and materials needed. Some students are watching their younger siblings while their parents work and can't focus on their courses (Spencer, 2020). All of the situations need to be taken into consideration in virtual learning.

Bender (2003) found online classes are more work for the teacher than face-to-face classes. Teachers were trained to teach in a face-to-face environment, not a virtual setting. When teachers were required to shift from in-person to virtual learning they were scrambling to adapt to virtual learning platforms (Williams, 2021). They received little to no training and only had a week at most to prepare. Teachers had to convert their current planned content to virtual. They also had to deal with technology/ Wi-Fi issues. This resulted in online instruction mostly relying on lectures where students are the recipients of information in the learning process. Students are expected to learn and master the content knowledge by just listening. Many times, teachers were unaware till the end of the lesson, week, or month that students were not mastering the content.

Most engagements in online environments stem from adaptations of teaching strategies from face-to-face instruction. Many teachers were plagued with the myth that virtual learning was equivalent to face-to-face learning (Williams, 2021; Meyers, 2008). As a result, they are

expecting the material to easily transfer to a virtual setting and for students to respond accordingly. Teachers needed professional development geared toward effectively teaching online (Williams, 2021). Teachers often teach how they were taught; however, some never experienced an online learning environment and have no idea how to conduct such. Technology professional development is important however it should continue beyond learning the technology to engaging in learning virtually (Williams, 2021). Teachers need tools to engage all students regardless of their circumstances in a virtual setting.

3. METHODOLOGY

This research study is a survey research design, in which quantitative data is collected from the survey (Creswell, 2015; Glasow, 2005). The survey was an electronic self-administered questionnaire that included a series of items reflecting the research aims (Ponto, 2015; Costanzo, Stawski, Ryff, Coe, & Almeida, 2012; Ponto, Ellington, Mellon, & Beck, 2010). The results from the survey provide a general picture of the overall context of the entire set of research questions (Creswell & Plano Clark, 2007). The following research questions assisted in concluding the purpose of the study:

1. What are the perspectives of secondary teachers of programs that promote engagement in a virtual setting?
2. What are the perspectives of secondary teachers on program implementation in a virtual setting?

3.1. Virtual Programs to Promote Student Engagement

Eleven different virtual programs were focused on during the study. Those programs include Kahoot, Google Docs, Socrative, Google Slides, Google Forms, Google Sheets, Edulastic, Go Formative, Classkick, Pear Deck, and Blooket. Each program was free during the time of the study. Below is a description and usage of each program.

Kahoot is a student-centered learning platform and content hub designed to help students to take an active role in their education through powerful play. It can be used in your classroom to: engage your class with interactive lessons, access ready-to-play learning content by subject and grade, get instant feedback from every student in the class, track learning progress over time for formative assessment, and foster creativity and teamwork to turn learners into leaders (Kahoot, 2022).

Google Docs is used to create, and collaborate on online documents. Students are able to edit together with secure sharing in real-time and from any device, with no special software required. Multiple students can work at the same time, you can see each other's changes as they make them, and every change is saved automatically (Google, 2022).

Socrative offers immediate feedback, which is a vital part of the learning process. It provides an efficient way to monitor and evaluate learning that saves time for educators while delivering fun and engaging interactions for learners. It is a classroom app for fun, effective engagement, and on-the-fly assessments, available on all platforms (Socrative, 2022).

Google Slides is used to create online slideshows. Students are able to make beautiful presentations together with secure sharing in real-time and from any device (Google, 2022).

Google Forms is used to create online forms and surveys with multiple question types while analyzing results in real-time and from any device. Teachers are able to get results at the same time by secure sharing in real-time and from any device (Google, 2022).

Google Sheets is used to create and edit online spreadsheets. Teachers and students get insights together with secure sharing in real-time and from any device (Google, 2022).

Edulastic is an engaging technology-enhanced assessment for benchmarks, the classroom, or distance learning. Teachers are able to easily administer district common or classroom formative assessments using high-quality item banks, diagnostic or curriculum-aligned assessments, create your own questions or mix and match (Edulastic, 2022).

Go Formative gives you the teaching tools to engage, instruct, and assess. It helps teachers improve student engagement and accelerate learning, they are able to start seeing real-time student responses (Formative, 2022).

Classkick allows teachers to see all their students working and give high-quality feedback—from anywhere. Teachers upload their own content or create something new—with drawings, text, images, audio, links, and videos to provide instruction or create assessments. Individually or in group settings, students input drawings, text, images, and audio or answer fill-the-blank or multiple choice in response to teacher-created material. Teachers provide individualized, real-time feedback and grading with an array of tools—directly on the canvas, in the help center, or with pointed stickers. Students can even ask their peers for help anonymously. Teachers can see who needs help and how students are progressing through the assignment (Classkick, 2022).

Pear deck is the fastest way to transform presentations into classroom conversations. Pear Deck is an add-on for Google Slides and as a result, you can add formative assessments and interactive questions to your presentations right from Google Slides (Pear Deck, 2022).

Blooket is an exciting new take on the modern classroom review game. It aims to match action with education to create the ultimate learning experience. Students are encouraged to participate in games with rewards for answering questions and exploring new methods of learning. Overcoming our challenges drives students to perform well while reviewing. Question sets can be painlessly imported or created easily. Teachers can also edit game settings with a variety of options (Blooket, 2022).

3.2. Sample Population

The sample population was 32 graduate students who were also currently secondary teachers in Southeast Alabama. These participants were either pursuing a master's degree in education or taking the courses needed to progress from a temporary to a professional teaching certificate. The participants have enrolled in a secondary methods course taught in the evening via zoom for safety purposes. Concurrently participants were virtually teaching their students during the day via zoom also.

The racial demographics of the population were 64% White/Caucasian and 36% African American. There were 28 females and four males. The ages ranged from 21-46 years old. 10 participants had less than a year of experience in education, five participants had less than three years of experience in education, two participants had 5 years of experience in education, 10 participants had ten years of experience in education, and five participants had more than 15 years of experience in education. The sample population was teaching a subject area of math, science, history, art, or English language arts at a middle or high school. Six participants were teaching math, four participants were teaching science, four participants were teaching history, four participants were teaching art, and ten participants were teaching English language arts.

3.3. Quantitative Data

To collect the quantitative data, a survey was sent to participants via email using Google Forms. The survey was comprised of five items, not including the demographics, and addressed the two research questions. The survey asked which technology programs were

the most helpful in engaging students in a virtual setting, least helpful in engaging students in a virtual setting, easy to implement in a virtual setting, difficult to implement in a virtual setting, and programs they would like to know more about. Each question was multiple selection options including all the free technology programs covered (Kahoot, Google Docs, Socrative, Google Slides, Google Forms, Google Sheets, Edulastic, Go Formative, Classkick, Pear Deck, and Blooket), participants weren't limited to selecting a certain amount for each question. Multiple select questions allow the researcher to gain more understanding of their participants (Pollfish, 2021). The results of the survey revealed the perspectives of secondary teachers on programs that promoted student engagement and the difficulty of implementation.

3.4. Data Collection and Analysis

Before the survey was sent an expert panel was used to analyze the questions. The expert panel consisted of assistant and associate professors in the southern region of the United States with a doctorate degree in education with previous experience teaching in a secondary school. There were 10-panel members in total. The panel was given the opportunity to examine, question, and express any concerns involving the survey.

Once the data was collected, descriptive statistics were used on each question separately. Descriptive statistics helps to simplify large amounts of data in a sensible way for a simpler summary (Trochim, 2021). This helped answer the four research questions.

4. FINDINGS

Through an analysis of the data, the participant's perspectives on the most helpful programs for engaging were similar to the programs for easiest implementation. Vice versa, the programs least helpful for engaging students were similar to the programs for easiest implementation, and some of the program's students wanted to learn more about it.

4.1. Perspectives of Programs for Engaging Students

The perspectives of which programs were the most and least useful for engaging students in a virtual setting were the first two questions in the survey. The survey was given after participants had an opportunity to learn about each technology program and potentially implement it in their classroom. All participants responded to the question of which programs are the most helpful for engaging students in a virtual setting and a few participants selected more than one answer. The top three programs participants selected as most helpful when engaging students in a virtual setting were Kahoot, Google Slides, and Google Docs. Results can be seen in Table 1.

Table 1.
Participant Responses: Which program(s) are the most helpful when engaging students in a virtual setting? (select all that apply).

Programs	<i>n</i>	%
Kahoot	31	91.2
Google Docs	24	70.5
Socrative	7	20.6
Google Slides	27	79.4
Google Forms	17	50.0
Google Sheets	16	47.1
Edulastic	3	9.0
Go Formative	3	9.0
Classkick	2	5.9
Pear Deck	11	32.4
Blooket	7	20.6

The next question asked participants which program(s) are the least helpful when engaging students in a virtual setting. Not all participants answered the questions. Only 27 participants responded to the question however there were multiple responses for some participants. Table 2 shows the results, the top four programs participants selected as the least helpful when engaging students in a virtual setting were Edulastic, Go Formative, Socrative, and Classkick.

Table 2.
Participant Responses: Which program(s) are the least helpful when engaging students in a virtual setting? (select all that apply).

Programs	<i>n</i>	%
Kahoot	2	7.4
Google Docs	3	11.1
Socrative	12	44.4
Google Slides	1	3.7
Google Forms	3	11.1
Google Sheets	4	14.8
Edulastic	13	48.1
Go Formative	13	48.1
Classkick	11	40.7
Pear Deck	8	29.6
Blooket	1	3.7

4.2. Perspectives of Programs for Implementation

Questions three and four of the survey focused on which programs were easy or hard to implement in a virtual setting. All participants responded to question three about which programs were the easiest to implement in a virtual setting, most participants selected more than one answer. The most selected responses were from Kahoot, Google Docs, and Google Forms. Results are shown below in Table 3.

Table 3.
Participant Responses: Which program(s) are the easiest to implement in a virtual setting? (select all that apply).

Programs	<i>n</i>	%
Kahoot	34	100.0
Google Docs	28	82.4
Socrative	1	2.9
Google Slides	15	44.1
Google Forms	20	58.8
Google Sheets	12	35.3
Edulastic	5	14.7
Go Formative	10	29.4
Classkick	11	32.4
Pear Deck	8	23.5
Blooket	15	44.1

The fourth question asked about the programs that were difficult to implement in a virtual setting, it had a lower response rate of 25 participants. Again, some participants selected more than one answer. The results are below in Table 4. The top four programs the participants selected for hardest implementation were Edulastic, Go Formative, Socrative, and Classkick.

Table 4.
Participant Responses: Which program(s) are the hardest to implement in a virtual setting? (select all that apply).

Programs	<i>n</i>	%
Kahoot	0	0.0
Google Docs	4	16.0
Socrative	15	60.0
Google Slides	1	4.0
Google Forms	10	40.0
Google Sheets	11	44.0
Edulastic	18	72.0
Go Formative	15	60.0
Classkick	14	56.0
Pear Deck	10	40.0
Blooket	5	20.0

5. FUTURE RESEARCH DIRECTIONS

The last question on the survey asked participants which programs they wanted to learn more about. This question did not correlate to any research questions and had a response rate of 32 participants with some participants selecting multiple answers. The top program's participants wanted to learn more about was Classkick, Go Formative, Pear Deck, Edulastic, and Socrative. The results are below in Table 5.

Table 5.
Participant Responses: Which program(s) would you like to know more about? (select all that apply).

Programs	<i>n</i>	%
Kahoot	5	15.6
Google Docs	3	9.4
Socrative	15	46.9
Google Slides	4	12.5
Google Forms	3	9.4
Google Sheets	2	6.3
Edulastic	15	46.9
Go Formative	17	53.1
Classkick	19	59.4
Pear Deck	16	50.0
Blooket	4	12.5
Other	0	0.0

Table 5 addresses the future research directions. Even though the participants found the programs to be least engaging and/or difficult to implement they still want to learn more about them. The next step in the study is to provide more in-depth professional development training for those programs. Future research would focus on current teachers implementing free online programs and the integration of instructional methods for learning in virtual settings for teacher preparation programs.

6. CONCLUSION/DISCUSSION

As a whole, participants found some of the free online programs to be engaging and helpful in a virtual setting. Participants shared that the programs they found to be most engaging in a virtual setting were Kahoot, Google Docs, Google Slides, Google Forms, and Google Sheets. In addition to most engaging they shared that these programs, with the exception of Google Sheets, were the easiest to implement. These programs help eliminate purely lecture-based lessons, students are able to engage in their learning using various programs (Khan, Egbue, Palkie, & Madden, 2017).

Unfortunately, there were some programs participants found ineffective in a virtual setting. Participants shared that the programs they found to be least engaging in a virtual setting were Edulastic, Go Formative, Socrative, and Classkick. These programs were also selected as the most difficult to implement. In a virtual setting, programs need to be engaged but also user-friendly so it does not take time away from learning (Bowman, 2010). In addition to these four programs not being engaging and difficult to implement, the participants wanted to learn more about these programs, including Pear Deck. This data leads to the conclusion that the participants were not trained effectively on the program and it could have led to ineffective usage. Therefore, more time needs to be spent on delivering professional development for the programs the participants found nonengaging and difficult to implement. The lack of understanding surrounding the various programs could be preventing the various programs from being implemented correctly to help increase engagement in learning.

Nonetheless, participants were eager to learn various programs for engaging students in virtual learning. Despite their limited training with programs participants implemented them in their own virtual classrooms. This shows teachers are eager to learn and adapt new instructional practices, they just need the proper professional development training.

REFERENCES

- Bender, T. (2003). *Discussion-based online teaching to enhance student learning: Theory, practice, and assessment*. Stylus. https://doi.org/10.1111/j.1467-9647.2006.00283_8.x
- Blooket (2022). *Learning reimaged*. Blooket. Retrieved from <https://www.blooket.com/>
- Bowman, L. (2010). *Online learning: A user-friendly approach for high school and college students*. R&L Education.
- Clark-Ibanez, M., & Scott, L. (2008). Learning to teach online. *Teaching Sociology*, 36(1). <https://doi.org/10.1177/0092055X0803600105>
- Classkick (2022). *How does it work?* Classkick. Retrieved from <https://classkick.com/>
- Costanzo, E. S., Stawski, R. S., Ryff, C. D., Coe, C. L., & Almeida, D. M. (2012). Cancer survivors' responses to daily stressors: Implications for quality of life. *Health Psychology*, 31, 360-370. <http://dx.doi.org/10.1037/a0027018>
- Creswell, J. W. (2015). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Pearson.
- Creswell, J. W., & Plano Clark, V. L. (2007). *Designing and conducting mixed methods research*. Sage Publications
- Edulastic (2022). *Put every student on the path to success*. Edulastic. Retrieved from <https://edulastic.com/>
- Farah, A. & Barnett R. (2019, August 28). *The 3 biggest challenges of blended learning- and how to overcome them*. Alliance for Excellent Education. Retrieved from <https://futureready.org/the-3-biggest-challenges-of-blended-learning-and-how-to-overcome-them/>
- Formative (2022). *The data districts need. The platform teachers love*. Formative. Retrieved from <https://www.formative.com/schools-districts>
- Glasow, P. A. (2005, April). *Fundamentals of survey research methodology*. MITRE. Retrieved from https://www.mitre.org/sites/default/files/pdf/05_0638.pdf
- Google (2022). *Google workspace learning center*. Google Workspace. Retrieved from <https://workspace.google.com/features/>
- Hertenstein, E. (2020, October 1). *Educators feel overwhelmed by increased by the increased workload of distance learning*. Berkeley High Jacket. Retrieved from <https://berkeleyhighjacket.com/2020/features/educators-feel-overwhelmed-by-the-increased-workload-of-distance-learning/>
- Jaggars, S. S. (2014). Choosing between online and face-to-face courses: Community college student voices. *American Journal of Distance Education*, 28(1), 27-38. <https://doi.org/10.1080/08923647.2014.867697>
- Kahn, P., Everington, L., Kelm, K., Reid, I., & Watkins, F. (2017). Understanding student engagement in online learning environments: The role of reflexivity. *Educational Technology Research and Development*, 65(1), 203-218. <https://doi.org/10.1007/s11423-016-9484-z>
- Khan, A., Egnue, O., Palkie, B., & Madden, J. (2017). Active learning: Engaging students to maximize learning in an online course. *Electronic Journal of E-Learning*, 15(2), 107-115.
- Kahoot (2022). *How it works*. Kahoot. Retrieved from <https://kahoot.com/schools/how-it-works/>
- Linnenbrink, E. A., & Pintrich, P. R. (2010). The role of self-efficacy beliefs in student engagement and learning in the classroom. *Reading & Writing Quarterly*, 19(2), 119-137. <https://doi.org/10.1080/10573560308223>
- Meyers, S. A. (2008). Transformative pedagogy when teaching online. *College Teaching*, 56(4), 219-224. <https://doi.org/10.3200/CTCH.56.4.219-224>

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- Mobile guardian (2020). *9 Challenges of the Virtual Classroom*. Mobile Guardian. Retrieved from <https://www.mobileguardian.com/9-challenges-of-the-virtual-classroom/>
- Pear Deck (2022). *Pear deck for google slides*. Pear Deck. Retrieved from <https://www.peardeck.com/googleslides>
- Pollfish (2021). *Understanding the data in multiple selection questions*. Pollfish. Retrieved from <https://resources.pollfish.com/pollfish-school/understanding-the-data-in-multiple-selection-questions/>
- Ponto, J. (2015). Understanding and evaluating survey research. *Journal of the Advanced Practitioner in Oncology*, 6(2), 168-171. <https://doi.org/10.6004/jadpro.2015.6.2.9>
- Ponto, J. A., Ellington, L., Mellon, S., & Beck, S. L., (2010). Predictors of adjustment and growth in women with recurrent ovarian cancer. *Oncology Nursing Forum*, 37, 357-364. <http://dx.doi.org/10.1188/10.ONF.357-364>
- Schaffhauser, D. (2020, June 2). *Educators feeling stressed, anxious, overwhelmed and capable*. The Journal. Retrieved from <https://thejournal.com/articles/2020/06/02/survey-teachers-feeling-stressed-anxious-overwhelmed-and-capable.aspx>
- Schwartz, S. (2020, November 16). *Survey: Teachers and students are struggling with online learning*. Education Week. Retrieved from <https://www.edweek.org/teaching-learning/survey-teachers-and-students-are-struggling-with-online-learning/2020/11>
- Schwartz, S. (2020, August 5). *How to make lessons cohesive when teaching both remote and in-person classes*. Education Week. Retrieved from <https://www.edweek.org/ew/articles/2020/08/06/how-to-make-lessons-cohesive-when-teaching.html>
- Socrative (2022). *Meet Socrative*. Socrative. Retrieved from <https://www.socrative.com/>
- Spencer, J. (2020). *The real issue isn't student engagement*. John Spencer. Retrieved from <https://spencerauthor.com/student-ownership-online/>
- Terada, Y. (2019). *Students think lectures are best, but research suggests they're wrong*. Edutopia. Retrieved from <https://www.edutopia.org/article/students-think-lectures-are-best-research-suggests-theyre-wrong>
- TopClass (2021). *9 ways to increase online student engagement*. TopClass LMS by WBT Systems. Retrieved from <https://www.wbtssystem.com/learning-hub/blogs/9-ways-to-increase-online-student-engagement>
- Trochim, W. M. K. (2021). *Descriptive Statistics*. Conjoint.ly. Retrieved from <https://conjointly.com/kb/descriptive-statistics/>
- Williams, C. (2021, February 22). *Virtual learning professional development for teachers*. Center for Student Achievement Solutions. Retrieved from <https://www.csas.co/virtual-learning-professional-development-for-teachers/>

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Chapter # 40

EXAMINING THE FACTORS INFLUENCING ENGLISH TEACHING AND LEARNING IN RURAL SETTINGS THROUGHOUT EUROPE AND THE UNITED STATES

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ABSTRACT

This chapter examines English learning environments and methods in rural settings in Europe and the United States, assessing their contributions to language learning, both written and spoken. Educational systems are compared and contrasted, including two different styles of English education structured in a comparative analysis using five focal areas. These focal areas are expanded to include the definition and structure of rural education, English language learning modalities, linguistic environment, educational outcomes, and indicators of success. The opportunity to investigate the experiences of teachers who are active in rural communities and focus on the multidimensional aspects of the education of multilingual learners provides valuable information that contributes to expert teaching and learning and bridges the gap between educating rural and urban populations of students. Embracing English language learning, new technologies, and initiating change through proactive educational strategies including a paradigm shift to incorporate a translanguaging pedagogy for emergent English speakers will lead to relevant and purposeful accomplishments in rural school settings.

Keywords: rural education, multilingual English learners, comparative research.

1. BACKGROUND AND INTRODUCTION

Often definitions of education and accompanying strategies for reforms do not capture the landscape or address the specific dimensions of the setting and environment. Rural education is defined in the United States as follows, “A rural school is in a census-defined rural territory that is anywhere from less than five miles to more than 25 miles from an urbanized area” (National Center for Education Statistics, 2022). The challenges that accompany schools in rural areas are distinctly different from educational settings and schools in urban and suburban locations. The expectations vary considerably and so do the participants in each educational endeavor. The recent events of the Covid pandemic have shattered the normalcy associated with educational endeavors and required creative and innovative means globally to strengthen traditional educational programs, often moving English teaching programs online and to virtual platforms. Rural areas that may not have the technology or bandwidth for online coursework are particularly impacted by a lack of resources and qualified educators. Often definitions of education focus on urban expectations and do not capture the entire landscape that includes and values rural educational environments. It is often acknowledged that education and the opportunity to learn in an educational setting is tantamount to economic prosperity. While the educational attainment in rural areas has improved, it continues to lag struggle compared to urban areas, and it is crucial that we invest in rural education across the globe. Schools in rural settings certainly do more than provide educational opportunities during the school day. They are often integral parts of the community and serve as gathering places for social, recreational, and cultural

endeavors. Therefore, home-school partnerships are critical to success and educational outcomes can be strengthened by positive school, community, and family relationships. Rural schools are also key to providing employment for members of smaller towns and villages.

English language learning throughout the United States and Europe is an ongoing factor linking leadership, teacher education and a wide range of intellectual disciplines. English language teaching in rural areas has a unique set of challenges and provides an overarching opportunity to impact success and serve as a catalyst for the expansion of learning. Strong programs in English language teaching in rural settings leading to quality educational experiences designed to meet the unique needs of learners are particularly valuable. Successfully delivering programs in English language acquisition in rural schools has become a challenging endeavor that is critical to the future of young people. Green and Corbett consider this topic by addressing the four areas of a) conceptualizing rural literacies, b) literacy/pedagogies, c) place and sustainability, and d) mobilities and futures (Green & Corbett, 2013). The goal of this study focuses on investigation and implementation of quality instructional programs in English language acquisition (English as a Second Language or ESL in the United States and English as a Foreign Language or EFL in Europe) that provide numerous opportunities and meet the needs of students in rural schools. This study will evolve into an in-depth investigation to provide detailed data regarding the educational outcomes and indicators of success in a comparative study with multilingual learners. How do these programs help students in rural settings speak, read, write, and understand English to communicate more effectively? In a recent publication, the author and a colleague discussed at length the challenges of rural education in the State of Idaho (Peralta & Boothe, 2021). Meeting with education leaders from multiple locations, in person and online, particularly those from rural settings will establish working relationships for future research and information gathering.

2. METHODOLOGY

This manuscript represents the initial stages of a comprehensive and ongoing study that utilizes a multi-case design for the purpose of conducting comparative research in English language learning in rural schools in Europe and the United States. Authentic accounts and visits to assess English language learning in rural schools are gained through interviews of educational leaders, observations, and review of selected relevant literature. The level of education and target areas considered range from age five through university. Further collaboration with colleagues at Boise State University and throughout Europe and the USA will lead to in-depth exploration of the topic and systematic collection of data. Additionally, presentations at professional meetings will provide opportunities to gain further access to resources, methodological tools, and best practices. The pedagogical potential including meaningful research opportunities and analytics, as well as strategies for educators to frame best practices focused on the diverse learning needs of rural students strengthens success. The data will be used and analyzed to construct a matrix comparison between the two learning environments.

3. DEFINITION AND STRUCTURE OF RURAL EDUCATION

Rural settings as well as English acquisition differ widely between the United States and individual European countries and the linguistic environment is unique in each location. Rural education in the United States has been described in numerous ways. The focus is on students attending schools and living in a rural setting with fewer than 600 students in the school district or 2,500 people living in the town (Rural education at a glance, 2021).

Rural is considered by the U.S. Census Bureau as all population, housing, and territory not included within an urbanized area or urban cluster (Ratcliffe, M. et. al., 2016). For example, four in ten public schools in the state of Idaho are located in rural communities and almost one in four students attend a school located in a rural district. Statewide, 72.9 percent of the districts are considered rural (Idaho State Department of Education, 2020). This is just one example of a state in the United States with a significant rural population and the educational challenges that impact and have a tremendous effect on student achievement including English language learning. Heller points out that rural students make up at least 20% of public school enrollments in the United States, yet continue to be marginalized, and rural areas often generate low tax revenues, and therefore cannot afford to pay teachers competitive salaries (Heller, 2022). Rural schools continue to experience a variety of educational challenges that directly affect student academic progress. Rural communities tend to be poor, and a considerable number of their families are experiencing homelessness, but “relatively few students qualify for specialized educational instruction.” (Stockard, J., 2011). Teachers in rural communities often operate in isolation, salaries are low, and they tend to lack educational opportunities due to geographical isolation (Showalter, Hartman, Johnson, & Klein, 2019). Indeed, the need to improve their teaching skills has been clearly documented. According to the *Why Rural Matters* 2018-2019 report, the school population in Idaho’s rural districts is “a mixed bag” in terms of diversity (Showalter et. al., 2019). The national average per rural pupil is \$6,367. Idaho rural expenditure per pupil is \$4,118” (Showalter et. al., 2019). This does not represent adequate funding to meet the needs of these students and provide quality educational services, particularly considering that many of these diverse students need additional assistance with English language acquisition and their teachers need further professional development and resources (Peralta & Boothe, 2021). In the states of New Mexico and Arizona, a very unique situation exists on the Navajo Reservation where there are over 150 schools according to the Bureau of Indian Affairs (Navajo Nation Department of Dine Education, 2022). The focus and educational mission of the Navajo Nation is to promote and foster lifelong learning for the Navajo People, and to protect the cultural integrity and sovereignty of the Navajo Nation. Many of these schools are located in rural areas and homes may lack electricity or running water. The Covid pandemic took a serious toll on the Navajo families because they tended to live in groups with many members and generations residing in the same household. Often attending school is difficult for children in rural areas who lack transportation and may not have access to technology and the internet.

In Europe, studies have been conducted to address rural education and the impact on learning. Europe certainly cannot be categorized as one location since unique circumstances exist within each country and educational system. The book *Educational Research and Schooling in Rural Europe: An Engagement with Changing Patterns of Education, Space and Place* (Gristy, Hargreaves, & Kučerová, 2020) discusses and outlines the effects of the revolutionary political reform experienced in the past half century on rural education in Europe from a variety of perspectives and educational settings. The information provided and reforms addressed include the liberation of the Baltic and Eastern European states from Soviet communist domination, the ‘eurozone’ economic crises, and the current and future migration of people fleeing war and poverty from the Middle East and Africa. The authors point out that “trapped in this distal whirlwind of change are thousands of small and/or rural elementary schools and the life chances of thousands of young children” (Gristy et. al., 2020). Unfortunately, based on recent developments in Ukraine, another chapter of tumultuous challenges is facing Europe fraught with a multiplicity of tragic circumstances certain to reshape and redefine education.

4. ENGLISH LANGUAGE LEARNING MODALITIES AND LINGUISTIC ENVIRONMENT

In the United States, numerous programs exist within school districts to provide quality programs for English language learning from ages 5 through 18. Throughout the country, it is the belief that every student should know how to read, write, speak, listen and use language effectively. The Idaho State Department of Education supports this philosophy by providing professional development, instructional strategies, and resources for Idaho educators to accomplish these goals. However, it is often up to school districts to support this learning by funding programs and opportunities for multilingual learners to excel and succeed. In the states of Arkansas and Georgia, limited funding is available to provide the additional resources needed by rural school districts. Often, this comes down to funding formulas and availability of resources to support English acquisition programs within each state or district. Rural districts function on considerably less resources than the larger urban districts. It is difficult to find educators in rural districts who hold endorsements in bilingual or English as a New Language (ENL) teaching. At the university level, Colleges of Education must work together within a shared leadership team to address the challenges and opportunities that must be addressed to serve teachers and students grappling with English language learning in rural settings (Snow, Martin, Osguthorpe, Coll, & Boothe, 2011). Resource limitations will require creative and innovative steps to strengthen existing programs and introduce new ones. Federal grant programs such as the Rural Endorsement Development Opportunities project at Boise State University in Idaho provide funding for professional development for educators to add an English as a Second Language or Bilingual endorsement to their Idaho teaching certification. However, obtaining federal grant funding is extremely competitive and larger school districts or universities who can afford paid professional grant writers often land on top when the money is being allocated. Educators in rural areas are tasked with a multiplicity of diverse responsibilities and find it difficult to spend the time writing competitive grants that they may not receive while completing all the other responsibilities associated with their profession. Students and classrooms come first, and the tremendous amount of time and effort required for competitive grant writing is difficult to achieve.

Educators throughout the United States realize that English language proficiency is based on the four modalities of listening, speaking, writing, and reading, and they focus on determining individual student needs in each area to challenge students and encourage them to excel and become proficient in each of these areas. It isn't enough just to teach these individual strategies, but educators must become culturally responsive and relate positively to students encouraging them to excel by lowering the affective filters. The use of technology to strengthen language learning and incorporate interesting tasks and methods can be a tremendous asset. English language learners from non-English speaking nations are confronting an increasingly challenging environment as they try to develop language skills to meet the competing demands of contemporary social media on one hand and those of English for Specific Purposes (ESP) on the other. Social media's explosion onto the global scene has created the need for non-English speakers to in effect learn two diverging contextual and communication patterns within what is supposed to be a common language. English, at least a form of English, dominates social media communications on Twitter, Instagram, Facebook, and a whole host of abbreviated format international social media platforms. Moreover, these platforms have developed communications mechanisms that do not even conform to normally accepted, conversational patterns of spoken or written English. The English of some social media platforms is informal, littered with special and unique

abbreviations, grammarless, decidedly unstructured, and abruptly short. The vocabulary is explicitly simple in most cases, consisting mostly of one and two syllable words. The introduction of the “emoji” graphics (now totaling over 2600 according to Unicode Standard, the emoji lexicographer) has added image elements to the phonetic root language vocabulary and the near total lack of punctuation, complicates the process of learning to communicate effectively to other than a select audience or specific groups of people. (Boothe & Wickstrom, 2019). By teaching language skills across the curriculum, students can strengthen their knowledge and understanding of English in a variety of subject areas and topics. Using multiple modalities of teaching and learning will support a variety of learners all with unique learning styles that will help them relate and gain language proficiency. Some students are visual learners and will benefit from visual clues while others may be auditory or kinesthetic learners. Best practices for challenging English language learners in Idaho include focusing on students’ educational needs. In addition to the strategies mentioned above, educators need to speak slowly and patiently wait for responses. Students need time to think through what they are speaking and writing. When they feel comfortable asking questions, English acquisition will come easier. By incorporating students’ native languages and valuing their experiences at home, they will be encouraged to tackle the challenges of learning English. Rural schools may not have the technology or labs that are found in urban settings, but many of these strategies can be incorporated into lessons and will highly benefit English language learners.

In the rural areas of Europe, the dynamics and linguistic environment are certainly different because the purpose for learning English is not the same as in the United States. Students continue to use their home language throughout the day and the use of English is an additional asset that they are endeavoring to acquire. The pressure associated with being thrust into a new setting and surrounded by English on a permanent basis is not present in Europe. The disadvantage is that they do not have the reinforcement of being surrounded by the English language and must rely on English speaking counterparts along with teachers and texts or computer programs in English. In rural areas of Europe with limited budgets and supplies, the teachers often do not speak English as a native or dual language and are also limited in their English-speaking abilities. Materials may not be accessible and professional development to strengthen educators’ knowledge of instructional strategies is not always available in rural areas. In Norway and Finland, globalization has strongly impacted rural education. Legislative changes in both countries have transferred power to local municipalities and rural villages and communities are willing to fight hard to retain their local schools. (Solstad & Karlberg-Granlund, 2020). Post socialist decentralization in Poland significantly affected the operation of rural schools and transformed the supervision of schools to local governments (Bajerski, 2020). Meanwhile, the ongoing events in Ukraine and neighboring countries continue to impact daily priorities. The affective domain is a strong determinant in language learning, and if students are surviving amid tension and strife, it is difficult to focus on studies. If there are psychological factors intervening with issues such as fear, safety, hunger, grieving for the death of a loved one, or the insecurities of war and displacement, then education takes a back seat to survival.

5. EDUCATIONAL OUTCOMES AND INDICATORS OF SUCCESS

In order to ascertain the impact of any program, it is first necessary to establish objectives that are more than just aspirational indicators but can measure student learning and expectations for students and instructors. These critical measures of the ability of rural schools in Europe and the United States to guide English learners are essential to determine

the success of programs. Clearly, these objectives will vary based on the vision and goals for each program. Critical measures to analyze programs and activities are helpful indicators of outcomes for English speaking programs in educational settings in Europe and the United States. It is important to consider the quality and impact of each program including the transformative experiences gained. Collecting data on rural schools is a strategic process and comparing diverse settings is challenging. Comprehensive standards-based measurement tools exist in both the United States and Europe, although they differ significantly in their content and scope. As student gains are measured on standardized tests in the United States, it is possible to gain a better understanding of the successes and challenges experienced by rural schools. As programs are analyzed and data is gathered in rural schools throughout Europe, it will be possible to measure the impact of English teaching programs in rural European settings.

Multilingual learners provide excellent opportunities for educators to strengthen their instructional skills, confidence and outreach to students, families, and the community particularly in rural settings. The interrelatedness of the school, home and community is complex and key to student success. Students and teachers in rural communities are often challenged by a variety of unique and diverse factors, and classroom teachers must address unique situations to make a significant impact by taking approaches that will meet the wide range of student needs—cognitive and affective. To engage students, rural educators are moving beyond the standard methodologies and best practices within the classroom to provide high levels of student achievement through outreach and making positive connections. TEFL/TESL teachers are expected to meet a multiplicity of student needs in rural areas and getting to know the community and students' families provides insight that will help build relationships and strengthen educators' knowledge, skills and dispositions.

6. FUTURE RESEARCH DIRECTIONS

As this study expands and develops through visits to rural areas in Europe and the United States including interviews with educators and students who are engaged in English language learning, the data will multiply, and the picture will come into clearer focus. What is known at this point, is that the number of English language learners in the United States and throughout Europe is on the rise, the need for increased funding and resources is clear, and the value of professional development for these educators is significant in order to provide equal educational opportunities. Teachers must address the challenges presented by a diverse multicultural population. Not only academic, but physical, social, and emotional needs must be taken into consideration when developing curricula and instructional strategies and we must work to preserve the cultural identity of our diverse multilingual learners (Myers & Boothe, 2000). There are certainly methodological limitations and intervening variables that will need to be addressed as we pursue further research and focus on strengthening English teaching and learning in rural areas. The ideas expressed in this chapter and in earlier publications have potential for expansion and further development into a series of specifically crafted chapters tailored to further examination of the factors influencing English teaching and learning in rural settings throughout the United States and Europe. Authentic accounts and ongoing study that utilizes a multi-case design for the purpose of conducting comparative research in English language learning in rural schools in Europe and the United States will provide valuable knowledge as we pursue this topic in further detail.

7. CONCLUSIONS/DISCUSSION

There is limited information or longitudinal data examining the factors relating to teaching English in Europe and the United States and making comparisons regarding the two settings is challenging. It is certainly time to explore the ongoing strengths and challenges of each setting and determine how to learn from the strategies incorporated in order to serve students in both settings. It is understood that students in rural settings in Europe and the United States often do not receive the same rigorous educational experiences and opportunities as students in urban areas due to funding, resources, technology, and availability of educators who have received the support and professional development needed. By developing pedagogical methods specifically addressing rural education and the increasingly diverse needs of students in rural schools, it is possible to address the distinctly different points of view and needs of rural English education in Europe and the United States and challenge them to new levels of learning. In both the United States and Europe, there is an ongoing need to serve refugee and migrant students that are entering many countries in large numbers. Educators are seeking to serve and provide quality programs for all students that will meet their needs and challenge them to excel. By connecting research, education, and professional development, it is possible to bring best practices and optimal experiences to English language learners in rural settings so that they can realize their dynamic potential.

REFERENCES

- Bajerski, A. (2020). Rural schools in Poland in the period of post-socialist decentralization and demographic decline. *Educational Research and Schooling in Rural Europe: An Engagement with Changing Patterns of Education, Space, and Place*. Charlotte, N.C.: Information Age Publishing. <https://doi.org/10.1007/s11159-021-09916-8>
- Boothe, D. & Wickstrom, C. (2019). Young professional ESOL learners confront competing demands of social media and ESP. *Cognitive Science-New Media-Education*. 5(1), 55-64. <https://doi.org/10.12775/CSNME.2018.011>
- Green, B. & Corbett, M. (2013). *Rethinking Rural Literacies: Transnational Perspectives*. New York, New York, Palgrave Macmillan.
- Gristy, C., Hargreaves, L., & Kučerová, S. (2020). *Educational Research and Schooling in Rural Europe: An Engagement with Changing Patterns of Education, Space, and Place*. Charlotte, N.C.: Information Age Publishing. <https://doi.org/10.1007/s11159-021-09916-8>
- Heller, R. (2022). Time to invest in rural education. *Spotlight on Rural Education*. *Kappan*. 103(4), 4. Idaho State Department of Education, 2020. *Consolidated State Performance Report Part I, School Year 2019-2020*.
- Myers, J. & Boothe, D. (2000). *Cultural and language diversity in the middle grades*. The Clearinghouse. 73(4). <https://doi.org/10.1080/00098650009600958>
- Navajo Nation Department of Dine Education (2022). Retrieved August 31, 2022 from <https://www.navajonationdode.org/about-dode/>
- National Center for Education Statistics (NCES). (2022). Locale Classifications and Criteria. Retrieved December 30, 2022 from <https://nces.ed.gov/surveys/annualreports/topical-studies/locale/definitions>
- Peralta, C., & Boothe, D. (2021). Rural endorsement development opportunities program: Culturally responsive professional development. *ICT for Language Learning*. 14(1). Florence, Italy: Filodiritto Editore. http://doi.org/10.26352/GY10_2384-9509
- Ratcliffe, M., Burd, C., Holder, K. & Fields, A. (December, 2016). *Defining Rural at the U.S. Census Bureau*. Retrieved March 1, 2022 from <https://www.census.gov/library/publications/2016/acs/acsgeo-1.html>

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- Rural education at a glance. (2021). *US Economic Research Service*. Retrieved March 3, 2022 from <https://www.ers.usda.gov/topics/rural-economy-population/employment-education/rural-education/>
- Showalter, D., Hartman, S., L., Johnson, J., & Klein, B. (2019). *Why Rural Matters 2018-2019. The Time is Now*. A Report of the Rural and Community Trust. Retrieved February 10, 2022 from <http://www.ruraledu.org>
- Snow, J., Martin, S., Osguthorpe, R., Coll, K., & Boothe, D. (2011). Telling the story of a teacher education shared leadership team: Insights, challenges and connections to outcomes. *Annual Meeting of the American Association for Colleges of Teacher Education*. Available at http://works.bepress.com/jennifer_snow/31/
- Solstad, K. & Karlberg-Granlund, G. (2020). Rural education in a globalized world: The cases of Norway and Finland. *Educational Research and Schooling in Rural Europe: An Engagement with Changing Patterns of Education, Space, and Place*. Charlotte, N.C.: Information Age Publishing. 49-76.
- Stockard, J. (2011). Increasing reading skills in rural areas: An analysis of three school districts. *Journal of Research in Rural Education*. 26(8). Retrieved October 1, 2022 from <http://jrre.psu.edu/articles/26-8.pdf>

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Chapter # 41

APPLYING INQUIRY-BASED LEARNING INTO PRACTICE: A CASE STUDY OF ONE RURAL SOUTH AFRICAN PHYSICAL SCIENCES TEACHER

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ABSTRACT

The South African secondary school curriculum expects teachers to adjust their ways of teaching to include activities that involve learner participation. However, there is little to no support that is aimed at developing in-service teachers' effective inquiry-based practises from the Department of Basic Education (DBE). Therefore, this mixed-method research aimed to investigate whether Physical Sciences teachers' beliefs about inquiry-based learning transpired in their teaching. A quantitative method was used to determine the teachers' beliefs about inquiry and a qualitative method was used to analyse the selected teacher's classroom pedagogical practices and provide insights into whether their beliefs about inquiry translated into their teaching practices. An adopted version of the Science Curriculum Implementation Questionnaire (SCIQ) was used to determine the teachers' beliefs while an Electronic Quality of Inquiry Protocol (EQUIP) was used to evaluate the selected teacher's pedagogical practices. The findings of this study indicate that the Physical Sciences teachers in the Zululand District generally had a positive belief about inquiry-based learning. However, the selected teacher's pedagogical practices did partially reflect their beliefs about inquiry. The qualitative method it was found that the selected teacher was centred within developing inquiry (Level 2).

Keywords: inquiry-based learning (IBL), in-service teachers, professional development.

1. INTRODUCTION

Over the past two and a half decades, the South African school curriculum underwent numerous reforms. The first official post-democratic curriculum was called Outcomes-Based Education (OBE)/Curriculum-2005, followed by a revised national curriculum statement (RNCS) and currently the curriculum assessment policy statement (CAPS) (Russell, Sirota, & Ahmed, 2019). All these curriculum changes over the years had different expectations for science teachers' pedagogical practices. Despite these curriculum changes, the country continues to perform worse in Physical Sciences and Mathematics annually (Naidoo & Sibanda, 2020). In the year 2021, only 18% of the Physical Science Grade 12 cohort who wrote their final year examinations passed and out of which only 15% passed with over 60%. This means, 4 out of every 100 Physical Sciences Grade 12 learners got 60%. This raises concerns because Physical Sciences is one of the subjects essential for STEM careers globally. As an attempt to alleviate the situation, the DBE through the CAPS document developed specific aims that are intended to encourage teachers to modify their teaching strategies. The inquiry-based approaches are used to advocate or to stimulate learner participation with the hope to improve the secondary school pass rate. Specific aims are teachers' guidelines on preparing learners to meet the challenges of society (DBE, 2011). CAPS comprises of three Specific Aims and inquiry-based learning is under specific aim 2

and the purpose of specific aim 2 as stipulated in the CAPS, is to encourage teachers and learners to develop (i) the construction and application of scientific and technological knowledge (ii) promote knowledge and skills in scientific inquiry and problem-solving, (iii) and an understanding of the nature of science and its relationships to technology, society, and the environment (DBE, 2011). All the above-mentioned skills are considered core skills for scientifically literate citizens (Mokiwa, 2014; DBE, 2011) and the adoption of inquiry-based learning is viewed as one of the possible solutions when teaching Physical Sciences as stipulated by the CAPS curriculum. Several countries support the adoption of inquiry-based learning (IBL) approaches by teachers as a pedagogical approach. The approach is suitable to motivate and stimulate learners' interest in science, develop their conceptual understanding, and motivate teachers to teach science and the nature of science (Minner, Levy, & Century, 2010).

Although there has been growing advocacy for IBL, teachers in South Africa are still struggling to implement this approach due to the variety of factors including not enough teaching time, dilapidated infrastructure, and lack of school resources to mention just a few. In South Africa, almost 60% of schools are poorly resourced. As part of the DBE's classification system, schools are categorised based on their socio-economic factors which fall under five quantiles (Hall, Leatt, & Rosa, 2009). Generally, schools which fall under quantile one to three do not charge tuition and are usually in impoverished areas (60%), while those in quantile four to five are private schools and are normally located in affluent areas (40%). This study was conducted in the Zululand District which accounts for 16% of the Kwa-Zulu Natal province territory, making it the largest District in the province. It is a predominantly rural district, about half of the area is under the jurisdiction of traditional authorities, whereas the rest is privately owned or protected. Due to this, most of the schools in the Zululand District are classified under the quantile one to three and they do not have adequate resources and/or infrastructure. Therefore, this is one of the reasons we decided to investigate the study of this nature in the rural areas because there are limited studies conducted in the rural areas in South Africa.

A study conducted by Ramnarain and Hlatshwayo (2018) in the rural schools of Mpumalanga province in South Africa with similar contextual and socio-economic factors to this study found that the Physical Sciences teacher had positive beliefs about the implementation of IBL. However, they did not know where to start, and contextual factors were among factors that hindered them to adopt inquiry-based learning. To solve this challenge, we decided to develop and facilitate a two-day cycled teacher training workshops in the Zululand District as an attempt to assist science secondary school teachers on how to implement IBL in their teaching environments. On the first day of the workshop, teachers were asked to respond to a questionnaire which aimed at eliciting their beliefs about IBL. Then they remaining time were spent training teachers on how to adopt inquiry-based pedagogies in their lessons using a repertoire of strategies which extensively drew from the improvisation framework, as we were considering their poorly resourced teaching contexts. To provide rich insights for the purpose of this research, we selected one teacher to conduct classroom observations as a follow-up method to establish whether their beliefs were in line with their classroom practices. As a result, this research mainly focused on IBL questions and pedagogical practices. Thus, the following research questions sought to guide this study:

- i. What are the Physical Science teachers' beliefs about the implementation of inquiry-based learning in their classrooms in the Zululand District?
- ii. Do the classroom teaching practices of the Physical Sciences teacher in the Zululand District reflect their beliefs about inquiry-based learning?

1.1. Defining Inquiry-Based Learning (Ibl)

IBL is a widely researched area across various disciplines (NGSCC Lead States, 2013; National Research Council, 2012). Thus, the National Research Council (NRC) (1996) defines IBL as activities where learners develop knowledge, understand scientific ideas, and understand how scientists study the natural world in their everyday lives. In an IBL environment, learners use experimental evidence to review what is already known. To achieve this, they use tools to gather, analyse and interpret data, propose answers, explanations, predictions, and communicate the results (NRC, 1996). IBL as an approach involves asking questions, coming up with hypotheses, empirical data collection, and making inferences and conclusions based on the data (NRC, 2007). The NRC (2011) listed five IBL features in a science classroom, these features include: (i) learner participates in scientifically orientated questions, (ii) prioritises evidence in responding to questions, (iii) uses evidence to formulate explanations, (iv) connects explanations to scientific knowledge, and (v) communicate and justifies explanations. That is why the 5E cycle learning model (CLM) has been widely used within science education research and in other fields as well (Asrizal, Yurnetti, & Usman, 2022). The 5E CLM contains the five key components of inquiry-based instruction which include: Engage, Explore, Explain and Extend/Elaboration and Evaluation which are all deemed crucial in fostering inquiry-based teaching and learning practices. Recently, there has since been advancements leading to development of the 4E X 2 Model. The 4E X2 Model was conceptualised using three key learning theories which involve (i) reflective practises (ii) inquiry-based instruction and (iii) formative assessments, which all have been proven effective in improving learners' conceptual development of scientific concepts during inquiry-based practises (Poti, Dudu, & Sebatana, 2022; Marshall et al., 2016).

Adopting IBL in a science classroom allows teachers to act as facilitators while learners become more self-directed. Learners are encouraged to come up with new knowledge independently, formulate and test hypotheses (Ramnarain & Hlatshwayo, 2018), promote autonomy and encourage learners to actively construct knowledge (Ramnarain & Hobden, 2015; Levy & Petrulis, 2012). Ramnarain and Hlatshwayo (2018) shows the importance of IBL and why it is strongly endorsed by the South African secondary school curriculum. However, in South Africa, IBL is still an unfamiliar territory and teachers are uncomfortable implementing this approach in their lessons (Ramnarain & Hlatshwayo, 2018; Ramnarain, 2016). Therefore, this research thought it was vital to establish the Zululand District Physical Sciences teachers' beliefs about IBL and their pedagogical practices since the CAPS endorses this approach in science lessons. Furthermore, inquiry-based learning can be adapted to address cultural relevance, incorporate local cultural knowledge and perspectives, which can make the learning more relevant and meaningful to learners in the rural areas.

2. TEACHER BELIEFS ABOUT INQUIRY-BASED LEARNING

The purpose of this research was to explore science teachers' beliefs regarding the use of IBL in the Zululand District. Calderhead (1996) defines beliefs as "suppositions, commitments, and ideologies that teachers have about their learners' learning of the subject matter" (p.715). Research on beliefs is important for the implementation of IBL since they influence teachers' pedagogical reasoning and instructional practices (Sikko, Lyngved, & Pepin, 2012). It is generally impossible to observe or measure beliefs directly, therefore, only what people say and do can be used to infer their beliefs (Pajares, 1992). If teachers' core beliefs are incompatible with inquiry-based pedagogies, they may serve as barriers to the use of inquiry as a teaching and learning strategy in their classrooms (Binns & Popp, 2013).

Correia and Harrison (2020) examined how secondary science teachers' beliefs about inquiry-based learning influence their formative assessment practices. They found that teachers who positioned themselves as facilitators adopted more open-guided inquiry-based approaches, whereas teachers who positioned themselves as shepherds adopted direct or traditional inquiry-based approaches. Hence, Ramnarain, Nampota and Schuster (2016) insinuate that how teachers teach is usually embedded in their belief systems. Although teacher beliefs and classroom practices appear to have strong links, the relationship between them is not linear (Correia & Harrison, 2020). This study was conducted because of this reason, to find out if the teachers' beliefs about inquiry-based approaches also manifested in their classroom practices.

3. INQUIRY-BASED APPROACH IN PRACTICE

As previously stated, there is a push in South Africa for more flexible school-based curriculum that draw on inquiry-based pedagogies rather than rigid, fixed curricula. As compared to other pedagogies, the IBL approach is believed to have more advantages (Correia & Harrison, 2020). According to Tan, Ong, Ng, and Tan (2022), there are four distinct types of IBL-related practices namely: (i) structured inquiry approach (a sequential process approach to inquiry-based learning) (ii) open-ended inquiry approach (a more learner-led approach to inquiry-based learning), (iii) problem-based inquiry approach (a problem-solving approach to inquiry-based learning) and (iv) guided inquiry approach (a more teacher-led approach to inquiry-based learning). Researchers active in this field have frequently reported that most teachers believe that these various IBL approaches would benefit their teaching and professional development (Correia & Harrison, 2020; Ramnarain & Hobden, 2015). Some studies have shown that teacher beliefs and classroom practices do not always align, which means that teaching science is not always translated into practice because of intrinsic and extrinsic factors (Friedrichsen & Dana, 2003). A study by Dai, Gerbino and Daley (2011) sought to determine whether Chinese middle and high school teachers follow an inquiry-based approach. They found that teachers are open to inquiry-based pedagogy, but they faced practical challenges when implementing it. Ramnarain and Hlatshwayo (2018) also examined teacher beliefs about IBL and their practice of inquiry in Grade 10 Physical Science classes in South Africa. In their survey, teachers were reported to have a positive attitude toward inquiry, however, various extrinsic and intrinsic factors contributed to challenges in enacting inquiry-based approaches in their teaching and learning contexts.

The influences of intrinsic and extrinsic factors are explained by Bronfenbrenner's ecological theory of development (1979). The extrinsic factors include cultural and physical aspects of the location where people live, as well as social aspects. The factors listed above are related to contextual factors found at school or in the curriculum implementation processes, and these are lack of resources, time, school culture, professional support, classroom management, class size, school type, and content coverage (Ramnarain et al., 2016; Lewthwaite, 2006). Intrinsic factors are associated with personal attribute factors, they are professional science knowledge, science teaching efficacy, science teaching interest and motivation, teacher content knowledge, and pedagogical beliefs (Ramnarain et al., 2016; Lewthwaite, 2006), subject matter knowledge (Abell, 2007; Gess-Newsome, 1999). Therefore, contextual factors can greatly influence the implementation of inquiry-based learning by teachers at schools.

4. METHODOLOGY

This research adopted a sequential mixed method approach (Creswell, 2014). During the teacher development workshop in Zululand District, KwaZulu Natal, South Africa, a questionnaire comprising different items was administered to Physical Sciences teachers. The questionnaire was completed by twenty-three (23) Physical Sciences teachers, with an average teaching experience of a few years to more than twenty-five (25) years. All the teachers taught in overcrowded classrooms and in schools where there were no laboratories. Figure 1 shows how the workshops were conducted.

Figure 1.
Example of how the physical science teachers work collaboratively in one of the workshops.



The workshops were specifically designed using an inquiry-based approach where teachers were positioned as learners so they could experience the benefits of this approach first-hand. The study purposefully and conveniently selected one ‘novice’ or beginning teacher, ‘Mr. Motsapi’ (pseudonym) for two classroom observations (two months apart) since his school was more easily accessible to us. Mr Motsapi has a Bachelor of Education degree and two (2) years teaching experience.

As earlier mentioned, an adapted version of the Science Curriculum Implementation Questionnaire (SCIQ) was used for quantitative data (Lewthwaite, 2001), now called the Scientific Inquiry Implementation Questionnaire (SIIQ). Several research publications have used the SCIQ to evaluate factors affecting science program delivery in Australian, New Zealand, and Canadian schools (Lewthwaite, 2004; Ramnarain, 2016). The SCIQ has forty-nine items, but only fifteen were selected as they were more aligned to the study’s objectives. The fifteen selected SCIQ item statements which the teachers had to respond were on a 5-point Likert scale that ranged from 1 (strongly disagree) to 5 (strongly agree). Taking into consideration that the same instrument was used in South Africa by Ramnarain (2016), therefore, a piloting study was not obligatory. So, to determine the general trends in

the Physical Sciences teachers' beliefs about inquiry, descriptive statistics, i.e., mode/median scores and percentages, were computed.

To evaluate teachers' classroom practices qualitatively, an electronic quality of inquiry protocol (EQUIP) was adopted (Marshall, Smart, & Horton, 2010). The EQUIP consist of four underlying constructs: Instruction, Curriculum, Interaction, and Assessment. This instrument was then used to observe Mr Motsapis' recorded classroom pedagogical practices. The EQUIP tool was particularly deemed as a suitable instrument because they are considered a reliable and valid instrument that supports inquiry-based practises (Poti, Dudu, & Sebatana, 2022; Marshall et al., 2010). Poti et al. (2022) ascertain that teachers can use EQUIP as a framework to make their instructional practice more intentional as they strive to increase the quality and quantity of inquiry instruction. In evaluating professional development projects, researchers can use EQUIP as an instrument to analyse the quantity and quality of inquiry being conducted. Since the instruments were used in different countries and by the authors, there was no need to validate them (Marshall et al., 2010). Cronbach's alpha coefficient for the instrument ranged between 0.880 and 0.888, indicating a strong internal consistency. Additionally, Cohen's Kappa internal reliability averaged 0.61, and the scale fell between moderate and substantial agreement (Marshall et al., 2010).

To increase validity, the authors repeated the coding process twice using EQUIP (Marshall, Smart, & Alston, 2016). A teacher's pre-recorded teaching video transcript was segmented into five-minute segments. Each five-minute interval was assessed using 20 different indicators that support inquiry-based teaching and learning. These indicators were considered across four factors, namely: discourse, instruction, assessment, and curriculum factors. According to the level of inquiry, each indicator was individually assessed before a holistic score was assigned. There were four inquiry levels, with a score of 1 given to Pre-inquiry, 2 to Developing Inquiry, 3 to Proficient Inquiry, and 4 to Exemplary Inquiry. At the end of the instrument, there is an overall summative mark and justification for the mark given.

5. FINDINGS

There are two sections under the findings, and they correspond to the two research questions that guided this study. We used an inquiry-based approach as a framework for implementing instruction as this study sought to examine how teacher beliefs about the implementation of inquiry-based learning reflected in their teaching practices.

5.1. Research Question 1: What are the Physical Science teachers' beliefs about the implementations of IBL in their classrooms in the Zululand District?

To get an understanding of the general trends in the Physical Sciences teachers' belief about inquiry-based learning of each item, the mode scores and percentage scores were computed. The results were grouped by item, and table 1 shows which item and overall mode contributed to the results.

Table 1.
The overall mode for each item.

Statements	Mode
IBL takes up too much of my teaching time	4
It is difficult to maintain control of learners during IBL	3
I prefer my learners to <i>design</i> their own inquiries	3
IBL helps my learners to develop experimental process skills	4
My head of department supports the way in which teaching is done in my class	4
The purpose of doing an inquiry is to confirm a theory	4
I feel confident teaching lessons where learners do science inquiries	4
Science inquiry activities are difficult to manage	2
The management of my school could do more to support me in implementing the inquiry-based approach to practical work	4
I borrow apparatus from other schools	4
The lesson time allocated is adequate for my learners to do practical work/Inquiry activities	2
My learners take a lot of time to settle down before starting with the inquiry activities	4
When I need lab equipment and chemicals the management of my school makes funds available for the purchase of these	2
With the new curriculum, I now include more practical activities in my teaching	3
My learners are well-behaved when they are doing practical work	3
Overall, Mode scores	4

Key: 1=Strongly Disagree; 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

Table 1 shows that all the teachers who attended this workshop had an overall mode of 4, which signifies they had positive beliefs about IBL. Nevertheless, 65% and 26% of the teachers agree and strongly agree respectively that IBL approaches take up too much of their teaching time. Under item ‘*When I need lab equipment and chemicals the management of my school makes funds available for the purchase of these*’, some teachers disagreed, because 22% of teachers selected ‘Strongly Disagree’, 30% selected ‘Disagree’ and 36% selected ‘Neutral’ option. The results show that many school management teams still do not believe in practical work, which is the ‘heart’ of IBL as they do not give science teachers support by purchasing the required materials. Finally, 26% selected ‘Strongly Disagree’ while 35% selected Disagree on the item “*The lesson time allocated is adequate for my learners to do practical work/Inquiry activities*”. This shows that teacher believe the time allocated for Physical Sciences to adopt inquiry in their lessons is not enough. Considering the results, the Zululand District Physical Science teachers are positive about inquiry-based learning, however, there are factors they perceive hinders their teaching, despite the overall mode score of 4 ‘Agree’, which implies they had a positive belief about IBL.

5.2. Research Question 2: Do the pedagogical practices of the Physical Sciences teachers in the Zululand District reflect their beliefs about inquiry-based learning?

The data shows that classroom pedagogical practices of the selected Physical Sciences teacher were partially in line with the overall group's beliefs about IBL. Following a thorough analysis of the EQUIP instrument's four factors as tabulated in table 2 the results show that Mr Motsapi's inquiry is still developing (Level 2).

Table 2.
Mr Motsapi overall EQUIP scores.

Factors supporting Inquiry	Mr Motsapi's lesson one	Mr Motsapi's lesson two
Inquiry Instructional Factors	2	1
Discourse Factors	2	2
Assessment Factors	2	2
Curriculum Factors	3	3
Mean Level of Inquiry Score	2.25	2
Overall Level of Inquiry	2	2

NB! 0=non-instructional time; 1=Pre-inquiry; 2=Developing inquiry; 3=Proficient inquiry; 4=Exemplary inquiry.

Table 2 shows the EQUIP four constructs, each factor had five sub-constructs to score which were then used to calculate the overall mean score. The overall mean score shows that Mr Motsapi was centred within the developing inquiry approach (Level 2). When comparing the teachers' overall mean score to the entire group's overall score about their inquiry there is a discrepancy in their scores. We then scrutinised each of the four constructs from each lesson to determine and justify the overall score of each lesson.

The inquiry instructional factors: Mr Motsapi was firstly observed teaching grade 10 class about the 'Equations of Motion'. The teacher spent the first 15 minutes of the lesson explaining the equations of motion and instructing learners, which resulted in this segment being extensively teacher centred. He then asked closed questions such as "*what is acceleration class? what are its units?*" these were closed questions. In the second quarter of the lesson, learners were deriving formulas following teachers' instructions. It was towards the end of the lesson, there were a few incidents that resulted in teacher-to-learner discussions. An example of such an incident manifested when the teacher wrote questions on the board and these sparked questions among learners. This indicates that there were a few aspects of inquiry that manifested in the first lesson. The same pattern was observable in the second lesson that was based on grade 11 Doppler Effect. Again, this lesson promoted passivity amongst learners as the teacher spent most of the time explaining concepts and asking closed-ended questions such as "*...what is the frequency and what is wavelength...?*" from time to time instead of asking open-ended questions that foster critical thinking and learner interactions as they are crucial components of inquiry-based learning. It was evident that the teacher was preparing the learners for the next grade because he often reminded them that "*...this is grade 12s work*", and they need to keep this information in their long-term memory. These are some of the reasons we decided to locate Mr Motsapi for this construct to be between pre and developing inquiry levels.

Discourse factors: In both lessons, the teacher leaned towards developing inquiry, his questions were rarely challenging to learners as they were mostly close ended in nature, as exemplified above. The communication between the teacher and learners was typically controlled and directed by the teacher with occasional input from learners in both lessons.

The assessment factor: In relation to this construct, in both lessons, the formal and informal assessment activities had few noticeable characteristics of inquiry as stipulated by the NRC (2011), and learners were mostly verifying pre-determined questions. The IBL characteristics were noticeable in the second lesson where the teacher used smart board and projected simulations to promote discussions. This segment involved both learners and the teacher critically analysing the given scenarios about Doppler Effect based on given scenarios.

Curriculum factor: The teacher showed signs of a good understanding of the secondary school curriculum. He understood the content covered in each grade and was making a connection between the previous grade, the current grade, and the forthcoming grades' content. However, the lessons had poor integration of content with practical work. In both lessons, the teacher did not go beyond the scope of the curriculum in terms of questioning. Based on our observations, for this construct we agreed that Mr Motsapi was centred on proficient inquiry (level 3).

The overall data emerged from the two lesson observations shows that Mr Motsapi was mostly in control of the teaching and learning for both lessons. The teacher often did not take into consideration some of the learners' contributions, and there were limited occurrences when class discussions were allowed. Both lessons were centred within the 'Developing Inquiry' (Level 2) construct as they were teacher-centred, with prescriptive questioning but not entirely inquiry. The teacher dominated the lesson and at times he was a facilitator and a giver of knowledge at the same time in both lessons.

6. DISCUSSION

To respond to the research question '**What are the Zululand District Physical Sciences teachers' beliefs about inquiry-based learning?**' The findings show that the sampled Physical Sciences teachers from the Zululand District displayed a positive belief about inquiry-based learning where the overall mode was 4 points. The score of 4 points 'Agree' show a strong belief in inquiry and this is a noteworthy finding since the CAPS documents advocate the implementation of inquiry-based learning at school. The findings of this study are in line with (Ramnarain & Hlatshwayo, 2018) that teachers from the rural district had a positive attitude towards inquiry in the teaching and learning of Physical Sciences. These teachers also recognised the benefits of inquiry, for example, inquiry motivates and supports learners in the understanding of abstract science concepts. Hence, when compared to other pedagogies, the inquiry-based learning approach is believed to have more advantages (Correia & Harrison, 2020).

To respond to Research Question 2: '**Do the classroom teaching practices of the Physical Sciences teacher in the Zululand District reflect their beliefs about inquiry-based learning?**' The findings from the data show that Mr Motsapi was centred on developing inquiry (Level 2) when observed teaching two lessons. These results shows that Mr Motsapi's pedagogical practices are not entirely line with the overall class beliefs. The teacher is still navigating his way in the implementation of inquiry-based approaches in his classrooms. The results resonate with Ramnarain et al. (2016, 2018), Dai et al. (2011) that teachers are receptive to inquiry-based pedagogies, but they experience difficulties in fully implementing this approach due to different factors such as contextual factors. It shows that

context plays an important role in influencing teachers' implementation of inquiry approaches in their classrooms. Based on the results of this study, we suggest that Physical Sciences teachers at school especially in rural areas should not be dismissive of inquiry-based learning as a possible teaching approach to adopt. Furthermore, there is a need for more professional development for teachers as they are limited in rural areas to make it easy for them to acquire the necessary skills and knowledge to implement inquiry-based learning effectively.

7. CONCLUSION

The findings based on this study have implications for practice for both in-service and pre-service science teachers who are teaching in rural areas where IBL is not supported. Firstly, facilitators who are running teacher development programs need to understand that teachers, especially novice teachers, bring along images about teaching construed from their previous secondary school teachers or mentors and they do not have images of IBL in practice and are often teacher-centred (Cross, & Ndofirepi, 2013). Therefore, they will take time to understand and master this approach. Even though the Physical Sciences teachers had a strong belief in inquiry, several factors determined what approach to adopt. Often, these teachers revert to direct approaches when they do not know how to proceed. We recommend professional teacher development program facilitators, especially in rural areas, to expose teachers to different instructional approaches that promote learner-centred activities, and they need to be aware of contextual factors influencing teachers. The workshops need to prepare teachers on how to teach in contexts where inquiry is not supported. The study experienced few limitations, the number of participants was only limited to twenty-three who answered the survey. This was not enough to generalise our findings but gives indications and insights on teacher trainers. The classroom observations were conducted to only one teacher and we cannot make sweeping generalisation about the findings. Therefore, we suggest future research complement the current research by further focusing on how teachers implement IBL in their science classroom that are situated in rural areas. The next focus needs to be based whether learner situated in the rural areas achieve better scores or pass rate when are taught Physical Sciences through IBL.

REFERENCES

- Abell, S. K. (2007). Twenty years later: Does pedagogical content knowledge remain a useful idea? *International Journal of Science Education*, 30(10), 1405-1416 <https://doi.org/10.1080/09500690802187041>
- Asrizal, A., Yurnetti, Y. & Usman, E. A. (2022). ICT Thematic Science Teaching Material with 5E Learning Cycle Model to Develop Students' 21st-Century Skills. *Journal Pendidikan IPA Indonesia*, 11(1), 61-72. <https://doi.org/10.15294/jpii.v11i1.33764>
- Binns, I. C. & Popp, S. (2013). Learning to teach science through inquiry: 8. *Science & Mathematics Education*, 17(1).
- Bronfenbrenner, U. (1979). Contexts of child rearing: Problems and prospects. *American Psychologist*, 34(10), 844. <https://doi.org/10.1037/0003-066X.34.10.844>
- Calderhead, J. (1996). Teachers: Beliefs and knowledge. In D. C. Berliner & R. C. Calfee (Eds.), *Handbook of educational psychology* (pp. 709–725). Macmillan Library Reference USA; Prentice Hall International.
- Correia, C., F. & Harrison, C. (2020). Teachers' beliefs about inquiry-based learning and its impact on formative assessment practice. *Research in Science & Technological Education*, 38(3), 355-376. <https://doi.org/10.1080/02635143.2019.1634040>

- Creswell, J. W. (2014). *A concise introduction to mixed methods research*. SAGE publications.
- Cross, M. & Ndofirepi, E. (2013). On becoming and remaining a teacher: rethinking strategies for developing teacher professional identity in South Africa. *Research in Education*, 1-19. <https://doi.org/10.1080/02671522.2013.851729>
- Dai, D. Y., Gerbino, K. A., & Daley, M. J. (2011). Inquiry-based learning in China: Do teachers practice what they preach, and why? *Frontiers of Education in China*, 6(1), 139-157. <https://doi.org/10.1007/s11516-011-0125-3>
- Department of Basic Education (DBE) (2011). *National Curriculum Statement Grades R-12*. Retrieved from <http://www.education.gov.za>
- Friedrichsen, P. M. & Dana, T. M. (2003). Using a card-sorting task to elicit and clarify science-teaching orientations. *Journal of Science Teacher Education*, 14(4), 291-309. <https://doi.org/10.1023/B:JSTE.0000009551.37237.b3>
- Gess-Newsome, J. (1999). Pedagogical content knowledge: An introduction and orientation. In *Examining pedagogical content knowledge* (pp. 3-17). Springer, Dordrecht.
- Hall, K., Leatt, A., & Rosa, S. (2009). The Means to Live. Targeting poverty alleviation to realise children's rights.
- Levy, P., & Petruilis, R. (2012). How do first-year university students experience inquiry and research, and what are the implications for the practice of inquiry-based learning? *Studies in higher education*, 37(1), 85-101. <https://doi.org/10.1080/03075079.2010.499166>
- Lewthwaite, B. (2006). Constraints and contributors to becoming a science teacher-leader. *Science Education*, 90(2), 331-347. <https://doi.org/10.1002/sce.20093>
- Lewthwaite, B.E (2001). *The development, validation and application of a primary science curriculum implementation questionnaire*. (Unpublished ScEdD Thesis). Curtin University of Technology, Perth.
- Lewthwaite, B.E. (2004). "Are you saying I'm to blame?" Exploring the Influence of a Principal on Elementary Science Delivery. *Research in Science Education*, 34, 137-152. <https://doi.org/10.1023/B:RISE.0000033763.12967.15>
- Marshall, J. C., Smart, J. & Horton, R. M. (2010). The design and validation of EQUIP: An instrument to assess inquiry-based instruction. *International Journal of Science and Mathematics Education*, 8(2), 299-321. <https://doi.org/10.1007/s10763-009-9174-y>
- Marshall, J. C., Smart, J., & Alston, D. M. (2016). Development and validation of Teacher Intentionality of Practice Scale (TIPS): A measure to evaluate and scaffold teacher effectiveness. *Teaching and Teacher Education*, 59, 159-168. <https://doi.org/10.1016/j.tate.2016.05.007>
- Minner, D. D., Levy, A. J., & Century, J. (2010). Inquiry-Based Science Instruction-What is it and does it Matter? Results from a Research Synthesis Year 1984 to 2002. *Journal of Research in Science Teaching* 47(4), 474-496. <https://doi.org/doi:10.1002/tea.20347>
- Mokiwa, H. O. (2014). Exploring the teaching of Physical Science through inquiry. *International Journal of Educational sciences*, 7(1), 21-27. <https://doi.org/10.1080/09751122.2014.11890166>
- Naidoo, J. & Sibanda, D. (2020). Examining science performance of South African grade 9 learners in TIMSS 2015 through a gender lens. *South African Journal of Education*, 40(2), S1-S10. <https://doi.org/10.15700/saje.v40ns2a1717>
- National Research Council (1996). *National Science Education Standards*. Washington, DC: National Academy Press. Retrieved from <http://www.csun.edu/science/ref/curriculum/reforms/nses/nses-complete.pdf>
- National Research Council (2011). *A Framework for K-12 science education: Practices, crosscutting concepts and core ideas*. Washington, DC: National Academy Press. Retrieved from <https://nap.nationalacademies.org/read/13165/chapter/1#iii>
- National Research Council. (2007). *Taking science to school: Learning and teaching science in grades K-8*. Washington, DC: The National Academics. Retrieved from https://www.nsf.gov/attachments/117803/public/2c--Taking_Science_to_School.pdf
- National Research Council. (2012). *Discipline-based education research: Understanding and improving learning in undergraduate science and education*. Washington, DC: National Academies Press.

- NGSS Lead States. (2013). *Following Generation Science Standards: For states, by states*. Washington, DC: The National Academies Press.
- Pajares, M. F. (1992). Teachers' Beliefs and Educational Research: Cleaning up a Messy Construct. *Review of Educational Research* 62(3), 307–332. <https://doi.org/10.3102/00346543062003307>
- Poti, J. G., Dudu, W. T., & Sebatana, M. J. (2022). A South African Beginner Natural Sciences Teacher's Articulated PCK-in-Practice with Respect to Electric Circuits: A Case Study. *EURASIA Journal of Mathematics, Science and Technology Education*, 18(10). <https://doi.org/10.29333/ejmste/12426>
- Ramnarain, U. & Hlatshwayo, M. (2018). Teacher beliefs and attitudes about inquiry-based learning in a rural school district in South Africa. *South African Journal of Education*, 38(1), 1-10 <https://doi.org/10.15700/saje.v38n1a1431>
- Ramnarain, U. (2016). Understanding the influence of intrinsic and extrinsic factors on inquiry-based science education at township schools in South Africa. *Journal of Research in Science Teaching*, 53(4), 598-619. <https://doi.org/10.1002/tea.21315>
- Ramnarain, U. D., & Hobden, P. (2015). Shifting South African learners towards greater autonomy in scientific investigations. *Curriculum Studies*, 47(1), 94-121. <https://doi.org/10.1080/00220272.2014.966153>
- Ramnarain, U., Nampota, D., & Schuster, U. (2016). The spectrum of pedagogical orientations of Malawian and South African physical science teachers towards inquiry. *African Journal of Research in Mathematics, Science and Technology Education*, 20(2), 119–130. <https://hdl.handle.net/10520/EJC191940>
- Russell, S. G., Sirota, S. L., & Ahmed, A. K. (2019). Human rights education in South Africa: ideological shifts and curricular reforms. *Comparative Education Review*, 63(1), 1-27. <https://doi.org/10.1086/701100>
- Sikko, S. A., Lyngved, R., & Pepin, B. (2012). Working with Mathematics and Science teachers on inquiry-based learning (IBL) approaches Teacher beliefs.
- Smart, J. B. & Marshall, J. C. (2013). Interactions between classroom discourse, teacher questioning, and student cognitive engagement in middle school science. *Journal of Science Teacher Education*, 24(2), 249-267. <https://doi.org/10.1007/s10972-012-9297-9>
- Tan, A. L., Ong, Y. S., Ng, Y. S., & Tan, J. H. J. (2022). STEM problem solving: inquiry, concepts, and reasoning. *Science & Education*, 1-17. <https://doi.org/10.1007/s11191-021-00310-2>

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Chapter # 42

REFLECTIONS ON DIDACTICAL CHALLENGES IN TEACHING COMPUTER PROGRAMMING

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ABSTRACT

One of the key challenges of modern society is the vast number of technological devices surrounding us. As a result, general ICT skills are essential for both work and personal time. In addition, ICT skills are widely used in the education of different subjects. The challenge is that while computer science (programming) is relatively well covered in the literature, computer science in other professions, including education for non-IT professionals, is not.

Teaching computer programming is particularly difficult in courses for students from outside computer science fields. The fundamental problem is: what computer skills should be taught and to what extent? It is usually impossible to teach all possible concepts in a course. In this case, the focus should be on programming terminology, key definitions, or perhaps - computational thinking and problem-solving skills? Another challenge may be using English or the national language and selecting examples based mainly on mathematics or practical experiences.

This chapter presents the experiences and reflections of authors from different universities, departments, and courses on teaching, using other pedagogical approaches, and programming theories comparing programming for computer science students and non-computer science students.

Keywords: programming skills, digital competencies, 21st-century skills, didactics in IT education, introduction to programming.

1. INTRODUCTION

Technology has never before been developed as quickly and is quickly becoming outdated. Technological development has recently increased digital literacy in industry, education, business, research, and personal lives. Digital Literacy is a collection of digital competence, digital usages, and digital transformation, which can be defined as:

the awareness, attitude, and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action; and to reflect upon this process (Martin, 2006, p.155).

This needs for skills and literacy towards digital development has caused many students to learn to program. As a result, programming has been introduced to other fields than computer science and information technology. This chapter aims to provide insight into how it can be done successfully and shed light on the challenges in teaching programming for non-programmers. This chapter tries to present some of the most common challenges (from different researchers) and match them to the pedagogical concept of the Didactical

Triangle proposed by Kansanen & Meri (1999). The research question discussed in this study is: What can be challenging in introducing programming based on the Didactical Triangle: Content, Teacher, and Student?

A discussion on challenges in teaching programming needs to address what programming is and that this term has a broad understanding. This chapter is based on Hartree's (1950) definition: "The process of preparing a calculation for a machine can be broken down into two parts, 'programming' and 'coding'. Programming is the process of drawing up the schedule of the sequences of individual operations required to carry out the calculation" (cited in Blackwell, 2002, p. 204). This definition differentiates between writing the code (coding) in a chosen programming language and designing a program through "planning, scheduling and performing a program" (merriam-webster dictionary, 2020). These actions were separate at the start of the computer era, but as the elements and methods in programming changed, there was a need for different strategies and structures.

Today many people mix the terms coding and programming. Blackwell states, "when people say they are programming, we should not question whether this activity is genuine programming, but instead analyze their experiences to understand the general nature of programming activity" (Blackwell, 2002, p. 208). Some of the findings of Schulte and Bennedsen (2006) suggest that many students view programming as coding in a typical introductory programming course because the teachers tend to focus on concrete details like notations rather than general understanding and structure.

This theoretical and reflective chapter is divided into five sections. The "*Background*" shows issues related to the dynamic expansion of IT and ICT fields and its educational challenges. Next, "*Challenges in Practice*" presents programming education challenges and some central aspects concerning the didactical triangle: Content, Teacher, and Student (Kansanen & Meri, 1999). Then the "*Discussion*" shows some thoughts and comments on differences and solutions. The last part, "*Conclusions*", gathers presented theories and examples in the conclusion.

2. BACKGROUND - ABOUT LEARNING AND TEACHING

Today, IT is changing more than any other field due to its integration and collaboration with other disciplines. There are continuously new elements and modifications to the existing ones. Previously used, considered the correct way of working, is obsolete and no longer meets the requirements (time of preparation of the application and its security). Changes in programming methods correspond to changes in the ways components are connected and used in the industry. Nowadays, it is not enough to know one programming language to have knowledge about writing programs. It is necessary to know the whole process, containing many elements, structures, methods, networks, environment, and security. That involves much more than just a language. The program must have a modern graphical interface, the ability to communicate with modern networks (communication protocols), multilingualism, and the possibility of easy modification and development. Looking for a job by a person with basic programming knowledge (Java, JavaScript, Python, C++, C#) without knowledge of the environment is a misunderstanding of the requirements. Such a person is not a professional candidate for the job.

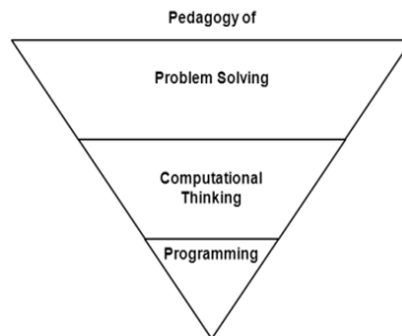
Programming itself is considered hard to learn (Sheard & Carbone, 2007). Different programming languages, technical differences, teaching methods, and personal approaches can affect the learning of programming (Demir, 2022; Robins, Rountree, & Rountree, 2003). In addition, there is also the gap between standardized education and the continuously changing requirements of employers. The issues lie with the use of the equipment, naming issues, language issues, methodologies, and structure of the task. Even the way of teaching

can present a different world in a lecture, especially regarding the definition from various fields (Blackwell, 2002). The result is that some students choose to quit their course because they misunderstand a subject's requirements or other expectations.

One of the reasons for this gap between education and industry is rapid technological development. While education is focused on basic structures and standard terminology, the industry is taking the next step in introducing ideas like the Internet of Things, Factory 4.0, Artificial intelligence, and Big Data. These concepts are similar in the way technology connects different aspects of technology. Still, they are used in various environments with different requirements, both for hardware and software. According to Bettin, Jarvie-Eggart, Steelman, and Wallace (2022, p. 309): "[u]nderstanding the static structure of computer programs and understanding the dynamic structure of program development are both vital competencies for novice programmers". So why is education not teaching how to implement those ideas? How is education prepared for these challenges? Do university students have the opportunity to obtain the necessary knowledge to the extent employers require? What skills are essential to living in the modern computerized world?

Fojcik, Galek, and Fojcik (2017) show in their research that many students do not have sufficient skills to evaluate their digital literacy. These students believe they have efficient ICT knowledge if they are fluent in using everyday technological equipment like smartphones, computers, social media, or software. Therefore, there is a need for more education about what requirements are necessary to be up to date with ICT knowledge and digital literacy (Vuorikari, Punie, Carretero, & Van den Brande, 2016). There is no doubt that society needs to know more about technological tools than "where to push the button", but the response to this need should not be introducing the newest ideas like machine learning or artificial intelligence. Higher education cannot fully implement theories and concepts still in development.

Figure 1.
Conceptual framework (Selby, 2014, p.19).

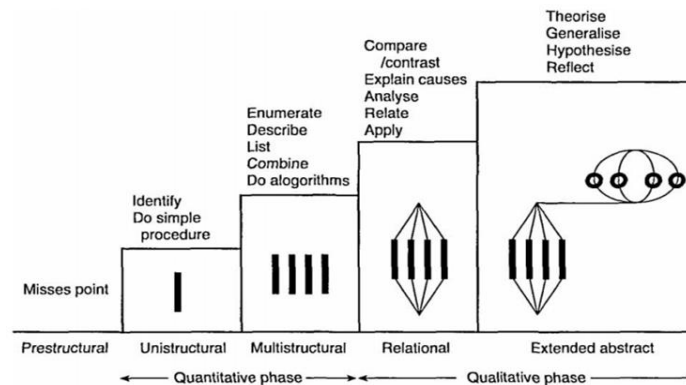


To cope with the challenge, some researchers present a set of best practices in teaching programming (Brown & Wilson, 2018, Cawthorne, 2021). Hence, the standard of university education delivers quality, research-based knowledge, and continuous change to modern ideas (that may not work, lose their popularity, or be exchanged for another idea) would not preserve the standard. A possible solution for filling this gap can be to teach skill development. Robins et al. (2003) proposed more explicit attention to programming strategies when introducing programming to students, and Demir (2022) suggested that there should be an integration between the theory and practice of programming to have a positive effect on learning. Griffin and Care (2015) divide the "hard skills" like knowing a programming language, theory of regulation, mathematical operations, etc., and "soft skills"

like time management, creativity, collaboration, critical thinking, etc. Showing that to better fill the industry's requirements, the students should learn both the hard and soft skills so that they can adapt to the technical specifications that will be present when they finish their education. To be a professional programmer, you need to know how to plan, do task analysis, use computational thinking, create algorithms, structure tasks, and know some programming languages, coding, and programming environment. Most of these elements are elements common to problem-solving strategies. This can be seen in figure 1.

There are different approaches to introducing and implementing programming for students. One necessary element is assessing students' knowledge and skills. According to De Raadt, Watson, and Toleman (2009, p. 54) "[s]tudents seem to learn and apply programming strategies more consistently when they are presented in an explicit manner than when they are learned implicitly". By knowing what students can do and what they already know, the teacher may prepare the required proregrression in the topic or prepare repetition of concepts that are not fully understood. A SOLO-taxonomy (Structure of the Observed Learning Outcomes) may help analyze student knowledge (Biggs, 2012) (figure 2). Studies that have used SOLO-taxonomy to assess programming courses (for example, Fojcik et al., 2020; Ginat, & Menashe, 2015; Malik, Tawafak, and Shakir, 2021; Sheard et al., 2008) show that it can be challenging for students to reach a higher level of observed learning outcome, and as Winslow stated "[t]he key to reaching this level is practice, practices and practice – starting with simple facts and problems and working up to more complicated facts, strategies and problems" (1996, p. 21).

Figure 2.
A hierarchy of verbs used in forms of curriculum objectives (Biggs, 2012, p.48).



The assessment of programming skills can be formative or summative. It can be written, oral, project-based, presentation, or practical exercises. Different learning approaches prioritize different working environments and challenge students in different ways. For example, writing a program may show if a student is able to plan and prepare the necessary structures, doing a project can present if a student can collaborate and implement working methods on a larger scale, an oral exam where a student is presenting their knowledge on a topic can assess of the student can use and exemplify the theoretical concepts with practical applications.

For example, a teacher learning programming must learn the programming language, working methods, and structures. Still, they also need to be able to explain this knowledge to others (as teachers do). In contrast, an automation engineer does not need to be great at explaining because they must connect the machines and supervise the program in all security aspects.

Diagram 1.
Description of how well the course from Volda University College, fits the IT and teacher criteria of SOLO-taxonomy. (Fojcik et al. (2020)).

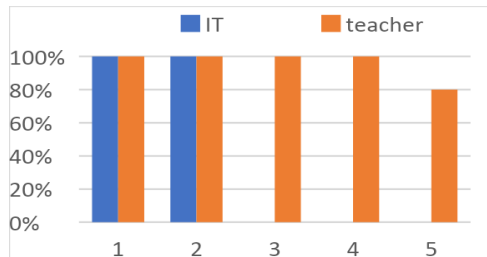
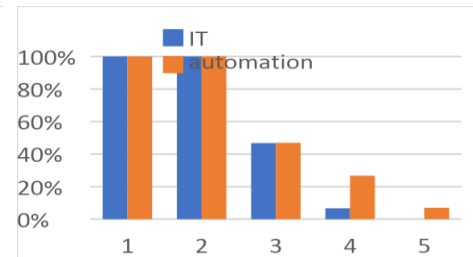


Diagram 2.
Description of how well the course from Western Norway University of Applied Sciences fits the IT and automation criteria of SOLO-taxonomy. (Fojcik et al. (2020)).

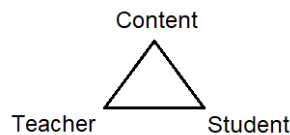


Fojcik et al. (2020) show that assessing non-computer programming students to "pure" programming or general IT programming (marked blue on Diagram 1 and Diagram 2) does not fill all the required learning outcomes, but if the criteria for assessment changes from general IT programming, to the specific needs of the programming outcomes in their field, for example in teacher education, the level of observed learning outcomes (figure 2) have increased (marked orange on Diagram 1 and Diagram 2).

3. CHALLENGES IN PRACTICE

Programming is not an easy course (Blackwell, 2002). There are challenges in teaching. For example, presenting information clearly and interestingly, motivating the students, keeping a preferred speed, assessing students, giving students feedback, and many more. In addition to the issues in teaching, some challenges appear when teaching programming. To understand the challenges in teaching programming, one must understand the didactics of programming. Kansanen & Meri (1999) present programming in the Didactical Triangle, with communication between a teacher, a student, and a content, where there is special attention to the context of a learned situation that affects the teacher and the student (figure 3). This part of the chapter will consider every element of the Didactical Triangle to present some opportunities and challenges noticed during the literature analysis supported by the authors' experiences. These elements are related to independent phenomena, but they can overlap while teaching.

Figure 3.
Model based on Didactical Triangle (Kansanen & Meri, 1999).



3.1. Content

3.1.1. Anthropomorphizing metaphor

In teaching programming, the content is central. To program is to create new solutions to problems using machines. A challenge that may arise is understanding the difference between tasks that are best solved by humans and tasks that machines can do better.

The anthropomorphizing metaphor can hinder learning programming (Dijkstra, 1989). This is a misleading phenomenon where the machine is treated like a human, not in feelings and opinions, but in decision-making. Students who look at a computer as a judge or an assessor do not understand the process of programming and designing precise instruction. It is a common mistake to say that "a program" is wrong. The only mistake a program can have is the programmer's mistake. The program just follows the instructions and does not influence the algorithm in any way. So, if there is something wrong, it means that the program was not written correctly.

3.1.2. Different approaches

Programming has its set of rules and structures that a program needs to follow as a field of knowledge. However, there are still many options for scheduling and building a program. One approach is to look at procedural programming. When the programmer gets several new features and writes a program, he can use the procedural method to enrich the code from what they have previously learned. This approach builds student knowledge step by step, always returning to the presented facts, even if they might share a narrow perspective on the new topic (Berglund & Lister, 2010). Another approach is looking at the new topic's most significant advantages (and differences), presenting the ideas first, and then going back slowly to recap how the new topic fits the rest. (Berglund & Lister, 2010).

3.1.3. Specialized content for the course

As previously mentioned, the content in teaching programming can vary from the course it is presented in. For example, in teacher education, programming is connected to the school curriculum introduced in Kunnskapsløftet (LK20, 2019). To manage kids to learn to program, the concept of computational thinking was introduced, where algorithms are linked to systematic problem solving and support «thinking like a computer» (Wing, 2006). This approach is also understood as a way of experimenting and tinkering with technology (Csizmadia et al., 2015). Computational thinking is seen as a means to uncover a problem field and is necessary when specific sub-problems are to be solved. In teacher education and in schools, building and programming small robots have been introduced to facilitate different encounters between computational thinking and the affordances of a given technology. In such projects, there is a close connection between the robots' physical properties and the behavior implemented virtually in code. When students build and code their own robots, they open up for discussions about how automatons become influential on an individual level and affect us at the societal level. This approach may not be as relevant in teaching bio technicians or automation engineers programming. Still, in teacher education, it is very relevant to address the pupils' way of computational thinking and learning (Fojcik et al., 2020).

3.1.4. The choice of language

Another challenge in teaching programming is the language specifications. There are different programming languages, but all of them have English as a foundation. This might be difficult for non-English speakers. On the one hand, if some names and variables were called in the native language, it might help the students understand the program structure. On the other hand, if the students keep the entire code in English, there would be easier to seek help or search for information in the literature. An experiment at the University of Oslo was performed in 2000 (EasyIO, 2020), where the Java environment was translated into Norwegian. This product allows using most of the coding in Norwegian. Unfortunately, after every update to java-software (1-3 times a year), there is a need to update EasyIO.

Since the updates were not coordinated, it took a long time. During that time, the product could not be used. The delay and the continuous working amount were the reasons for discontinuing EasyIO. Another issue was that the students who used EasyIO during their studies had to learn the "common" English way after the studies were finished and started working. A similar situation happens to C#. Many additional programs show class structures graphically. However, the program descriptions are only in English. Using Norwegian names makes it more difficult than easier because the students need to learn Norwegian and English terms.

3.2. Teacher

3.2.1. Student-centered approach

The other aspect is shifting the focus from the teacher to the student. Teachers tend to base their teaching on their own needs or assumptions about the student's needs. As the Didactic Triangle represents, there is a connection between teachers and students and teachers and content (Berglund & Lister, 2010). It is not enough to just look at the content to teach. There needs to be a pedagogical approach to consider students' side of the process of learning.

3.2.2. Experiences with programming

Teaching programming means: "*teaching how to interact with a computing machine and how to deal with all the surprises that a machine can throw at you*" (Kak, 2009, p. 2). Therefore, teachers need to demonstrate interesting cases, show good practices, and instill the joy of programming in students. This can be done by someone who truly knows what he/she is doing, both in the subject's content and in pedagogical approaches. If, for example, a teacher with automation experience is teaching programming for biotechnology students, they would point out their own experience. Still, the results might not be comparable with the students. The same goes for professors that have not been involved in software development. Then, the only experience shared with students can be a theoretical one (Berglund & Lister, 2010).

3.2.3. Updating qualifications

"One of the greatest dangers in teaching is the routine, and habitual repetition of actions often observed in one's teachers or colleagues" (Czerepaniak-Walczak, 2014, p. 10). This is particularly evident in teaching engineering subjects related to computer science. This area is quickly changing time. Therefore, updating the teacher's qualifications and experience is an absolute must to avoid repetitions. Terms and concepts in computer science 50 years ago might not be used anymore. At the same time, the industry introduces many new terms and ideas that are more relevant for students when they apply for jobs after they finish studying.

3.2.4. Programming as a supplementary tool

In some subjects, programming is not the primary objective. Still, it is used as a tool that makes it possible to achieve other educational goals. Initially, this will emphasize what programming is used for and fewer concerns about efficiency, quality of code, etc. Following such an approach, one can later work more in detail regarding the actual code. Findings from Danish primary schools show that this approach may be fruitful. The schools have invested quite a lot in small robots, where the idea is that the robots can be used to teach pupils mathematics and English. Unfortunately, school practices show that robots do not work well in the intended topics. However, they are very well suited for introducing pupils to code (Bruun & Hasse, 2016).

Another example is when code is used as an artistic tool. When teaching mainly aesthetic topics, the teachers do not emphasize the logic and code quality as such. It is the outcome, what the code produces, that is considered most significant. When code is used to create a visual or auditory object that is not presented live, the program's efficiency is close to irrelevant as long as it produces a result. In other instances, time can be crucial, for example, when live coding music. One such example is Sonic Pi (<https://sonic-pi.net>), a code-based tool used to create music and live performances.

3.3. Student

3.3.1. Pedagogical approach

As mentioned in section 3.1, some students misunderstand how programming works. The first meeting with programming can be confusing. Many students start their learning process with memorization and creating habits they do not fully understand. For example, some students claim that: *"I do not know what this code sequence does, but without it, the program does not work"* or *"In all previous programming tasks, we have done this, so we continue to do it now as well"*. This can be explained as reward and punishment in behaviorism. When the students choose a code sequence that works, they might use it again in a different setting to see if it is still working. This might create a "reward" for this habit, even if the student does not understand why it works (or does not work) (Ertmer & Newby, 2013). Presents that constant patterns, repetitive actions (not necessary with understanding), and signals for positive and negative responses can be desirable and helpful at the beginning of the course. Students have to learn names and definitions. But the programmer cannot rely only on repetition and memorization. It is necessary to have understanding, and problem-solving skills, to talk with others – to divide the problem into smaller parts, which are possible to (parallel) in a group.

3.3.2. Students' expectations

Most students want to acquire valuable knowledge for work after they finish their education. Still, they don't always know what is needed to achieve their goal; therefore, they rely on teachers/students and the descriptions of the subjects taught there. Students observe the world, use modern tools (mobile phones, PC, smart homes/watches/...), and often communicate that they would like to have something similar in their studies. For example, they say: *"Why should you learn two years of text programming (instead of graphical GUI) when NO ONE (outside the university) uses text programming."* Sometimes the students have interesting ideas that should be implemented in the course. In contrast, they at other times want to learn about big ideas like the Internet of Things and do not see that it is a more complex term than just the name.

There is a potential for an increased mismatch between the most common ways of programming, applied to solve more or less common problems and the programming of more complex systems. A potential future of coding envisions code and software written by or assisted by Artificial Intelligence and neural nets – Software 2.0 (Karpathy, 2017). Such systems will be able to translate the natural language to code across a number of programming languages.

A future where computer code is created through verbal dialogue with an AI can open programming to new fields and other practices. At the same time, this (see OpenAI and their demonstration of GTP3 - <https://youtu.be/SGUCcjHTmGY>). This continues an ongoing shift from lower to higher levels of abstraction over the years. With the development of AI and language models, there is a sharp increase in this development. This will still require a technical understanding and the ability to see the need and impacts of what one is building

and how a solution can become part of a whole. This can be greatly beneficial for innovation and progress in many areas, especially in fields where computers have had relatively little impact. Some artistic use may serve as examples.

A potential downside is that students that are not very interested in learning to code the traditional way will be able to skip this. It is also a fundamental question regarding how the models are trained. The skills needed to come up with a new, innovative solution will perhaps change, but hardly be less hard.

3.3.3. Teaching through Pandemic

An internal survey of Western Norway University of Applied Sciences showed that digital lectures make programming more difficult. Grades from last year's introductory programming exams show that many more students failed exams than usual before the previous year. There were the same teachers (and additional assistants) and the same time for teaching, practice, and labs. However, the form was different – the students could not meet on campus, and there was no physical contact with the teacher or the assistant. It looks like it was the only change that affected students significantly (table 1).

Table 1.
Comparison of student results in a programming course.

HVL programming (DAT 100)	2019 - blended	2020 digital online
Students accepted to the exam	92%	89%
Accepted students who passed the exam	84%	65%
Students who manage to score course	78%	58%

4. DISCUSSION

This chapter presents different points of view and different criteria for the content of programming, teachers that teach programming, and students that are learning to program. Today, teaching is not happening individually. There are still possible to have a relationship as a mentor-apprentice. Still, today's structure often involves many elements: teachers, students, administration, management, library, and IT services. Teachers should share experiences and help and motivate each other. Different people with their ideas, backgrounds, and point of view in good cooperation can do much more than each individual. To increase such synergies, this collaboration has to be organized. One approach is to develop and implement a system/rules that facilitate knowledge sharing and collaboration. If all want to do the same – it is not inspiring, and shared resources may distribute the work and allow individuals to contribute where they are strongest. Open-source projects with a shared codebase and distributions of tasks may serve as a potential model.

Teaching programming has many possibilities and requirements. The teacher's knowledge, the avoidance of problematic elements in teaching, and the use of modern and accessible tools require particular knowledge and skills. This does not seem to be necessary in every case for teaching programming. It seems advisable to divide programming courses according to the expected knowledge of the students. Programming students should have more theoretical and practical knowledge and skills. Students of other majors don't need the same theory, and basic knowledge of algorithmics, problem-solving, and commitment would suffice.

With sophisticated language models, like OpenAI Codex (OpenAI, 2022), this seems quite likely in the near future: Once a designer knows what to build, the act of writing code can be thought of as (1) breaking a problem down into simpler problems, and (2) mapping

those simple problems to existing code (libraries, APIs, or functions) that already exist. Most programmers probably find the latter tasks the least interesting part of programming. At the same time, this is where assistance by AI excels the most. In this scenario, coding becomes available as a service, and the most crucial skills will be defining and breaking down the problems that the programs are to solve. Important skills will then be training and weighting of the models, and the needed skills may be very different from what is commonly understood as programming today.

*Table 2.
Summary of the challenges according to the Didactical Triangle.*

	Content	Teacher	Student
Challenges	Anthropomorphizing metaphor	Student-centered approach	Pedagogical approach
	Different approaches	Experiences with programming	Students' expectations
	Specialized content for the course	Updating qualifications	Teaching through pandemic
	The choice of language	Programming as a supplementary tool	

5. CONCLUSIONS

What should be the content in programming courses? What is necessary knowledge, and for whom? The research question discussed in this study is: What can be challenging in introducing programming based on the Didactical Triangle: Content, Teacher, and Student? Real-world examples show that there is no "golden solution" to teaching programming that will fit every course, every teacher, and every student, but by addressing the didactical challenges, see table 2, there is a potential to teach computer programming in a way that will let students practice their skills and competencies.

In teaching computer programming, there are different expectations in scope (speed, standards, knowledge of technologies, libraries, programming environments) as well as the area (industry, banking, marketing, education), which shows that there are very different expectations, and it is impossible to meet them all in all courses. Some courses can be more effective for particular students, while others might reach other students. There is no "one size fits all", and different approaches to programming fit better to different students. The teachers should be aware of the didactical challenges and obstacles on various levels of teaching computer programming and choose relevant methods.

It is necessary to choose the right topic depending on what you want to teach the students. Many times, courses have very general names, which can mislead candidates. E.g., "advanced programming", "introductory programming", and "basics of programming". - what do they include? Object-oriented programming (another popular term) can be treated in several ways. Depending on the teacher, students can learn the whole subject or just a small part. Unfortunately, there is no standard naming for programming topics and what knowledge and skills they are developing.

A division into different types of programming courses - for computer scientists and for "others" - is suggested. Teachers require a different approach than computer scientists. Their purpose for education and the challenges they meet in their professional lives differ.

A programming course is a challenge for many students. It should be taught by a competent teacher with knowledge of the subject and pedagogy. It's easy to alienate students.

It's harder to motivate them if there are problems. In programming, almost every element builds on the previous ones. Lack of mastery of the primary material (for various reasons) will give rise to deficiencies in subsequent elements, and as a result - the student will "drop out". A solution might be to support the students with more follow-ups by the teachers. It shouldn't be that a teacher has a student for 1 semester, and then whatever happens.

Conversely, the student learns for a few years and then goes to work. Teachers should adapt their teaching to the student's needs, not do what suits them better. The use of the (national) language should be considered - whether it will bring more benefits or problems in the following years. We probably also have to consider the impact of language models on creating code. This can lead to fundamental changes where the definition of problems, their structure, and the prioritizing among different solutions will be of much greater importance than the code itself.

REFERENCES

- Berglund, A., & Lister, R. (2010). Introductory programming and the didactic triangle. In T. Clear & J. Hamer (Eds.), *Proceedings of the twelfth Australasian conference on computing education – Volume 103 (ACE'10)* (pp.35–44). Australian Computer Society. <http://hdl.handle.net/10453/16619>
- Bettin, B., Jarvie-Eggart, M., Steelman, K. S., & Wallace, C. (2022). Preparing first-year engineering students to think about code: A guided inquiry approach. *IEEE Transactions on Education*, 65(3), 309–319. <https://doi.org/10.1109/TE.2021.3140051>
- Biggs, J. (2012). What the student does: Teaching for enhanced learning. *Higher Education Research & Development*, 31(1), 39–55. <https://doi.org/10.1080/07294360.2012.642839>
- Blackwell, A. F. (2002). What is programming? In J. Kuljis, L. Baldwin & R. Scoble (Eds), *Proceedings of the 14th workshop of the Psychology of Programming Interest Group (PPIG)*, 204–218. Retrieved from <https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=fffaed8f98da11d4c6fb3d692dc0ffd41736f209>
- Brown, N. C., & Wilson, G. (2018). Ten quick tips for teaching programming. *PLoS computational biology*, 14(4), e1006023. <https://doi.org/10.1371/journal.pcbi.1006023>
- Bruun, M. H. & Hasse, C. (2016). Studying robots in the wild. In J. Seibt, M. Nørskov & S. Andersen (Eds.), *What social robots can and should do: Proceedings of Robophilosophy 2016 / TRANSOR 2016*, (vol. 290), 373–377. IOS Press, Incorporated.
- Cawthorne, L. (2021). Invited viewpoint: teaching programming to students in physical sciences and engineering. *Journal of Materials Science*, 56(29), 16183–16194. <https://doi.org/10.1007/s10853-021-06368-1>
- Csizmadia, A., Curzon, P., Dorling, M., Humphreys, S., Ng, T., Selby, C., & Woollard, J. (2015). *Computational thinking - A guide for teachers*. Retrieved from https://eprints.soton.ac.uk/424545/1/150818_Computational_Thinking_1_.pdf
- Czerepaniak-Walczak M., (2014), Miedzy teorią a praktyką, Funkcje koncepcji pedagogicznych w pracy nauczycieli i nauczycielek. [Between theory and practice. Pedagogical concept functions in teachers work]. *Refleksje* 6, 10–14.
- Demir, F. (2022). The effect of different usage of the educational programming language in programming education on the programming anxiety and achievement. *Education and Information Technologies*, 27(3), 4171–4194. <https://doi.org/10.1007/s10639-021-10750-6>
- De Raadt, M., Watson, R., & Toleman, M. (2009). Teaching and assessing programming strategies explicitly. In M. Hamilton & T. Clear (Eds.), *Proceedings of the eleventh Australasian conference on computing education – Volume 95 (ACE 2009)*, 45–54. Australian Computer Society. Retrieved from https://research.usq.edu.au/download/c4fbd62549f5c273e706c0384353bc7878d4564b76f530eb34451529e8b5b5a5/1061813/DeRaadt_Watson_Toleman_ACE2009_PV.pdf

- Dijkstra, E.W. (1989). On the cruelty of really teaching computer science. *Communications of the ACM*, 32(12), 1398–1404. Retrieved from <https://www.psy.gla.ac.uk/~steve/educ/dijk/EWD1036.v4.pdf>
- EasyIO, (2020). *Installasjon av programpakken easyIO [Installation of programmingpackage easyIO]*. <https://nettressurser.no/java/Java-og-easyIO>
- Ertmer, P. A., & Newby, T. J. (2013). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance improvement quarterly*, 26(2), 43–71. <https://doi.org/10.1002/piq.21143>
- Fojcik, M. K., Fojcik, M., Sande, O., Refvik, K. A., Frantsen, T., & Bye, H. (2020). A content analysis of SOLO-levels in different computer programming courses in higher education. In *Norsk IKT-konferanse for forskning og utdanning* (No. 4). Retrieved from <https://ojs.bibsys.no/index.php/NIK/article/view/823>
- Fojcik, M., Galek, J., & Fojcik, M. K. (2017). IKT kompetanse blant studenter. Er vi klar for framtiden? [ICT-competencies in students. Are we ready for the future?]. In R. Lyng & M. M. Jakobsen (Eds.) *Proceedings for the MNT-Conference*, 204–207.
- Ginat, D., & Menashe, E. (2015). SOLO Taxonomy for assessing novices' algorithmic design. In *Proceedings of the 46th ACM Technical Symposium on Computer Science Education* (pp. 452–457). <https://doi.org/10.1145/2676723.2677311>
- Griffin, P., & Care, E. (2015). The ATC21S method. In P. Griffin & E. Care (Eds.), *Assessment and teaching of 21st century skills. Educational assessment in an information age*, 3–33. Springer. https://doi.org/10.1007/978-94-017-9395-7_1
- Hartree, D. R. (1950). Automatic Calculating Machines. *The Mathematical Gazette*, 34(310), 241–252.
- Kak, A. (2009). *Teaching programming*. Retrieved from <https://engineering.purdue.edu/kak/TeachingProgramming.pdf>
- Kansanen, P., & Meri, M. (1999). The didactic relation in the teaching-studying-learning process. In B. Hudson, F. Buchberger, P. Kansanen, & H. Seel, (Eds.), *Didaktik/Fachdidaktik as Science (-s) of the Teaching profession (TNTEE)*, 2(1), 107–116.
- Karpathy, A. (2017). *Software 2.0*. <https://karpathy.medium.com/software-2-0-a64152b37c35>
- LK20 (2019). *Kunnskapsløftet 2020, Curricula in English*. Utdanningsdirektoratet. <https://www.udir.no/in-english/curricula-in-english/>
- Malik, S. I., Tawafak, R. M., & Shakir, M. (2021). Aligning and assessing teaching approaches with solo taxonomy in a computer programming course. *International Journal of Information and Communication Technology Education (IJICTE)*, 17(4), 1–15. <https://doi.org/10.4018/IJICTE.20211001.0a5>
- Martin, A. (2006). A European framework for digital literacy. *Nordic Journal of Digital Literacy*, 1(2), 151–161. <https://doi.org/10.18261/ISSN1891-943X-2006-02-06>
- merriam-webster dictionary (2020). <https://www.merriam-webster.com/>
- OpenAi (2022). OpenAI Codex. <https://openai.com/blog/openai-codex/>
- Robins, A., Rountree, J., & Rountree, N. (2003). Learning and teaching programming: A review and discussion. *Computer science education*, 13(2), 137–172. <https://doi.org/10.1076/csed.13.2.137.14200>
- Selby, C. C. (2014). How can the teaching of programming be used to enhance computational thinking skills? (Doctoral dissertation, University of Southampton, Southampton, United Kingdom). Retrieved from <https://eprints.soton.ac.uk/366256/>
- Sheard, J., Carbone, A., Lister, R., Simon, B., Thompson, E., & Whalley, J. L. (2008). Going SOLO to assess novice programmers. In *Proceedings of the 13th annual conference on innovation and technology in computer science education* (pp. 209–213). <https://doi.org/10.1145/1384271.1384328>
- Sheard, J., & Carbone, A. (2007). ICT teaching and learning in a new educational paradigm: Lecturers' perceptions versus students' experiences. In *Proceedings of the Seventh Baltic Sea Conference on Computing Education Research - Volume 88* (pp. 109–117). Retrieved from https://www.researchgate.net/profile/Judy-Sheard-2/publication/228394103_Ict_teaching_and_learning_in_a_new_educational_paradigm_lecturers_perceptions_versus_students_experiences/links/563c804a08ae405111a9e048/Ict-teaching-and-learning-in-a-new-educational-paradigm-lecturers-perceptions-versus-students-experiences.pdf

- Schulte, C., & Bennedsen, J. (2006). What do teachers teach in introductory programming? In *Proceedings of the second international workshop on Computing education research (ICER'06)*, 17–28. <https://doi.org/10.1145/1151588.1151593>
- Vuorikari, R., Punie, Y., Carretero, S. & Van den Brande, L. (2016). *DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1: the Conceptual Reference Model*. Retrieved from <https://publications.jrc.ec.europa.eu/repository/handle/JRC101254>
- Wing, J. M. (2006). Computational thinking. *Communications of the ACM*, 49(3), 33–35. <https://doi.org/10.1145/1118178.1118215>
- Winslow, L. E. (1996). Programming pedagogy—a psychological overview. *ACM Sigcse Bulletin*, 28(3), 17–22. <https://doi.org/10.1145/234867.234872>

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Section 4
Organizational Issues

Chapter # 43

RELATIONSHIP BETWEEN SCHOOL CLIMATE AND GRADE 9 LEARNER ACHIEVEMENT IN SCIENCE: COMPARING SOUTH AFRICA AND SINGAPORE

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ABSTRACT

South Africa scored worst in scientific achievement at the high-grade level in the Trends in International Mathematics and Science Studies (TIMSS) 2019. Singapore, the TIMSS 2019 leader, and South Africa are compared. Quantitative positivist design was applied. Multi-level models showed that, for both countries, learners with a higher sense of belonging performed better. In Singapore, school buildings, grounds, and audio-visual tools for instruction were significant predictors; however, in South Africa, appropriate instructional materials and technologically skilled staff were. Singaporean learners at schools where principals claimed their audio-visual resources for instruction were not affected by shortage or inadequacy performed significantly worse than those in schools where principals said it is affected. Several explanations were offered for this surprising discovery, but Singapore education officials and stakeholders may need to investigate more. Thus, for Singapore, we urge additional investigation of the surprising outcome while, for South Africa, prioritising schools with insufficient instructional materials and training all teachers in technology. Stakeholders should also invest in school climate surveys and other interventions supporting a healthy school environment. Additional research is encouraged to establish the nature of the impact that a healthy school climate has on learner achievement through longitudinal studies where causation can be proven.

Keywords: school climate, learner achievement, TIMSS 2019, multi-level models.

1. INTRODUCTION

In South Africa, poor learner achievement in science has occupied the centre stage with the release of the TIMSS 2019 results, where TIMSS refers to the “Trends in International Mathematics and Science Studies” (Reddy et al., 2021, p. 1). Although TIMSS studies are conducted on Grade 4 and Grade 8 levels, South Africa uses Grade 5 and Grade 9 as South African learners had participated at Grade 4 and Grade 8 levels in previous cycles of TIMSS and performed poorly (Reddy et al., 2015). The focus of this study is on Grade 9 level. TIMSS 2019 can be divided into low (under 400), intermediate (under 475), high (under 550), and advanced (under 625) benchmarks (Mullis, Martin, Foy, Kelly, & Fishbein, 2020) with learners achieving above 400 points being classified as “having acquired basic ... science knowledge” (Reddy et al., 2021, p. 4) and only 36% of South African Grade 9 learners achieving this for science. At Grade 9 level, 39 countries participated, and South Africa was last in science achievement, whereas Singapore was first on the opposite end. Many comparative educational studies have been done between different nations and Singapore (even South Africa with Singapore (e.g. Chinengundu, Hondonga, Chakamba, Masina, & Mawonedzo, 2022; Milne & Mhlolo, 2021; Wolhuter & Russo, 2013), as Singapore is one of the top-performing nations globally; this is evidence by large-scale international studies such as TIMSS. Perhaps Singapore’s innovations in its science education curricula have led to their success. In Singapore, learners’ first encounter with a

formal science class is at the age of nine (in Primary 3), and the science curriculum framework is implemented through a “science as an inquiry” (Tan, Teo, & Poon, 2016, p. 159) platform which explores learners’ attitudes toward science application in real-life situations. Science is made practical, and both the learner and the teacher are involved in the inquiry process, with the learner as the “inquirer who determines ways to solve problems by asking appropriate questions, planning and conducting experiments, analysing the data collected, drawing conclusions, communicating and defending their findings” (Tan et al., 2016, p. 159). In South Africa, as soon as learners enter the school at Grade R (age 5 to 6 years), they are introduced to science; however, the curriculum limits science learning to only one of the “Life Skills” topics for Grades R to 4 (Foundation Phase) and only moves to “Natural Sciences and technology” topic in Grade 5 (age 11 years) and, accordingly, “teachers seem to minimise early science learning opportunities” (Minnaar & Naude, 2016, p. 366). The latter authors concluded by stating that South African teachers find it challenging to teach science skills and concepts in such a way that is relevant to young children.

South Africa can learn many lessons from Singapore regarding science education. As scientific inquiry has the potential to make science more engaging for learners, South Africa’s science curriculum could benefit from Singapore’s expertise in these areas. South Africa should likewise embrace this method in which learning in the classroom is conducted to tackle real-world problems outside of the classroom. It’s also interesting that South African learners are exposed to science (or at least some form of it) at the early ages of five or six years of age, whereas learners in Singapore are only exposed the formal science learning at the age of nine, yet Singapore greatly outperforms South Africa in science achievement. This may be attributed to the fact that South African early-year teachers seem to have a lack of understanding of science concepts (Kazeni, 2021; Ogegbo & Ramnarain, 2020), find it challenging to teach science skills and concepts in such a way that is relevant to young children (Minnaar & Naude, 2016).

Although many studies have been conducted on how to improve South African learners’ science achievement, the focus is mainly on their poor exposure to science topics during early childhood development and the fact that South African early-year teachers seem to have a lack of understanding of science concepts (Kazeni, 2021; Minnaar & Naude, 2016; Ogegbo & Ramnarain, 2020). In South Africa, early primary school (grades R to 3) scientific education has been in the limelight in recent years, as science education academics increasingly recognise the need to establish a solid foundation in science education in order to persuade learners to continue studying the topic in later grades; however, fewer studies focus on the later years by exploring factors negatively associated with South African learners science achievement in later years. Thus, in this study, Grade 9 is the focus, and since much literature has shown that school climate is associated with learner performance (this literature will be considered next), we included an investigation into this topic in this study. Furthermore, since it seems that South Africa can learn much from Singapore relating to science education, a comparative study between South Africa and Singapore is conducted. Thus, this study is taking a multi-faceted approach by not only conducting a comparative study between the country that performed the worst in science in TIMSS 2019 (South Africa) and the one that performed the best (Singapore) to explore what that worst-performing country can learn from the top-performing country, but it also explores the relationship between school climate and teaching outcomes. All this is done with the aim of exploring how all these issues can help improve South African science achievement. The association between school climate and learner performance is considered next.

School climate has become a staple of organisational-educational research and is considered here in relation to learner academic achievement. Many researchers have found school climate to be a predictor of learner achievement (Belton, 2021; Dolegowski, 2022;

Richard, 2021; Zysberg & Schwabsky, 2021). Belton (2021) conducted a study in Virginia, USA, using Grade 5 data from 97 schools, and found a strong correlation between school climate and learner achievement. In another American study using data from 6,670 fifth-graders, Richard (2021) found that a positive school climate had a significant relationship with English Language Arts achievement. Another American study (Dolegowski, 2022) which conducted qualitative research on teacher perceptions of the association between school climate and learner achievement in two rural schools in Western New York, found the school climate domains of engagement, safety and environment, to affect learner achievement significantly. Quansah (2022), who conducted a quantitative study in Ghana, found that many factors influence learner achievement, with school climate being one of them. In a study conducted in Brazil by Rizzotto and França (2022), who explored the association between school climate and science performance, they found that learners experiencing a positive school climate significantly outperformed learners experiencing a negative school climate. Within the South African context, Arends, Winnaar, and Namome (2021), using TIMSS 2015 data, showed that school climate and access to and use of school resources have a significant association with learner achievement. In two other South African studies, Winnaar (2021) and Graham (2022), both analysed TIMSS 2019 data using different statistical techniques, and both found that school climate was significantly associated with learner achievement. Maslow's hierarchy of needs (Maslow, 1943) was used as theoretical framework, as learners attending a school with a negative climate cannot devote their full attention to learning, which, in turn, negatively impacts learner achievement. The South African results are compared to the results of Singapore, as Singapore is the top-performing country in TIMSS 2019 (Reddy et al., 2021) concerning science achievement. South Africa and Singapore have many similarities; for example, both countries have a very similar colonial rule history and lacked inclusive quality education systems for many decades (Milne & Mhlolo, 2021). Also, classes in both nations are instructor-led and focus on learning pre-existing information, using a language, English, other than the mother tongue of most students, as the main media of instruction (Naroth & Luneta, 2015; Tan, 2017). The two countries followed different paths to accommodate all exceptional students rather than the select few favoured during the colonial era (DBE, 2011; Milne & Mhlolo, 2021). Singapore strove to create an inclusive education system driven by excellence, while the South African education model was based on ensuring equity (Milne & Mhlolo, 2021). The vastly different outcomes motivated more than 80 South African schools to attempt an intervention utilising the Singapore mathematics curriculum (SMC) to enhance students' mathematics proficiency (Naroth & Luneta, 2015) and motivated us to select Singapore for comparison purposes with South Africa. Perhaps if South Africa is following the lead of Singapore in mathematics, this could be considered for science as well with the aim of improving South African science achievement.

2. METHODOLOGY

2.1. Methods

Secondary data analysis refers to a research design that mostly uses existing data, mostly quantitative data, to reapply and reanalyse such data to test hypotheses or validate models (Mouton, 2001). We used a quantitative design with a positivist philosophical stance and a deductive approach. A secondary data analysis was run using Grade 9 TIMSS 2019 data from South Africa and Singapore.

2.2. Participants and instruments

In South Africa, a total of 519 schools and 20,829 learners participated in TIMSS 2019, whereas, in Singapore, it was 153 schools and 4,853 learners (LaRoche & Foy, 2020). Table 1

shows the TIMSS 2019 variables considered in this study; these are the independent variables (predictors), and the dependent variable is science achievement. Multi-level models were built using HLM software (Raudenbush & Bryk, 2002). Re-coding has to be done since, for the multi-level model, it's ideal to either use continuous or dichotomised variables in the analysis. The majority of the variables are categorical (with more than two response options), which makes interpretation of them challenging concerning achievement since we do not know what the reference categories are, and HLM will most likely read these variables as continuous variables. Accordingly, all variables have been re-coded to be binary. For binary variables, it is typical to use no centring at Level-1 (learner-level) and grand-centring at Level-2 (school-level) (Raudenbush & Bryk, 2002). Missing values were replaced using multiple imputation, which Van Ginkel, Linting, Rippe, and Van der Voort (2020) have shown is the best way to deal with missing values regardless of the type of missing value it is.

Table 1.
Details on the independent variables used in the multi-level models and information on re-coding.

Variable	Description	Response options	Re-coding done
Level-1: Learner questionnaire answered by learners			
BSBGHER	“Home educational resources” (Martin, von Davier & Mullis, 2020, p. 16.168)	1 – 8.4 = “Few” 8.4 – 12.2 = “Some” > 12.2 = “Many”	1 – 12.2 = 0 = “Few or some” > 12.2 = 1 = “Many” New variable name: BSBGHER → L1V1
BSBG01	“Gender” (TIMSS, 2018b, p. 3)	1 = “Girl” 2 = “Boy”	0 = “Boy” 1 = “Girl” New variable name: BSBG01 → L1V2
BSBGSSB	“Sense of school belonging” (Martin et al., 2020, p. 16.198)	1 – 7.8 = “Little” 7.8 – 10.7 = “Some” > 10.7 = “High”	1 – 10.7 = 0 = “Little or some” > 10.7 = 1 = “High” New variable name: BSBGSSB → L1V3
Level 2: School questionnaire answered by principals			
“How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of the following?” ⁱ			
BCBG13AA	“Instructional materials (e.g., textbooks)”	1 = “Not at all” 2 = “A little” 3 = “Some” 4 = “A lot”	0 = “Some or a lot” 1 = “Not at all or a little” New variable names: BCBG13AA → L2V1 BCBG13AB → L2V2 BCBG13AC → L2V3 BCBG13AD → L2V4 BCBG13AE → L2V5 BCBG13AF → L2V6 BCBG13AG → L2V7 BCBG13AH → L2V8 BCBG13AI → L2V9
BCBG13AB	“Supplies (e.g., papers, pencils, materials)”		
BCBG13AC	“School buildings and grounds”		
BCBG13AD	“Heating/cooling and lighting systems”		
BCBG13AE	“Instructional space (e.g., classrooms)”		
BCBG13AF	“Technologically competent staff”		
BCBG13AG	“Audio-visual resources for delivery of instruction (e.g., interactive white boards, digital projectors)”		

Variable	Description	Response options	Re-coding done
BCBG13AH	“Computer technology for teaching and learning (e.g., computers or tablets for student use)”		
BCBG13AI	“Resources for students with disabilities”		

¹All direct quotes from the school questionnaires are from TIMSS (2018a, p. 2)

3. ETHICAL CONSIDERATIONS

No permission was needed to analyse the TIMSS 2019 data, as it is available for public use on the IEA’s website where IEA stands for “International Association for the Evaluation of Educational Achievement” (Fishbein, Foy, & Yin, 2021, p. II). The TIMSS 2019 data also has no identifiers, so schools and participants cannot be identified.

4. RESULTS AND DISCUSSION

The percentage responses for South Africa and Singapore for the re-coded variables are shown in Table 2, with the percentages for South Africa being in the first row and those of Singapore being in the second row. The differences in percentages are evident; for example, when considering the level-2 predictors, there is a clear pattern that, for South Africa, the distribution is roughly 50-50 between the categories of “some or a lot” and “not at all or a little”, whereas, for Singapore, the distribution, this distribution is roughly 20-80 between “some or a lot” and “not at all or a little”, indicating that, according to the principals, the majority of schools in Singapore is either not affected by shortages or inadequate resources or they are unaffected at all by shortages or inadequate resources, whereas, for South Africa, this is a very different picture with about half the schools being either not affected by shortages or inadequate resources or being unaffected at all by shortages or inadequate resources.

Table 2.
Percentage responses for South Africa and Singapore to selected predictors.

Variable	Response options	
	Few or some	Many
L1V1 “Home educational resources” (Martin et al., 2020, p. 16.168)	97.1 86.4	2.9 13.6
L1V2 “Gender” (TIMSS, 2018b, p. 3)	Boy 46.7 51.2	Girl 53.3 48.8
L1V3 “Sense of school belonging” (Martin et al., 2020, p. 16.198)	Little or some 53.3 72.2	High 46.7 27.8
“How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of the following?” ⁱ	Some or a lot	Not at all or a little
L2V1 “Instructional materials (e.g., textbooks)”	55.0 13.3	45.0 86.7

	L2V2	49.1	50.9
	“Supplies (e.g., papers, pencils, materials)”	11.3	88.7
	L2V3	50.0	50.0
	“School buildings and grounds”	15.8	84.2
	L2V4	42.2	57.8
	“Heating/cooling and lighting systems”	14.6	85.4
	L2V5	52.3	47.7
	“Instructional space (e.g., classrooms)”	17.2	82.8
	L2V6	54.0	46.0
	“Technologically competent staff”	22.5	77.5
	L2V7	52.0	48.0
	“Audio-visual resources for delivery of instruction (e.g., interactive white boards, digital projectors)”	14.5	85.5
	L2V8	49.1	50.9
	“Computer technology for teaching and learning (e.g., computers or tablets for student use)”	15.2	84.8
	L2V9	32.1	67.9
	“Resources for students with disabilities”	23.1	76.9

ⁱAll direct quotes from the school questionnaires are from TIMSS (2018a, p. 2)

Two multi-level analyses were conducted. Firstly, the null models without variables were created to indicate the variance in achievement amongst schools (see Table 3). For the South African null model, the variance at the learner level is 5,275.08, which signifies 47.5% of the total variance. The variance at the school level is 5,840.41, which represents 52.5% of the total variance, which is statistically significant ($p < 0.001$). For the Singapore null model, the variance at the learner level is 4,244.23, which signifies 53.8% of the total variance. The variance at the school level is 3,631.44, which represents 46.2% of the total variance, which is statistically significant ($p < 0.001$).

Table 3.
The null models.

		<i>var</i> component	<i>df</i>	χ^2	<i>p</i>	<i>var</i> explained
South Africa	Intercept	5,840.41	518	22,580.62	<0.001*	52.5%
	Level-1, r	5,275.08				47.5%
Singapore	Intercept	3,631.44	152	4,174.47	<0.001*	46.2%
	Level-1, r	4,224.23				53.8%

Note: *Statistically significant $p < 0.05$, *var* = “variance”, *df* = “degrees of freedom”

The parsimonious model was created by introducing all independent variables into the null model and then removing all insignificant variables one at a time, with only significant variables retained. Table 4 shows the results of the parsimonious model (also referred to as the final model).

Table 4.
The parsimonious models.

		<i>var</i> component	<i>df</i>	χ^2	<i>p</i>	<i>var</i> explained
South Africa	Intercept	5,240.22	516	20,749.54	<0.001*	50.0%
	Level-1, r	5,243.00				50.0%
Singapore	Intercept	3,328.34	152	3,887.41	<0.001*	44.5%
	Level-1, r	4,150.77				55.5%

For the South African parsimonious model, the variance at the learner level is 5,243.00, which signifies 50.0% of the total variance. The variance at the school level is 5,240.22, which represents 50.0% of the total variance, which is statistically significant ($p < 0.001$). For the Singapore parsimonious model, the variance at the learner level is 4,150.77, which signifies 55.5% of the total variance. The variance at the school level is 3,328.34, which represents 44.5% of the total variance, which is statistically significant ($p < 0.001$).

The average reliability estimate was 0.978 and 0.959 for the South African and Singapore final models, respectively, indicating that sample averages reflected the true school means. For South Africa, by comparing the variance components of the final models to those of the null models, the percentage reduction in the variance at learner-level was 0.6% (learner-level) and 10.3% (school-level). For Singapore, by comparing the variance components of the final models to those of the null models, the percentage reduction in the variance at learner-level was 1.7% (learner-level) and 8.3% (school-level). Table 5 shows the effect sizes (β 's) of the significant predictors of the parsimonious models for South Africa.

Table 5.
Significant predictors of the parsimonious models for South Africa.

	β	s. e.	t	p
Intercept	352.41	6.83	51.59	<0.001*
Level-1/learner-level (Learner predictors)				
L1V1: "Home educational resources" (Martin et al., 2020, p. 16.168) 0 = "Few or some" 1 = "Many"	23.52	5.36	4.39	<0.001*
L1V2: "Are you a girl or boy" (TIMSS, 2018b, p. 3) 0 = "Boy" 1 = "Girl"	3.64	1.62	2.25	0.027*
L1V3: "Sense of school belonging" (Martin et al., 2020, p. 16.198) 0 = "Little or some" 1 = "High"	8.94	1.67	5.36	<0.001*
Level-2/school-level (School predictors)				
L2V1: "Instructional materials (e.g., textbooks)" (TIMSS, 2018a, p. 2) 0 = "Some or a lot" 1 = "Not at all or a little"	26.89	13.38	2.01	0.045*
L2V6: "Technologically competent staff" (TIMSS, 2018a, p. 2) 0 = "Some or a lot" 1 = "Not at all or a little"	30.17	12.68	2.38	0.018*

Note. *Statistically significant $p < 0.05$, s. e. = "standard error", t = "Approximate t-ratio"

Gender and socio-economic status were included in the model only as control variables and not discussed in detail here. At learner-level, learners who reported a high sense of school belonging performed significantly higher (on average by 8.94 points) than those that reported little of some sense of school belonging. This finding is not surprising, as Winnaar's (2021) South African study also used the TIMSS sense of school belonging scale and had a similar finding. At school-level, there were two significant predictors. Learners from schools where the principals indicated that the school's capacity to provide instruction is "not at all or a

little” affected by a shortage or inadequacy of instructional materials performed significantly better (on average 26.89 points) than learners in schools where principals reported that it is affected “some or a lot”. This result is not a surprising finding, as Arend et al.’s (2021) South African study also showed that access to and use of school resources has a significant association with learner achievement. Learners from schools where the principals indicated that the school’s capacity to provide instruction is “not at all or a little” affected by a shortage or inadequacy of technologically competent staff performed significantly better (on average 30.17 points) than learners in schools where principals reported that it is affected “some or a lot”. Table 6 shows the effect sizes (β ’s) of the significant predictors of the parsimonious models for Singapore.

Table 6.
Significant predictors of the parsimonious models for Singapore.

	β	s.e.	t	p
Intercept	599.21	5.59	107.03	<0.001*
Level-1/learner-level (Learner predictors)				
L1V1: “Home educational resources” (Martin et al., 2020, p. 16.168) 0 = “Few or some” 1 = “Many”	22.87	3.94	5.80	<0.001*
L1V2: “Are you a girl or boy” (TIMSS, 2018b, p. 3) 0 = “Boy” 1 = “Girl”	-8.02	2.55	-3.14	0.002*
L1V3: “Sense of school belonging” (Martin et al., 2020, p. 16.198) 0 = “Little or some” 1 = “High”	6.64	2.55	2.60	0.009*
Level-2/school-level (School predictors)				
L2V3: “School buildings and grounds” (TIMSS, 2018a, p. 2) 0 = “Some or a lot” 1 = “Not at all or a little”	34.85	12.71	2.74	0.007*
L2V7: “Audio-visual resources for delivery of instruction (e.g., interactive white boards, digital projectors)” (TIMSS, 2018a, p. 2) 0 = “Some or a lot” 1 = “Not at all or a little”	-44.12	14.04	-3.14	0.002*

Note. *Statistically significant $p < 0.05$, s.e. = “standard error”, t = “Approximate t-ratio”

At learner-level, learners who reported a high sense of school belonging performed significantly higher (on average by 6.64 points) than those that reported little or some sense of school belonging. At school-level, there were two significant predictors. Learners from schools where the principals indicated that the school’s buildings and grounds are “not at all or a little” affected by a shortage or inadequacy of it performed significantly better (on average 34.85 points) than learners in schools where principals reported that it is affected “some or a lot”. Learners from schools where the principals indicated that the school’s audio-visual resources for delivery of instruction (e.g., interactive white boards, digital projectors) are “not at all or a little” affected by a shortage or inadequacy of it performed significantly worse (on average 44.12 points) than learners in schools where principals

reported that it is affected “some or a lot”. This result may seem counterintuitive; however, this result may be biased by the sparse responses in the category of “some or a lot”, with less than 15% of the principals in Singapore schools selecting this category. It is well-known that schools in Singapore use audio-visual resources for science teaching (see, e.g. Adams & Lim, 2020; Teo & Pua, 2021), so almost 15% of principals stating that there is a shortage may not have realised what is truly meant by the term “shortage”, as Singapore is the second richest country in the world (Global Finance, 2022) and ranks 18th in the world according to the ICT Development Index (Machmud, Widiyan, & Ramadhani, 2021).

5. CONCLUSION

The multi-level analysis using HLM software showed that a high sense of belonging was a significant predictor of science achievement for both countries. For South Africa, schools with sufficient instructional materials, and technologically competent staff are significant predictors of science achievement. We recommend that South African schools with insufficient instructional materials be prioritised for receiving the necessary material and that all South African teachers be trained in the use of technologies, as these are significant predictors of learner achievement. This will, in turn, enhance learners’ sense of belonging, which is also a significant predictor. Another recommendation for South African schools is that stakeholders invest in school climate surveys and other interventions supporting a healthy school environment, as many researchers, including this study, have shown that a healthy school climate is a significant predictor of learner achievement. Additional research is encouraged to establish the nature of the impact that a healthy school climate has on learner achievement through longitudinal studies where causation can be proven. For Singapore, school buildings and grounds and audio-visual resources for the delivery of instruction were found to be significant predictors. It was also found that learners from schools where the principals indicated that the school’s audio-visual resources for delivery of instruction (e.g., interactive white boards, digital projectors) are “not at all or a little” affected by a shortage or inadequacy of it performed significantly worse than learners in schools where principals reported that it is affected “some or a lot”. We have tried to give some explanations as to why this counterintuitive result was found; however, it may not be up to us but rather to the policymakers and the stakeholders in the Singapore education system to further investigate this counterintuitive result.

REFERENCES

- Adams, J., & Lim, F. V. (2020). Towards a functional literacy approach to teach the language of science in the Singapore classroom. *Pedagogical Linguistics*, 1(2), 125-148. <https://doi.org/10.1075/pl.19008.ada>
- Arends, F., Winnaar, L., & Namome, C. (2021). Reproducing inequality in the South African schooling system: What are the opportunities? In W. Pearson & V. Reddy (Eds.), *Social justice and education in the 21st century* (pp. 53-73). Switzerland: Springer.
- Belton, D. A. (2021). *The relationship between school climate and student achievement at the elementary school level* (Doctoral dissertation). Virginia Tech, United States of America.
- Chinengundu, T., Hondonga, J., Chakamba, J., Masina, R., & Mawonedzo, A. (2022). Professional development for educators in Singapore, South Africa, and Zimbabwe: Lessons to learn from each other. In O. Al-Mahdi & T. Purinton (Eds.), *Global perspectives on teacher performance improvement* (pp. 204-231). Hershey, PA: IGI Global. <https://doi.org/10.4018/978-1-7998-9278-6.ch011>
- Department of Basic Education. (2011). *Curriculum and assessment policy statement*. Department of Basic Education. Retrieved from <https://www.education.gov.za>

- Dolegowski, M. J. (2022). *Rural teachers' and school leaders' perceptions of school climate and student achievement in math and reading: A multiple case study* (Doctoral dissertation). Available from Liberty University ProQuest Dissertations Publishing (UMI 29164790).
- Fishbein, B., Foy, P., & Yin, L. (2021). *TIMSS 2019 user guide for the international database*. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: <https://timssandpirls.bc.edu/timss2019/international-database/>
- Global Finance. (2022, September 08). Richest countries in the world 2022. *Global Finance*. Retrieved from <https://www.gfmag.com/global-data/economic-data/richest-countries-in-the-world>
- Graham, M. A. (2022). Safety factors associated with mathematics achievement in South African primary schools. *Social and Health Sciences*, 20(1-2), 1-26. <https://doi.org/10.25159/2957-3645/10719>
- Kazeni, M. (2021). Early primary school teachers' perceptions about science and science process skills: A case study in South Africa. In M. Carmo (Ed.), *Education and New Developments 2021* (pp. 18-22). Lisbon, Portugal: inScience Press. <https://doi.org/10.36315/2021end004>
- LaRoche, S., & Foy, P. (2020). Sample implementation in TIMSS 2019. In M. O. Martin, M. von Davier, & I. V. S. Mullis (Eds.), *Methods and procedures: TIMSS 2019 technical report* (pp. 9.1-9.261). TIMSS & PIRLS International Study Center, Lynch School of Education and Human Development, Boston College and International Association for the Evaluation of Educational Achievement. Retrieved from <https://timssandpirls.bc.edu/timss2019/methods/chapter-9.html>
- Machmud, M. T., Widiyan, A. P., & Ramadhani, N. R. (2021). The Development and Policies of ICT Supporting Educational Technology in Singapore, Thailand, Indonesia, and Myanmar. *International Journal of Evaluation and Research in Education*, 10(1), 78-85. <https://doi.org/10.11591/ijere.v10i1.20786>
- Martin, M. O., von Davier, M., & Mullis, I. V. S. (Eds.). (2020). *Methods and procedures: TIMSS 2019 technical report*. TIMSS & PIRLS International Study Center. Retrieved from <https://timssandpirls.bc.edu/timss2019/methods/>
- Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, 50(4), 370-396. <https://doi.org/10.1037/h0054346>
- Milne, A., & Mhlolo, M. (2021). Lessons for South Africa from Singapore's gifted education – A comparative study. *South African Journal of Education*, 41(1), 1-8. <https://doi.org/10.15700/saje.v41n1a1839>
- Minnaar, R., & Naude, F. (2016). Grade R teachers' awareness of the development of science process skills in children. *Proceedings of the ISTE Conference: Mathematics, Science and Technology Education* (pp. 366-376). UNISA Institutional Repository. <https://uir.unisa.ac.za/>
- Mouton, J. (2001). *How to succeed in your Master's and Doctoral studies: A South African guide and resource book*. Pretoria, South Africa: Van Schaik.
- Mullis, I. V. S., Martin, M. O., Foy, P., Kelly, D. L., & Fishbein, B. (2020). *TIMSS 2019 international results in mathematics and science*. TIMSS & PIRLS International Study Center. Retrieved from <https://timssandpirls.bc.edu/timss2019/international-results/>
- Naroth, C., & Luneta, K. (2015). Implementing the Singapore mathematics curriculum in South Africa: Experiences of foundation phase teachers. *African Journal of Research in Mathematics, Science and Technology Education*, 19(3), 267-277. <https://doi.org/10.1080/10288457.2015.1089675>
- Ogebo, A., & Ramnarain, U. (2020). Early year teachers' understanding and implementation of science process skills. In M. Carmo (Ed.), *Education and New Developments 2020* (pp. 414-418). Lisbon, Portugal: inScience Press.
- Quansah, E. A. (2022). An appraisal of school-related factors that contribute to the academic achievements of low social-economic-status of students in Ghana. *Open Journal of Educational Research*, 2(2), 93-101. <https://doi.org/10.31586/ojer.2022.286>
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: SAGE.
- Reddy, V., Winnaar, L., Juan, A., Arends, F., Harvey, J., Hanna, S., Namome, C., Sekhejane, P., & Zulu, N. (2021). *TIMSS 2019. Highlights of South African Grade 9 results in mathematics and science*. Retrieved June 10, 2021, from https://www.timss-sa.org/download/books_and_reports/TIMSS-2019_Grade9_HSRC_FinalReport_2021.pdf

- Reddy, V., Zuze, T. L., Visser, M., Winnaar, L., Juan, A., Prinsloo, C. H., Arends, F., & Rogers, S. (2015). *Beyond benchmarks. What twenty years of TIMSS data tell us about South African education*. Human Sciences Research Council.
- Richard, N. R. (2021). *School climate indicators and academic achievement: An investigation of vulnerable subgroups* (Doctoral dissertation). Claremont Graduate University, United States of America.
- Rizzotto, J. S., & França, M. T. A. (2022). Indiscipline: The school climate of Brazilian schools and the impact on student performance. *International Journal of Educational Development, 94*, 102657. <https://doi.org/10.1016/j.ijedudev.2022.102657>
- Tan, K. C. D., Teo, T. W., & Poon, C.-L. (2016). Singapore science education. In M.-H. Chiu (Ed.), *Science education research and practice in Asia: Challenges and opportunities* (pp. 155-174). Singapore: Springer. <https://doi.org/10.1007/978-981-10-0847-4>
- Tan, R. (2017, June 23). How Singapore education compares to the rest of the world. *SMILETutor*. Retrieved from <https://smiletutor.sg/how-singaporean-education-compares-to-the-rest-of-the-world/>
- Teo, T. W., & Pua, C. Y. (2021). Embracing Inclusivity through Pedagogical Practices: Case Studies from Singapore Science Lessons. *Asia-Pacific Science Education, 7*(2), 235-279. <https://doi.org/10.1163/23641177-bja10027>
- Trends in International Mathematics and Science Study. (2018a). *School questionnaire: Grade 9. TIMSS & PIRLS International Study Center*. Retrieved from <https://timssandpirls.bc.edu/timss2019/questionnaires/index.html>
- Trends in International Mathematics and Science Study. (2018b). *Student questionnaire: Grade 9. TIMSS & PIRLS International Study Center*. Retrieved from <https://timssandpirls.bc.edu/timss2019/questionnaires/index.html>
- Van Ginkel, J. R., Linting, M., Rippe, R. C. A., & Van der Voort, A. (2020). Rebutting existing misconceptions about multiple imputation as a method for handling missing data. *Journal of Personality Assessment, 102*(3), 297-308. <https://doi.org/10.1080/00223891.2018.1530680>
- Winnaar, L. (2021). The effect of school climate: How feelings of safety and belonging support learners' achievement. *HSRC Review, 19*(2), 20-22.
- Wolhuter, C. C., & Russo, C. (2013). Dealing with incidents of serious disciplinary problems amongst learners: A comparative study between South Africa and selected countries. *Koers: Bulletin for Christian Scholarship = Koers: Bulletin vir Christelike Wetenskap, 78*(3), 1-11.
- Zysberg, L., & Schwabsky, N. (2021). School climate, academic self-efficacy and student achievement. *Educational Psychology, 41*(4), 467-482. <https://doi.org/10.1080/01443410.2020.1813690>

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Chapter # 44

PERCEIVED REALITIES OF RURAL PRIMARY SCHOOL TEACHERS IN MALAWI: APPLYING BRONFENBRENNER'S ECOLOGICAL SYSTEMS THEORY

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ABSTRACT

The ability of teachers to enhance the quality of education depends on the teachers' knowledge, skills, motivation and conducive working environment. This study examines teachers' experiences in four rural primary schools in Malawi, focusing on the impact of their working and living conditions on the quality of education. The study followed a qualitative research approach, collecting data through semi-structured interviews. Data were obtained from 24 teachers, four headteachers and four primary education advisors (PEA). Bronfenbrenner's ecological systems theory was applied to interpret data. The teachers, headteachers and PEAs are represented in the *microsystem*, their interactions comprise the *mesosystem*, their working and living conditions are represented in the *exosystem*, and the *macrosystem* consists of the customs and laws of society. The findings show that the microsystem, which involves teachers, headteachers and PEAs, appears somewhat active; teachers teach despite numerous challenges. However, interactions between units within that system are weak, resulting in limited mesosystemic interaction. Implications of the findings are discussed later in this chapter.

Keywords: ecological systems theory, rural teachers, rural primary schools, quality primary education, Malawi.

1. INTRODUCTION

The importance of quality education as one of the factors critical to escaping poverty is asserted in the Sustainable Development Goal (SDG) number 4 – Quality education for all, promoting “lifelong learning opportunities for all” (United Nations [UN], 2015). Quality education improves the individual's employability and health, increases earning power and addresses poverty (United Nations, 2018). In addition, quality education provides society with skills and innovations and fuels economic growth (Idrees & Siddiqi, 2013; Ismail, 2015; UN, 2018; World Bank, 2018). Research has suggested that ensuring every child's access to quality education and job skills may increase low-income countries' gross domestic product (GDP) (Chikhungu, Kadzamira, Chiwaula, & Meke, 2020). Primary education is arguably a stepping stone for human capital development, enhanced by secondary and higher education (Winters, 2011). This supports the case for making the needed investment in quality primary education. However, doing so remains challenging in many low-income countries, such as those in sub-Saharan Africa (SSA), including Malawi. While Malawi has seen an expansion of primary education provision in recent years, the quality has remained poor, as signified by the large numbers of learners who complete primary education without developing basic proficiency in numeracy and literacy (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2017; World Bank, 2018).

The teachers' role and the nature of the working environment are vital in promoting quality primary education. In rural areas, structural factors such as poverty often hinder creating and sustaining a primary school environment conducive to quality education. Poor and dilapidated primary school infrastructure in rural areas is too common, with many schools lacking the necessary infrastructure to function efficiently (du Plessis & Mestry, 2019). Many teachers consider rural working conditions unfavourable and are reluctant to work in remote regions, mainly due to poor working and living conditions and limited opportunities for professional development (International Labour Organization [ILO], 2016). Rural teachers' concerns include inadequate classrooms and library facilities or a total lack thereof. In addition, teachers are put off teaching in rural schools due to a lack of teaching and learning materials, such as chalkboards and chalk (Chakanika, Sichula, Sumbwa, & Nduna, 2012). A shortage of textbooks is another factor which affects quality teaching. Even when textbooks are available at schools, they may not be freely available to learners, as school authorities often keep them locked and inaccessible due to the cost and logistical challenges of replacing them (World Bank, 2015).

Rural schools' challenges have resulted in an imbalance in teacher distribution, with rural primary schools experiencing a disproportionate shortage of teachers compared with urban schools (Adedeji & Olaniyan, 2011; Asim, Chimombo, Chugunov, & Gera, 2019; Mulkeen & Chen, 2008). The acute shortage of qualified teachers is a significant problem for the education system in SSA, where only 65% of teachers in primary schools are qualified, compared to 81% globally (United Nations, 2021). In Malawi, the shortage of primary school teachers is reflected in highly qualified teacher/learner ratios of up to 1:95 (Ministry of Education, Science and Technology [MoEST], 2019). Projections indicate that if we are to reach the goal of universal quality education by 2030, 6.3 million primary school teachers will be needed in SSA to cover new teaching posts and counteract attrition (UNESCO, 2016).

Due to poor infrastructure and a lack of qualified teachers in rural areas, a widening inequality related to the knowledge gap exists between rural and urban schools, with children from rural areas falling behind in what they learn and know compared to children from urban areas (Adedeji & Olaniyan, 2011). As du Plessis (2019) points out, learners in rural communities are denied the same opportunity for quality education as learners in urban and less disadvantaged communities. In Malawi, since 84% of the population lives in rural areas (National Statistics Office, 2019), it is imperative to address rural schools' challenges to bridge that learning and attainment gap.

To address some of the challenges of poor education provision in rural areas, in some countries, housing has been provided as an incentive to encourage teachers to move to rural areas (ILO, 2016). Housing provision is critical in ensuring teacher retention in rural schools (Mulkeen & Chen, 2008). The perceived low status of the teaching profession is another factor that may cause teachers to be reluctant to accept a teaching position in rural areas. For some individual teachers, becoming a teacher is often seen as a last resort (Adedeji & Olaniyan, 2011); however, for others, teaching represents the "most attractive profession" (Mtika & Gates, 2011, p. 425).

Using Bronfenbrenner's ecological systems theory, this study explores teachers' working and living conditions in rural primary schools in Malawi and their perceptions of the teaching profession.

1.1. Theoretical Framework: Ecological Systems Theory

To understand the experiences of rural primary school teachers, it is essential to listen to them talk about their lives and learn about their working and living conditions. Teachers can talk about ecological factors such as their housing situation, their interactions with colleagues, and opportunities for professional development. They can also talk about their perceptions of the teaching profession. We applied Bronfenbrenner's ecological system theory (EST) to identify the various social elements and influences that impact teachers' experiences and to view them as a holistic social ecology.

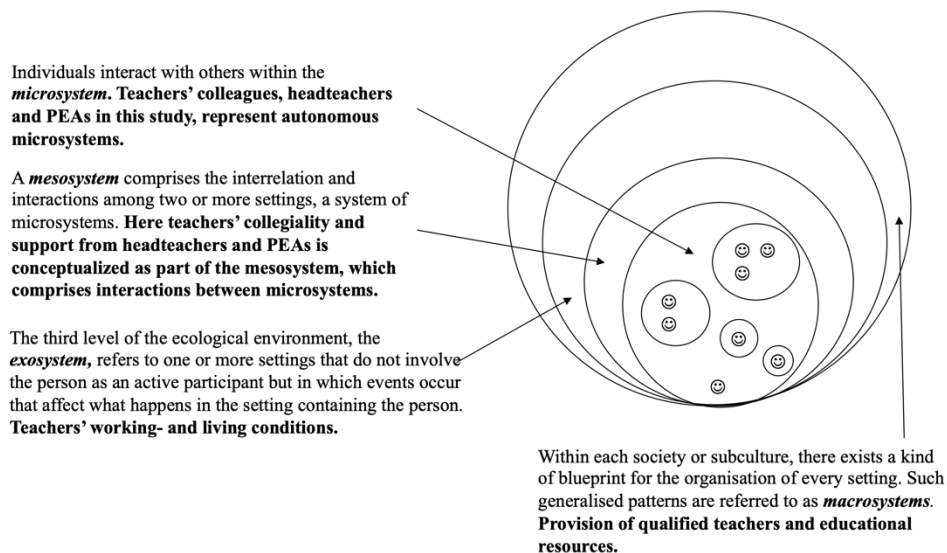
Bronfenbrenner (1979) formulated EST to understand human development in the context of social systems of reciprocal interactions and relationships within a person's environment. EST comprises four interacting nested systems which can both affect and be affected by the individual's development. The four nested systems are *microsystem*, *mesosystem*, *exosystem* and *macrosystem*. Later, Bronfenbrenner added a fifth system, the time element, and labelled it the chronosystem, which does not concern the current study.

At the core of these systems is the developing individual nested in the microsystem, which involves roles, activities and interpersonal relationships in the individual's immediate surroundings. The mesosystem comprises bi-directional linkages between the microsystems. The exosystem represents the social system, which affects the individual without that person having an active role. The macrosystem consists of cultural values and customs, belief systems and laws within the context of the developing individual. We opted to adapt EST as best suited for this study and use it as a framework to understand better the complex interconnections between stakeholders and how different systems affect the individual.

EST has been applied to various research topics ranging from individual development to complex organisational systems such as school districts or individual schools. Seginer (2006) applied Bronfenbrenner's EST in her home- and school-based parental involvement research. Her analysis indicated that while parental involvement through home-school-based activities is positively linked to educational outcomes, the exosystem and macrosystem aspects need additional examination, namely parents' culture and ethnicity. Mthiyane and Chiororo (2020) applied EST to examine school decline in two secondary schools in Zimbabwe. The results indicate that the schools' decline was caused by a set of complex, conflicting mesosystemic, exosystemic and macrosystemic factors, such as the interaction between teachers and headteachers, educational policies and cultural-, social- and economic climate.

The current study focuses on teachers in a rural setting. Within Bronfenbrenner's ecological framework, the teachers' colleagues, headteachers, and PEAs represent autonomous microsystems. Their interactions and relationships are conceptualised as part of the mesosystem, comprising interactions between microsystems. The exosystem incorporates the teacher's working and living conditions, which affect the individual, but over which the person has no control. Lastly, located in the macrosystem are issues such as the provision of qualified teachers and educational resources. Figure 1 depicts each system's different systems and elements as represented in this study.

Figure 1.
An adaptation of Bronfenbrenner's ecology systems of education of four Malawian primary schools, inspired by Bronfenbrenner's EST and Jónsdóttir's (2012) work.



This study aims to explore teachers' working and living conditions in rural primary schools in Malawi and their perceptions of the teaching profession. Bronfenbrenner's (1979) ecological systems theory underpins the research questions, which are:

1. How do teachers in four rural primary schools in Malawi experience their working and living conditions?
2. How do teachers in four rural primary schools in Malawi perceive their profession, its challenges and support?

The findings from this study will add to the growing understanding and research on teachers' experiences in rural areas in Malawi. Such in-depth understanding is essential and will increase our knowledge of rural schools and teachers' challenges. It may also provide insights on how to address these challenges in the hope of improving teachers' working and living conditions and the overall quality of education.

2. CONTEXT OF THE RESEARCH

This study was carried out in rural Malawi. In Malawi, primary school runs from Standard 1 to 8, with the official entry age of six years. On average, learners receive 4.5 years of education (United Nations Development Programme [UNDP], 2018). Primary school enrolment has increased significantly in recent decades; currently, an estimated 85% of primary school-age children are enrolled in school (MoEST, 2019). About 89% of primary schools in Malawi are situated in rural areas. Each district in Malawi is divided into education zones. A Primary Education Advisor (PEA) presides over each zone, supervising 15 primary schools on average. PEAs' responsibilities typically involve providing pedagogic support and in-service training for teachers. In addition, they collect and keep all statistical data for their schools and are the contact person between schools/zones and the district education office (MoEST, 2018).

The government of Malawi has been unable to keep up with the sharp increase in primary school enrolment in recent years. Existing problems such as fragile infrastructure, a lack of resources and teacher shortages have increased. This is evident in the high teacher/learner ratio and relatively low primary completion rate (MoEST, 2018). In addition, drop-out and repetition rates both indicate poor education quality and represent wastage. Based on these statistics, it is unlikely that the link between education and poverty will be easily broken.

This study was conducted in Mangochi District in the Southern Region of Malawi. Mangochi has a literacy rate of 53%, compared to the national rate of 69% (National Statistical Office, 2019). The average qualified teacher/learner ratio is 1:79 compared to 1:70 nationally. The average dropout and repetition rates for the school year 2017-2018 were 6.1% and 29%, respectively, compared to the national rates of 3.2% and 24.5%, respectively. The national primary completion rate of 52% has remained relatively unchanged in recent years (MoEST, 2018).

Improving the overall quality of education in rural schools, such as those in Mangochi District, may ensure that rural children benefit equally from their education as urban children. The children and young people would have a realistic opportunity to develop relevant skills and capabilities and progress to secondary and higher education for enhanced human capital. This emphasises the importance of this study.

This qualitative study explored teachers' experiences in four rural primary schools in Mangochi District.

3. METHODOLOGY AND METHOD

This qualitative study focuses on rural primary school teachers. A semi-structured interview approach was applied to collect data. The study's objective is to assess teachers' subjective experiences in Mangochi District related to their working and living conditions and their perceptions of the teaching profession. Teachers, headteachers and PEAs were interviewed to answer the following research questions: *1. How do teachers in four rural primary schools in Malawi experience their working and living conditions? 2. How do teachers in four rural primary schools in Malawi perceive their profession, its challenges and support?*

3.1. Research Participants and Data Collection

Four rural primary schools were selected for participation: Baobab Primary School, Lakeview Primary School, Chambo Primary School and Hillside Primary School (pseudonyms). Participant selection was purposive and based on participants' lived experience of working in or with rural schools, availability and willingness to participate. Headteachers, teachers and primary education advisors (PEAs) were informed of the purpose of the study, motivation and goal. A schedule for data collection was developed with their cooperation.

Six teachers and one headteacher from each of the four schools were interviewed. Four PEAs were also interviewed, each representing a different zone. All four primary schools were located in impoverished communities, with shortages of qualified teachers, overcrowded classrooms, poor teaching and learning material provision, and a lack of classroom infrastructure and teacher housing.

The field researcher (first author) spent, on average, five days at each school during data collection from May to July 2016. Teachers were interviewed in pairs and asked, for instance, whether becoming a teacher was their first choice, the biggest challenges they

faced in their job, their living situation, and their views on the teaching profession. Headteachers and PEAs were interviewed individually and asked, for instance, how they support their teachers and what opportunities teachers have for professional development in rural areas. All interviews were audio-recorded with participants' permission and lasted between 35-50 minutes.

3.2. Data Analysis

Interviews were transcribed verbatim and then thematically analysed (Braun & Clarke, 2022; Clarke & Braun, 2017). Transcripts were read thoroughly to gain a more comprehensive understanding of and insight into the data, in line with what Creswell (2012, p. 243) termed 'preliminary exploratory analysis'. All points of interest related to the research questions were highlighted. After that, all transcribed interviews were summarised. The next step was to use the emergent codes relating to the interview questions and relevant literature. These codes were further categorised into six sub-themes: *infrastructure, resources, professional development, teachers' housing, teaching as a first-choice career, and whether teachers are valued*. Finally, these sub-themes were reorganised under three main themes: *working conditions, living conditions and the teaching profession*. When presenting findings, the participant's identifier and school (all pseudonyms) are provided at the end of each quote. 'T' indicates teachers, 'HT' is used for headteachers, and 'PEA' is used for the primary education advisors. Thus 'T1 Baobab' represents a quote from teacher 1 from Baobab primary school.

In terms of limitations, the findings in this study encompass teachers' experiences in four rural primary schools in one district in Malawi. Consequently, these findings will only provide information about teachers' working and living conditions in those schools. Nevertheless, the findings may demonstrate common teachers' experiences in other primary schools with similar conditions and may be transferable to other areas.

3.3. Ethical Considerations

Ethical requirements were strictly adhered to throughout the research process. The main ethical rule of "do no harm" (Madge, 1997, p. 114) guided this study. All participants participated in the study voluntarily after being approached by the field researcher. The field researcher informed participants about the study and whether they were willing to participate. Their informed consent was obtained. Participants were assured of anonymity and confidentiality. At the beginning of each interview, the field researcher opted to make a brief personal disclosure (Braun & Clark, 2013) to build rapport. It was important to inform participants that the field researcher is a teacher by profession and had lived with her family in SSA for many years, including five years in Malawi. During her stay in Malawi, she set out to get to know the school system. Five consecutive days were spent at each school for data collection, during which time the field researcher was greeted with what she interpreted as friendliness and congeniality. Additionally, the field researcher observed an atmosphere of amicability among teachers, as well as between teachers and headteachers.

4. FINDINGS

The aim of this study was to explore teachers' working and living conditions in rural primary schools in Malawi and to investigate their perceptions of the teaching profession. We interviewed teachers, headteachers and primary education advisors in four rural primary schools in an attempt to answer the following research questions: 1. *How do teachers in four rural primary schools in Malawi experience their working and living conditions?* 2. *How do*

teachers in four rural primary schools in Malawi perceive their profession, its challenges and support? This section presents the main findings, supported by direct quotes from participants. Sub-themes from the three main themes *working conditions*, *living conditions* and *the teaching profession*, are identified and discussed.

4.1. Working Conditions

Within this main theme, three sub-themes were identified: infrastructure, such as outside classrooms; school resources, such as shortage of teachers and teaching and learning material; and teachers' opportunities for professional development.

4.1.1. Infrastructure

According to the teachers, poor infrastructure, such as the lack of classrooms, was of great concern, along with the numerous challenges that teaching in an outside classroom brings. For instance, when a teacher is preparing and writing lesson plans: *"Sometimes there is heavy wind, so when you are writing the lesson plans, the papers fly all over"* (T5 Baobab). During the rainy season, outside classes are often combined with inside classes, leading to overcrowded classrooms: *"Yes, we can squeeze into one classroom, but it is very difficult to teach"* (T1 Chambo).

Participants were aware that a staffroom would allow them to collaborate when preparing their lessons, grading papers or discussing how to teach a particular subject. However, none of the schools had a staffroom. *"We could help each other. What can we do with this lesson? Can I teach it this way?"* (T2 Baobab).

4.1.2. Resources

The shortage of teachers was another problem, and as a result, large classes and complex in-class management were the reality for many of the teachers: *"We have a large number of learners in one class, so to control learner misbehaviour in that class becomes a problem"* (T5 Chambo).

Limited teaching resources were another concern. A teacher noted: *"Sometimes we may have only six textbooks for the whole class"* (T3 Hillside). The teachers also spoke of the difficulty of teaching a subject without the actual teaching aids to demonstrate, and for the most part, they tried to improvise. However, that was not always possible:

We told the learners about computers, but we do not have any. But we explain to learners the little knowledge we have from just reading books. A teacher can't improvise everything (T6 Hillside).

Teachers were forced to be resourceful in finding suitable teaching and learning materials and reach out to other teachers for assistance. A teacher stated:

That is why we do interact with them [other teachers], so we find help with what will be an appropriate resource for this subject (T4 Baobab).

Lack of teaching and learning materials affects teachers' pedagogical practices and undermines the quality of teaching. This affects the overall quality of primary education.

4.1.3. Professional Development

Primary education advisors (PEAs) are required to visit each school at least once per term to ensure that schools are upholding standards and quality, but they are hampered by a lack of funding. A PEA noted: *"This year, I failed to manage that [visit to each school] because of funds"* (PEA Chambo). However, a headteacher noted that they meet with PEAs monthly: *"We do meet and discuss issues concerning our schools"* (HT Chambo).

Primary school advisors are expected to provide teachers with in-service training, such as workshops or refresher courses. However, they were impeded, again due to funding issues: *“We do call some teachers to come for refresher courses, but because of the [lack of] funds this year, we could not”* (PEA Lakeview).

The importance of in-service training was acknowledged by teachers, as one teacher noted:

We learn a lot of new methods of teaching. For example, I left teacher training college in 1996, and the syllabus has been changing now and again. So, I benefitted a lot from in-service training (T2 Hillside).

However, only about half of the teachers had been invited to attend a workshop or a refresher course during their careers.

In the absence of PEA-led workshops, all headteachers encouraged their teachers to work together and collaborate. A headteacher noted: *“They plan separately, but sometimes they do share ideas or views on a particular lesson. This is what I told them to do”* (HT Chambo). Teachers agreed and stated that they collaborate with colleagues when the need arises: *“Even myself, if I don’t know a certain subject, I can require that somebody who knows better that part can come and help me”* (T6 Hillside). Most teachers, however, prepared lessons alone without the benefit of any in-service support.

When asked whether they expressed approval or praised their teachers for a job well done, the headteachers agreed that they did, as noted: *“Yes, I do that because I appreciate they are doing good work”* (HT Lakeview). Some teachers concurred and felt it important that their headteacher recognised their good work. A teacher stated: *“Especially our headteacher, it is very important. Because as soon as he does that, you feel like on top of the world”* (T1 Chambo).

4.2. Living Conditions

This main theme relates to teachers’ accommodations and what, if any, effects it has on the teachers.

Shortage of teachers’ accommodation is one of the challenges rural areas face when recruiting teachers. If teachers are not provided housing, they must rent accommodation from a nearby village, often far from the school. This was the reality for the majority of the teachers in this study. Specifically, 21 out of the 24 rented far from the school premises. For most of them, it took about 30 minutes to walk to school since they had no other way of commuting: *“Some of us are travelling a long distance, on foot. Sometimes we arrive at school and meet the classes while we are tired and sweating”* (T3 Baobab). A tired teacher is less likely to be effective, and the reality that the school does not have accommodation near the premises can make teachers feel unimportant. This can affect their attitudes and dedication to quality teaching.

4.3. Teaching Profession

This main theme covers two sub-themes: whether becoming a teacher was their first choice; and whether teachers feel their profession is valued by society.

4.3.1. Teaching as a First Choice

Of the 24 teachers interviewed, 23 were already qualified. They had varying teaching experiences, from two months to 22 years. However, only 13 wanted to become a teacher as their first choice career. One of them noted: *“I was to become a teacher because my mother is also a teacher. So, it was like in the blood”* (T6 Baobab).

Those who indicated that teaching was not their first career choice ended up becoming teachers because they could not pursue their original dream career due to different circumstances, whether financial or job opportunities. The two excerpts below illustrate this:

My first choice was nursing, but because of lack of financial support... (T3 Lakeview).

I qualified as a mechanic, but it was due to a lack of job opportunities (T3 (Baobab)).

The findings show that different factors influenced individuals' decisions to join the teaching profession. These factors, coupled with working and living conditions, can affect the quality of teaching and learning, rural teacher retention and attrition.

4.3.2. Status of Teachers

Of the 23 teachers who answered the question in this study about whether Malawian society values the teaching profession, 13 thought it did not. For example, one teacher noted:

Honestly, I can say that teachers are not valued very much because teachers face many challenges in Malawi. They receive a small salary, and working conditions are not good at all (T5 Chambo).

Consequently, regardless of their feelings about the quality of their teaching, teachers believe they are not good role models for the younger generations because teaching is a low-status profession: "*People look at me and see low status, so we are not their role models*" (T6 Lakeview). Learners emulate such views: "*So a learner says, I won't be a teacher*" (T2 Hillside). However, ten of the 23 participating teachers believed that the teaching profession is valued in Malawi. One of the teachers stated, "*I think they value teachers because we are the ones who are moving the nation*" (T2 Chambo).

Interestingly, whether becoming a teacher was their first choice or whether they felt the teaching profession was valued did not seem to matter, they all enjoyed teaching. This was encapsulated by a comment by one of the teachers: "*With time, I have come to love teaching*" (T4 Chambo). The common reply they gave to the question "what is the best part of being a teacher?" was their interaction with their learners and when they noticed their students were learning from their teaching. This was best noted by two teachers who stated:

I enjoy most the interaction with the learners (T6 Baobab).

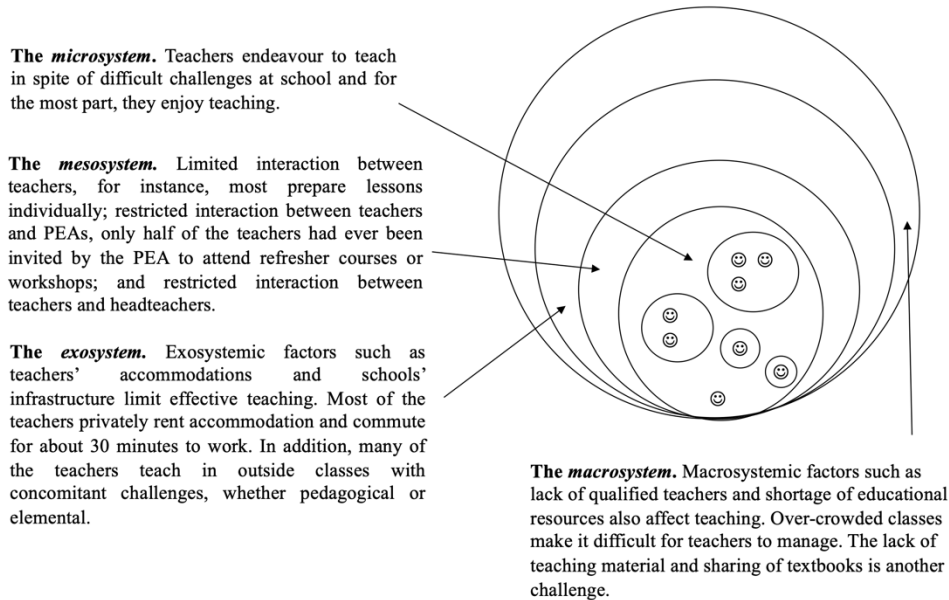
What I enjoy most is when I see my learners doing well (T1 Lakeview).

It was evident that all teachers in this study had come to enjoy teaching and appeared to get internal rewards that helped to counteract their profession's challenging conditions and perceived low status.

5. DISCUSSION

This study provides insights into teachers' experiences in four rural primary schools in Malawi. The study sought to understand the working and living conditions of the teachers and their perceptions of the teaching profession through the lenses of Bronfenbrenner's ecological systems theory. Bronfenbrenner (1979) stated that humans develop through reciprocal interactions and relationships within the community and broader society. A summary of the main findings in the ecological systems is depicted in Figure 2.

Figure 2.
Ecological systems of education of four Malawian primary schools.
Summary of main findings.



This study found that the microsystem appears to be somewhat active. For example, in spite of numerous challenges, teachers aspire to teach. However, the internal ties within the microsystem are weak, with limited mesosystemic interactions between teachers and headteachers, for instance. Furthermore, there is limited interaction between teachers and PEAs due to financial restrictions preventing PEAs from holding regular supervisory visits, in-service training and workshops. To improve the quality of teaching and learning, it is essential to provide teachers with opportunities for professional development (Adedeji & Olaniyan, 2011). However, only about 75% of primary schools in Malawi receive a visit by their PEA each term (MoEST, 2018).

None of the schools in this study had a staffroom, making it difficult for teachers to collaborate. Without a shared workspace or staffroom, teachers in this study were more likely to work in isolation and, thus, miss out on the opportunity for collegial support. Such a lack of professional collaboration makes it difficult for teachers to develop professionally and maximise effective teaching (Botha, 2012). This is a clear indication of how the exosystem negatively affects mesosystemic interactions.

Exosystemic factors, such as schools' infrastructure and teachers' housing, affect educational outcomes in rural areas, as they limit effective teaching. Dilapidated and fragile facilities in rural primary schools are common, with many schools lacking the necessary infrastructure to function efficiently (du Plessis & Mestry, 2019). Such poor quality of infrastructure is the primary driver of the crisis in the education system in many African countries (Adedeji & Olaniyan, 2011). In Mangochi District, for example, during the school year 2017- 2018, the learner/classroom ratio was 165:1, the highest reported in the country (MoEST, 2018).

In this study, working conditions appear to be burdensome and enervating, with many teachers teaching in outside classrooms and overcrowded classes. This reality produces

another set of challenges, such as shielding learners and classroom activities from the elements and pedagogical issues, such as displaying visual teaching aids.

Regarding teachers' living accommodations, most teachers in this study privately rented accommodations in the surrounding villages and commuted for about 30 minutes to school every day. In Mangochi District, only 19.5% of teachers are provided with accommodation on school grounds, compared to 23% nationwide (MoEST, 2018). A combination of such exosystemic factors culminates in poorer educational outcomes in rural areas (Adedeji & Olaniyan, 2011; Chakanika et al., 2012; du Plessis & Mestry, 2019). These exosystemic factors overflow into the macrosystem, amplifying problems with teacher recruitment and retention.

Macrosystemic factors such as shortages of teachers and resources make teaching in rural areas difficult and negatively affect educational outcomes. The lack of teachers results in overcrowded classes and difficulty in implementing behavioural management. This adds to teachers' workload, which is detrimental to the quality of education (Chakanika et al., 2012).

The lack of teaching resources within the macrosystem was a further challenge for the teachers in this study, and the necessity of sharing textbooks is a problem in many rural schools. In Mangochi District, for example, an average of 2.7 learners shared one textbook in mathematics in standard 5 (S5) and 1.9 in S8 (MoEST, 2018). Textbooks and other learning materials are essential for an effective education system, and their lack affects educational attainment and quality.

The perceived low status of the teaching profession matters to many teachers and in many countries. Teaching is one of the most underappreciated professions (Adedeji & Olaniyan, 2011), and only half of the teachers in this study consider teaching as their first-choice career. Evidence shows that many individuals became teachers because they could not get another job (Adedeji & Olaniyan, 2011). This may be reasonable considering the challenges they face according to the findings of this study. The results are similar to Mtika and Gates (2011) in their research focusing on secondary teachers in Malawi. When interviewing secondary trainee teachers, some stated that they had only joined the teaching profession due to their inability to follow their chosen profession.

6. CONCLUSION AND RECOMMENDATIONS

By providing an in-depth understanding of rural schools and teachers' challenges, this study adds to the growing understanding and research on teachers' experiences in rural areas in Malawi. Based on the findings, teachers, headteachers and PEAs in these four primary schools need to strengthen their interactions and mutual relationships to improve the quality of teaching and learning. In the context of limited funding for in-service training, teachers can, for instance, prioritise teacher collaboration as part of their professional development. PEAs and headteachers can combine efforts by having the PEAs prepare the headteachers to give teachers much-needed in-service training. This could lessen the funding issue and increase teachers' opportunities for professional development. Lastly, education authorities must make the provision of teachers, teachers' housing, and teaching resources their prime concern. These steps can improve educational quality as all these factors interact and influence rural teachers' ecological systems.

REFERENCES

- Adedeji S. O., & Olaniyan, O. (2011). *Improving the conditions of teachers and teaching in rural schools across African countries*. Ethiopia, Addis Ababa: UNESCO International Institute for Capacity-Building in Africa. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000216062>
- Asim, S., Chimombo, J., Chugunov, D., & Gera, R. (2019). Moving teachers to Malawi's remote communities: a data-driven approach to teacher deployment. *International Journal of Educational Development*, 65, 26-43. <https://doi.org/10.1016/j.ijedudev.2018.12.002>
- Botha, E. M. (2012). Turning the tide: creating professional learning communities (PLC) to improve teaching practice and learning in South African public schools. *Africa Education Review*, 9(2), 395-411. <https://doi.org/10.1080/18146627.2012.722405>
- Braun, V., & Clarke, V. (2013). *Successful qualitative research; a practical guide for beginners*. Los Angeles, CA: SAGE Publication.
- Braun, V., & Clarke, V. (2022). *Thematic analysis: a practical guide*. Los Angeles, CA: SAGE Publication.
- Bronfenbrenner, U. (1979). *The ecology of human development: experiments by nature and design*. Cambridge, MA: Harvard University Press.
- Chakanika, W. W., Sichula, N. K., Sumbwa, P. I., & Nduna, M. (2012). The challenges of rural education in Africa. *South Africa Rural Educator* 2, 6-17. Retrieved from https://www.researchgate.net/publication/336676604_The_challenges_of_rural_education_in_Africa
- Chikhungu, L., Kadzamira, E., Chiwaula, L., & Meke, E. (2020). Tackling girls dropping out of school in Malawi: Is improving household socio-economic status the solution? *International Journal of Educational Research*, 103, 101578. <https://doi.org/10.1016/j.ijer.2020.101578>
- Clarke, V., & Braun, V. (2017). Thematic analysis. *The Journal of Positive Psychology* 12(3), 297-298. <https://doi.org/10.1080/17439760.2016.1262613>
- Creswell, J. W. (2012). *Educational research: planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Boston, MA: Pearson.
- Idrees, A. S., & Siddiqi, M. W. (2013). Does public education expenditure cause economic growth? Comparison of developed and developing countries. *Pakistan Journal of Commerce and Social Sciences*, 7(1), 174-183.
- International Labour Organization (2016). Rural teachers in Africa. *ILO International Labour Office; Centre for International Teacher Education* (Working Paper No 312). Retrieved from https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---sector/documents/publication/wcms_543617.pdf
- Ismail, S. (2015). Equity and Education. In J. D. Wright (ed.), *International Encyclopedia of the Social & Behavioral Sciences* (2nd ed., Vol. 7, pp. 918-923). Oxford, Elsevier. <http://dx.doi.org/10.1016/B978-0-08-097086-8.92099-3>
- Jónsdóttir, S. R. (2012). *The location of innovation education in Icelandic compulsory schools* (Doctoral dissertation, University of Iceland, Reykjavík, Iceland). Retrieved from <http://hdl.handle.net/1946/10748>
- Madge, C. (1997). The ethics of research in the "Third World". In E. Robson, & K. Willis (Eds.), *Postgraduate Fieldwork in Developing Areas: A rough guide*. London, UK: Royal Geographical Society, and Institute of British Geographers.
- Ministry of Education, Science and Technology (2018). *Malawi Education Statistics 2017/18*. Malawi: Education Management Information System; EMIS. Retrieved from <https://docplayer.net/223852293-Malawi-education-statistics-2017-18.html>
- Ministry of Education, Science and Technology (2019). *Malawi Education Sector Analysis*. Lilongwe, Malawi: Government of the Republic of Malawi. Retrieved from <https://www.unicef.org/malawi/media/4581/file/Malawi%20Education%20Sector%20Analysis.pdf>

- Mulkeen A., & Chen, D. (2008). *Teachers for rural schools: experiences in Lesotho, Malawi, Mozambique, and Uganda* (Africa Human Development Series 43970). Washington, D.C: The World Bank. Retrieved from <https://openknowledge.worldbank.org/handle/10986/6423>
- Mthiyane, S. E., & Chiororo, F. (2020). Chronicling the causes of school decline: the case of two Zimbabwean schools. *Africa Education Review* 17(2), 73-87. <https://doi.org/10.1080/18146627.2018.1514266>
- Mtika, P., & Gates, P. (2011). What do secondary trainee teachers say about teaching as a profession of their “choice” in Malawi? *Teaching and Teacher Education* 27(2), 424-433. <https://doi.org/10.1016/j.tate.2010.09.012>
- National Statistical Office (2019). *2018 Malawi Population and Housing Census Report*. Zomba, Malawi: Government of Malawi. Retrieved from <https://malawi.unfpa.org/sites/default/files/resource-pdf/2018%20Malawi%20Population%20and%20Housing%20Census%20Main%20Report%20%281%29.pdf>
- du Plessis, P. J. (2019). Closing the achievement gap in disadvantaged communities: Lessons from successful schools. *Africa Education Review*, 16(6), 22-36. <https://doi.org/10.1080/18146627.2018.1464649>
- du Plessis, P., & Mestry, R. (2019). Teachers for rural schools – a challenge for South Africa. *South African Journal of Education*, 39(Supplement 1), 1-9. <https://doi.org/10.15700/saje.v39ns1a1774>
- Seginer, R. (2006). Parents' educational involvement: a developmental ecology perspective. *Parenting: Science and Practice*, 6(1), 1-48. https://doi.org/10.1207/s15327922par0601_1
- United Nations (2015). *Transforming our world: the 2030 agenda for sustainable development*. Retrieved from <https://sdgs.un.org/2030agenda>
- United Nations (2018). *Sustainable development goals 2030*. New York, USA: United Nations. Retrieved from <https://www.un.org/sustainabledevelopment/education/>
- United Nations (2021). *The Sustainable Development Goals Report 2021, Extended Report*. Retrieved from [https://unstats.un.org/sdgs/report/2021/extended-report/Goal%20\(4\)_final.pdf](https://unstats.un.org/sdgs/report/2021/extended-report/Goal%20(4)_final.pdf)
- UNDP (2018). *Statistical Update 2018: Human Development Indices and Indicators*. New York, NY: United Nations Development Programme. Retrieved from <https://hdr.undp.org/system/files/documents/2018humandevlopmentstatisticalupdatepdf.pdf>
- UNESCO. (2016). *The world needs almost 69 million new teachers to reach the 2030 education goals*. (Fact sheet no 39). Paris, France: UNESCO Retrieved from <http://uis.unesco.org/en/document/world-needs-almost-69-million-new-teachers-reach-2030-education-goals>
- UNESCO (2017). *More than one-half of children and adolescents are not learning worldwide* (Fact sheet no. 46). Paris, France: UNESCO. Retrieved from <http://uis.unesco.org/sites/default/files/documents/fs46-more-than-half-children-not-learning-en-2017.pdf>
- Winters, J. V. (2011). Human capital, higher education institutions, and quality of life. *Regional Science and Urban Economics*, 41(5), 446–454. <https://doi.org/10.1016/j.regsciurbeco.2011.03.001>
- World Bank (2015). *Getting textbooks to every child in Sub-Saharan Africa: Strategies for addressing the high cost and low availability problem*. Washington, DC: World Bank. Retrieved from <https://documents1.worldbank.org/curated/en/479151468179972816/pdf/96468-PUB-PUBLIC-Box391437B-9781464805400.pdf>
- World Bank (2018). *Learning to Realise Education's Promise. World Development Report*. Washington, DC: World Bank. Retrieved from <https://www.worldbank.org/en/publication/wdr2018>

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This study forms part of doctoral research “What is the nature of interactions between teachers and communities surrounding four selected primary schools in rural Malawi?” The core of the study concerns the nature and significance of the interactions and collaboration among teachers, parents, schools and the communities in rural Malawi.

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