

ENABLING STUDENTS TO EVIDENCE AND ARTICULATE UNESCO FUTURE COMPETENCIES IN STUDENTS THROUGH RESEARCH-BASED EDUCATION FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT

Today's complex global challenges call upon a different pedagogical approach to Higher Education (HE) that is fit for the purpose of preparing our students – to paraphrase the words of Sir Jonathan Porritt - not only for the world of work, but the work of the world. Indeed, we can and should be preparing students for both, as it is through their professional lives and activities that they will arguably be able to have the most positive impact on these global challenges. Consequently, re-focusing teaching on ways of thinking, being and practicing, the so-called 'head, heart and hands' framework, should be done in a way that actively stretches students beyond the comfort of their disciplinary boundaries, knowledge and skill sets.

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This paper will present the University of Strathclyde's practice and experience of establishing their award winning Vertically Integrated Projects for Sustainable Development (VIP4SD) programme, as an exemplar of how to embed Research-Based Education for Sustainable Development in undergraduate curricula.

This paper will show how VIP4SD provides students with the time and space in their curriculum to develop demonstrable levels of domain expertise and exercise key UNESCO sustainability (and ergo employability) competences. We then discuss how we have sought to evidence this by supporting students to recognise and articulate their competency development, achieved through the experiential and transformational learning provided by the VIP4SD programme.

1 INTRODUCTION

UNESCO define Education for Sustainable Development (ESD) as “the process of equipping students with the knowledge and understanding, competencies, skills and attributes needed to work and live in a way that safeguards environmental, social and economic wellbeing, both in the present and for future generations.” (UNESCO 2020). Thew and COP26 Universities Network (2021) suggest that ESD and Climate Education “seeks to equip learners with the transferable skills they need to respond to a wide variety of complex, dynamic challenges including but not limited to the climate crisis”. Therefore, ESD is increasingly being viewed and implemented across HE as a pedagogy rooted in active, problem- and inquiry-based, experiential learning that has competency development at its heart. This can lead to transformational impacts on learners and the stakeholders, communities, and organisations that learners interact with, and deliver impact for, during their learner journey.

It is not the purpose of this paper to make the case for ESD, as changes in the sector (and society more generally) make clear the increased demand for it. Most notably, the current QAA guidelines for review of degree Subject Benchmark Statements now explicitly calls for ESD to be embedded at degree programme level across all disciplines (QAA and AdvanceHE 2020). The Engineering Council's most recently published AHEP 4 (Engineering Council 2020) asks for programme learning outcomes to have “a sharper focus on inclusive design and innovation, and the coverage of areas such as sustainability and ethics”, encouraging HEIs to “make use of the United Nations Sustainable Development Goals, and Engineering Council Guidance on Sustainability in programme design and delivery.” Student-centric drivers such as the SOS-UK Responsible Futures accreditation programme (SOS-UK 2021), which is gaining membership and momentum, is another ‘external’ force advocating for the mainstreaming of ESD in HE.

1 BACKGROUND

1.1 Vertically Integrated Projects – Embedding Undergraduate Research in the Strathclyde Curriculum

Vertically Integrated Projects (VIP) are a unique approach to undergraduate research-based learning that has been implemented in various universities worldwide (SOS-UK 2021). Georgia Institute of Technology and the University of Strathclyde have been at the forefront of VIP implementation. The VIP programme involves undergraduate and

graduate students working together in teams to solve real-world problems proposed by academic leads, industry partners, research centres, third sector organisations, or students themselves. The VIP model is unique because it spans multiple years of study (vertical integration), allowing students, in some cases from across disciplines (horizontal integration, enabling interdisciplinary working) to build upon the work of previous teams and set the objective of future teams. The Strathclyde VIP programme was initiated in 2011, while the Georgia Tech VIP programme began in 1998. Both universities have reported success in improving student engagement, retention rates, and career readiness (Baxter et al. 2011) while delivering real impact to organisations and communities (Marshall et al. 2014) (Cullers et al. 2018).

1.2 Embedding Research-Based Education for Sustainable Development in the Strathclyde Curriculum through VIP

In 2016 University of Strathclyde introduced the idea of aligning VIP with the 17 UN Sustainable Development Goals (“THE 17 GOALS | Sustainable Development,” n.d.) to create the Vertically Integrated Projects for Sustainable Development (VIP4SD) programme (Strachan et al. 2019) (Strachan, Logan, and Marshall 2022). The range of existing Strathclyde projects is available on our website (“Vertically Integrated Projects for Sustainable Development | University of Strathclyde,” n.d.).

(Kolmos et al. 2016) speak of education *about* sustainability as an assimilation strategy where sustainability *subjects* are included in the formal curriculum,. They contrast this with education *for* sustainability, which involves some modification of the programme and which is an *integration* strategy, going further than the add-on strategy by mapping and coordinating various courses and integrating professional and soft skills. This requires curriculum overview and therefore the support of the academic managers, e.g. program leaders, Deans and Heads of School. The VIP4SD programme follows this integration approach, as it requires coordination and collaboration across and between faculties and programmes as it seeks to embed active learning and skills and competency development in programmes.

While we have anecdotal evidence of students developing a range of skills through their VIP4SD experience, we have more recently sought to find a mechanism of formally measuring and evidencing this. This allows us to not only measure student development in this area (and build their capacity to reflect on this themselves), but also test the efficacy of the VIP4SD programme. To achieve this we have partnered with the developers of an experiential learning platform known as Practera (Practera 2023) to develop a pilot programme, which is explained in more detail later in the paper.

1.3 ESD and UNESCO Sustainability Competencies

A broad consensus is growing between scholars and educators in ESD circles that central to transformational learning experiences are the cognitive, affective and psycho-motor domains and the interplay between these elements. Core to these domains are the 8 UNESCO Sustainability Competencies, which consist of systems thinking, future thinking, critical thinking, strategic competency, collaboration competency, integrated problem solving, self-awareness, and normative competency. These competencies are categorised as ways of thinking, ways of being and ways of practicing (aligned with the head, heart and hands framework) by QAA/Advance in

their UK HE Guidance for Embedding ESD, and are identified as crucial in aiding students to foster their knowledge, understanding, values, attitudes and behaviours in order to make a meaningful contribution to sustainable development (QAA and AdvanceHE 2020). Neither the UK HE ESD Guidance nor ESD for 2030 UNESCO framework (UNESCO 2020) are prescriptive about how the competencies are delivered or developed, but instead aim to facilitate institutions to create curriculum architectures and subject relevant content and embrace suitable pedagogies which support and enact these competencies for sustainable development. How, then, can ESD be implemented holistically through a systemic, whole institution approach?

1.4 Pedagogies for ESD

The pedagogical pillar is key to integrating ESD into curricula and for effective operationalisation of key competencies to occur. It requires transformative, critical and emancipatory pedagogies (Sandri 2020) underpinned by concepts and values that empower students to critically explore beliefs, knowledge and values, and develop a sense of critical consciousness and agency (Ukpokodu 2009). (Brundiers and Wiek 2017) call for pedagogical innovations that are integrated, holistic, that provide real-world, experiential, transformative, context-specific learning experiences as sustainability cannot be learned independent of context (Sterling 2004). This also calls for real-world learning opportunities that take students beyond a theoretical understanding of ESD and encourage the development of practical competencies. Learning experiences should be holistic, integrated and experiential and unify the cognitive, affective and psycho-motor domains (Bonello and Musumeci 2022). Deep learning for sustainability requires learners not to be taught what to think but to develop the necessary dispositions to act successfully in different contexts autonomously and should be seen as a learning process not the 'rolling out' of predetermined behaviors and predefined outcomes (Vare and Scott 2007).

1.5 Enabling students to articulate competency development through VIP for Sustainable Development

The VIP4SD model presents a new way of teaching and learning for both students and staff. As such, it presents new ways of assessing students as well, ways that recognise and reward students not only for their disciplinary learning, but for their skills and competency development. However, how we might achieve this is less clear. As Strathclyde's VIP4SD team sought to more fully embed ESD and sustainability competencies in the programme, we were also faced with the challenge of how to do this meaningfully and in a way that did not present competency development as an "add-on" to students' project work. Rather, we were faced with the challenge of integrating competency development within the core learning experience, and enabling students to see the value of being able to recognise and articulate their competencies in relation to their role as global citizens, as well as their professional development and employability prospects. Furthermore, the VIP4SD model is intended to allow students to spend more time working on a dedicated area of sustainability-related research, and so offers a greater opportunity for students to develop and hone these competencies over a longer period of active participation.

Practera, an ed-tech provider that supports experiential learning via its online platform, presented a way of managing VIP4SD projects by more directly connecting students

and academic leads for project supervision, progress reporting and feedback purposes. It also supported consistent competency reflection and peer feedback. We entered into a pilot with Practera in academic year 2021/22 to work with us to develop a student competency reflection and articulation platform and are currently finishing up our second year of collaborating with them. What follows describes the platform design process, its features, and how these have supported the students in identifying and articulating their competency development. Later we discuss the data captured and what we have learned about the programme.

2 METHODOLOGY

2.1 Co-designing a platform to support experiential learning and students' competency reflection and articulation

While we understood anecdotally that students were gaining and developing skills and competencies through their VIP4SD experience, we had no mechanism of proving this qualitatively or quantitatively. Practera presented a ready-made solution to this challenge; as we are a small team with limited resources and with limited expertise in digital learning, this was an attractive option. This gamified platform was also accessible and engaging for students, academics and the programme co-ordinator.

The workflow design requires students to fill in a team log every other week and submit a competency reflection in the weeks in between. This reflection requires students to articulate which of the 8 UNESCO competencies they have exercised and developed most in the previous couple of weeks, focusing on up to 3 competencies.

At the end of each semester students engage in a 'Team 360' peer review, which involves leaving anonymised feedback to each other. In turn, students receive their own feedback from peers and are asked to reflect on this feedback in the 'Post Team-360 Reflection'. This presented an opportunity we had not yet been able to provide through VIP4SD. At the end of the academic year students then use the feedback and their own reflections throughout the two semesters to map their competency development across the programme and populate their Competency ePortfolio, which can then be made available to link to their CVs and LinkedIn pages.

The platform's focus on feedback loops – whereby students submit work, reflections and team logs and academic leads provide short pieces of regular feedback - encourages and enables consistent academic support that incentivises and bolsters student engagement. In summary, the benefits of developing this platform included 1) offering the opportunity for students to reflect, understand, and – crucially – articulate their competency development in real time as they progressed through their project; 2) enabling and streamlining consistent academic and peer feedback; 3) providing the VIP4SD team with data that evidenced the programme's efficacy in developing the sustainability and employability competencies that employers are increasingly searching for, and which are so key to effectively embedding ESD.

The initial work of this pilot involved designing and configuring the platform to fit with VIP4SD workflow and structure, which takes place over 22 weeks from October to December and January to April (the autumn and spring semesters). The initial design was completed by the Practera team, following a brief from the VIP4SD programme team. In year two, the programme design remained largely the same, and so could be

modified slightly by our Programme Co-ordinator. The platform presented a project workflow divided into 'milestones' that aligned with the VIP4SD programme's key submissions and assessments. These included a statement of intent at the beginning of semester one – where the group outline their aims for the project over the course of the academic year; a group literature review presentation at the end of the first semester, which is designed to demonstrate the students' understanding of the project's central problem, the state-of-the-art and how their research area engages with and impacts the SDGs; a team poster to be presented at a University-wide ESD@Strath student conference, held at the end of the second semester; and a final group report and reflection. Additionally, students must compile and submit their Competency ePortfolio as an assessed element. This draws on the competency reflection logs (mentioned previously) that they are routinely prompted to maintain throughout the year via the platform. The students are required to articulate how, when and where they have exercised these UNESCO competencies using the STAR (Situation, Task, Action, Result) framework, to offer a consistent approach to articulating their competencies development. They are also required to append an artifact (a file, report, paper, poster, notes, drawing, code, etc.), which is the output from the task where they exercised a specific competency.

Alongside these key elements are onboarding material, as well as supportive elements throughout. These include, for example, short sections that explain how to produce an effective STAR statement, as well as guidance on the UNESCO ESD competency framework. These elements are an essential aspect of the platform in that they provide scaffolding and motivation for the students in the completion of their competency reflections, which is often the first time the students will have been asked to consider these as part of their educational journey. In the next version of the platform the Competency ePortfolio will be replaced with a customisable tool that enables programme designers to assign an Open Badge for each competency a learner meets the criteria for.

3 RESULTS

The first year of the pilot engaged a sample of 8 teams from a total of 24 VIP for Sustainable Development teams in total, representing 30 students (i.e. a section from the 120 strong programme cohort), and 8 members of staff. The second year saw 7 teams comprising 30 students and 6 staff take part. In general, most students reported an increase in their competencies in the final reflection at the end of the academic year. In the baseline competency self-assessment for the pilot year (2021-22), students were asked if they were able to consider the relative costs and benefits of a potential action in order to choose the most important one, the answer to which would indicate their level of competency in systems thinking. This approach – which uses the UNESCO definition of systems thinking - was chosen rather than simply asking students to rate their systems thinking competency as it is unlikely that all students would know what systems thinking was. In this survey – which students completed at the beginning of the first semester as part of their Practera onboarding – most students selected 'Very skilled' (40.6%) or 'Somewhat skilled' (again, 40.6%) in response to this statement. In the exit survey at the end of the second semester, the majority more confidently selected 'Extremely skilled' (38.9%) and 'Very skilled' (44.4%). Similar

results are seen in the second year (2022-23). When asked in the baseline competency self-assessment if they were able to 'create their own vision of the future ... to contribute to a more sustainable world' - therefore demonstrating Future Thinking – the majority said they were 'Somewhat skilled' (48%) and 'Not very skilled' (13%). In the final competency self-assessment, the majority said they were 'Very skilled' (48%) and 'Extremely skilled' (28%), with the remaining students selecting 'Somewhat skilled' (24%) and no one reporting no level of skill.

While these results demonstrate the efficacy of the programme somewhat (as these are self-assessments of students' own skill level) we also recognised some need for improvement in various aspects of the programme in both years. For example, while the platform built in supportive sections that explained the competencies, we realised that more than this was needed to get students to not only understand what the competencies were, but to value their development of them and understand why it was important for them to be able to articulate them. Initially, students were being asked to reflect on skills in their biweekly group logs; for example, they were asked to describe (as a group) what they had worked on that week and discuss any challenges faced, and to then reflect on their competency development with this in mind. We decided in year two to separate these exercises into biweekly group updates and biweekly individual reflections, due in alternate weeks. The individual reflection made more sense in that it followed the same format as the Competency ePortfolio the students would complete at the end of semester 2, which is also an individual submission. Submitting these reflections individually may have also led to more frank and representative responses. We also made the decision in the second year of the pilot to rename the competencies, while continuing to use the UNESCO ESD competency framework. This is because it was clear that students did not intuitively connect with some competencies, which perhaps led to them shying away from engaging with less intuitive or familiar ones. For example, students found Collaboration and Critical Thinking easy to recognise and engage with, but seemed to find it more difficult to grasp Normative Competency and Anticipatory Thinking. To aid this, we changed Normative Competency to 'Values Thinking' and Anticipatory Thinking to 'Future Thinking', while retaining (slightly simplified) UNESCO definitions. Student feedback gathered in anonymised surveys has been largely positive. One student from the 2022-23 academic year noted in free text comments that "referring back to the key skills and competencies throughout the project in the form of reviews captures well how much progress has been made", while another stated that the project "has offered a platform where I can constantly self-reflect and improve". However, some students did not see the full benefits of the platform, with one commenting that there were "a few too many deliverables for teams that are engaging with supervisor", perhaps meaning that the unassessed elements (such as the biweekly reflections) were seen as unnecessary or onerous. Nonetheless, 82% of students Strongly Agreed with the statement "I am likely to use this experience as evidence of my skills in my applications for future opportunities" in the same survey.

While it is to be expected that not everyone will see the value of engaging in competency development and articulation in this way, the challenge for the VIP4SD team going forward is to put more resource into supporting students with their

reflections and professional development, and helping them to see more clearly the benefits of this work.

4 CONCLUSIONS AND FUTURE WORK

What has become clear in the two academic years of this pilot is that while the platform provides the tools students need to track, understand, evidence and articulate their competency development, more work is required offline to encourage students to understand why these competencies are valuable *to them* (in becoming more sustainable and globally-minded citizens), their *prospective employers*, and *society* as a whole. Central to this is their appreciation of how their capacity to effectively recognise how, when and where they are exercising and developing these competencies and their ability to articulate them effectively, and how this will increase their employability prospects when sustainability-literate graduates are increasingly being sought after by organisations in all sectors.. To aid this, our aim for the next academic year will be to link up with our Careers and Employability Service and Strathclyde Inspire (the university's entrepreneurship initiative led by our Business School) to develop a more cohesive narrative around competency development, sustainability, employability, innovation and entrepreneurship.

We also hope to have visits from employers in related industries to show students that employers are interested in the programme and the work students are producing, and importantly how and why they value these competencies. A Sustainability Skills Passport is also being piloted at the institution, and we hope that we can encourage students to engage with this initiative and related resources that highlight the value of these wide-ranging skills. We also seek to offer opportunities to link the awarded competency badges with their passport points.

We also plan to more rigorously test the claim that the VIP4SD programme is an effective experiential learning programme that develops student competencies and skills by developing a survey that introduces two control groups to compare VIP4SD students engaging with the Competency Badges. We will use these surveys to compare their perspectives on their competency development with other VIP4SD students (not engaged with the competency reflection and badges), and non-VIP4SD students. However, care and consideration will be required here to avoid bias arising from the existence or absence of a priori and posteriori knowledge of these competencies between the different control groups.

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