# EDUCATING THE TRANSDISCIPLINARY MIND: CURRICULUM DESIGN FOR A PROFESSIONAL DOCTORATE

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## Abstract

In our current curriculum design project we are building on many-years of experience in designing curricula and starting new degree courses. We are particularly building on the methodological approach developed over the years, that can be summarised in the following five design concepts: the overall curriculum design process is 'quasi-algorithmic', the individual steps within the process are 'quasi-heuristic', the desired learning process is 'quasi-incremental', the outcome of this learning process is a 'quasi-abductive' big picture, and it is 'quasi-validated' in the context of a single problem area. Similarly to most of our recent endeavours, this professional doctoral school (PDS) will also be post-experiential. This time, however, we are working on a unique educational concept at doctoral level. We are pioneering a professional doctorate which concept is currently unknown in the context of the Hungarian higher education. Furthermore, our curriculum design is unique worldwide.

Keywords: professional doctorate, curriculum design, transdisciplinary learning, problem-based learning.

## 1 GLOCAL PROBLEM DOMAINS

In terms of the wider picture, we tackle the problems of university education often discussed by Sir Ken Robinson. The significance of aiming at a professional doctorate is twofold:

1. Our focus is relevant applied, more precisely applicable, knowledge which can solve real-world problems.
2. We are aiming at the highest level of such relevant applicable knowledge.

Marshall McLuhan [1], some half century ago, introduced the conception of the global village. Many believe that the global village was brought about by the internet. However, one of the authors of this paper watched in 1960 the Olympic Games from Rome, on a TV set manufactured in East Germany, in a pub in the former Yugoslavia. Neither East Germany nor the former Yugoslavia exist anymore... Prior to that, a number of people became 'global villagers' using the radio. So globalisation was certainly not initiated by the internet. However, internet did have a great impact, and is one of the key reasons that nearly anyone can become a global villager nowadays. There are still a few isolated spots on the planet that are not part of it but there is less and less of these and they are getting smaller and smaller. In everyday life this means that we can, for instance, watch the football (soccer or any other version of it) world cup final in more or less any country in the world. This sounds as a very simple example but it requires globalisation to be happening on many levels. First of all there need to be an infrastructure available (the TV set, the satellite, antenna or cable through which the programme is received, etc.), the broadcasting has to be standardised, and language barriers need to be overcome. The trickiest part, however, is that we need the concept of football to be globalised. On the 2nd February 2014 the Super Bowl (American professional football) game in New York was broadcasted in 198 countries, in 25 languages, with well over 100 million people watching it live. This is what the global village means. Globalisation definitely affects our PDS (professional doctoral school) concept: our playground is the World.

It is great to be a member of the global village. But it is also great to be a member of the local village. It makes no difference whether we support the school basketball team or the district champion in tennis. We hear the rumours of the global village and we gossip about it in the local one. A colleague of ours made a joke about this; when someone noted that XY world celebrity actress was staying in the same hotel, he replied that she was in his room the night before – later he added that this happened on the TV screen...


*ISBN: 978-84-606-8243-1*

The professionals we expect in our school should be (or become) able of transcending the global-local dichotomy. We capture this aspect in the concept of GLocal Community. The local real-world problems provide the topics around which research is organised according to the interest of the individual learners and then global experience is used for making sense of the problem and for making an initial attempt at solving it. We will return to the process of problem solving later on, here we are solely focusing on the notion of GLocal. By the meaningful way of utilising global experience we mean that instead of trying to replicate excellent solutions (e.g. Silicon Valley) these are used as sources of learning, based on which something new and different is developed aiming at suitability in the local context. In addition, if really powerful new solutions are produced for local problems, these may have global impact, which means that we are closing the global-local gap once again, and thus we achieve a full loop. So in this school concept of professional doctorate the *GLocal problem domains refer to problems that are felt locally, thought about globally, with local solution that potentially have global impact*.

# 2 INFORMAL LEARNING

In this section we are trying to depict a conception of developing a problem solver who has the chance of successfully attacking the above described GLocal problems and achieving global impact with a local solution. In order to achieve this we need to briefly revisit the formal learning so that we can argue that the educating a problem solver with a transdisciplinary mind needs an informal approach to the learning process (for more details on formal vs. informal learning see [2]).

What we call formal learning is what typically takes place in a classroom-like setting and is mostly associated with the formal education, which is regulated by the law and provides various qualifications that are generally recognised. Elementary and secondary schools, vocational schools, colleges, universities, all belong here. Although we do not think that such formal education is without problems, we do think that it is necessary. Only learning should not and does not end there. Graduation may be the end of formal but at the same time the beginning of informal learning. Of course, formal learning also has its place in post-university age, many are attending postgraduate courses that they find useful to refresh their knowledge or to venture into new areas. The essence of the formal education is to produce a cultivated mind. Formal education is always multidisciplinary in nature, even though multidisciplinarity decreases with the increase of the level of education. We believe that this great, as we think it is useful to know that the Gauss-curve is bell-shaped, that there is a non-Euclidian version of geometry, what scale-invariance means, what Hamlet's struggle was, how long the Hundred Years' War waged from 1337 to 1453, or to recognise the melody of the Fifth Symphony. This is the basis we want to build on.

What are the options for those who want to learn further, at a higher level, but do not want to engage with rigid curricula and want to pursue their chosen topic of interest? They can take various short courses (although these may have fairly rigid setups) or they can, for instance, participate in Massive Open Online Courses (MOOCs). These options are useful if one is interested in elementary-level things of disciplines they previously did engage with, but they certainly do not meet the requirement of the exceptionally high level of knowledge. The highest knowledge level today is associated with the various doctoral degrees. In many countries, including Hungary, the PhD (doctor of philosophy) degree specifically prepares the students for an academic career, where today all is about writing journal papers that no one else outside the narrow academic discipline can read. In some countries and in some disciplines there are versions of professional (sometimes also called applied) doctorate exist, such as DBA in business, EdD in education, etc., in Hungary, and many other countries, the concept of the applied doctorate is unknown. Depending on the quality of the particular schools these doctoral schools provide the highest level of learning, and they tend to be informal. A useful metaphor for distinguishing between the informal is the setting in which we can view animals. A *Zoo* corresponds to formal education, to the classroom setting. The animals (problems) are taken out from their natural context, and put into a cage. It is very safe to study them this way, and it is useful as we can learn to distinguish the lion from the giraffe. However, we will not learn anything about the natural behaviour of the animals. Informal learning can be described with the metaphor of the *Safari*, when we do not remove the animals (problems) from their natural context, but we enter that context – while still trying to make it as safe as possible. Extending the above GLocal concept, we could say that our aim is to create a *Safari in the GLocal problem domain*.

What we need to address here next is the didactics of the proposed informal education. One could suggest that this is the methodological aspect of our new school, but we would have to disagree – this approach is in many ways anti-methodological. We do not intend to invent anything new here; as matter of fact, we propose going back to the once well-known model of the master apprentice relationship. This was an accepted mode of learning from the ancient times, through the craftsmen's and artists' workshops in the before the industrial revolution, till recently – but today we can only find traces of it in most professions and isolated examples in others with a few disciplines, such as haute cuisine, where it is nurtured. (See e.g. [3], [4]) Of course, we want to add a few things to improve the learning process even further.

The master-apprentice relationship became unpopular over the past decades not as it was not effective, but as its strong asymmetry is often perceived as politically incorrect, and as the apprentices do not want to stay in the background for an extended period of time until they can perform as masters. [5] We are fully aware that we cannot take practitioners out of their jobs for 10 years, how long the apprenticeship should approximately last. However, the 10-year rule (e.g. [6]) assumes a beginner apprentice at the start of the process who achieves the highest 'grandmaster' level of knowledge [7]; and this also means that the master in the master-apprentice relationship needs to be a grandmaster. We expect high-flying professionals for our professional doctorate, so we should assume expert-level knowledge (level 3 out of 5, so in need of about 4 further years of intensive study), and as we expect that they bring their own problems, we do not plan to take them out from their working environment. At least not completely – only for short periods of time. To the contrary, we want to make use of the working context, make it part of their learning. To that end, our learners should have a mentor in their work context, who would provide one side of the mentoring process, which we call *professional mentoring*. The second side is an *academic mentoring*, provided by a highly qualified experienced researcher; and the third side is *peer mentoring*, which the learners provide to each other. Besides this *triple mentoring*, there will be *guru lectures* provided by world leading minds from a variety of disciplines (we will get back to the notion of disciplines in Section 0); the learners will also have the chance to pitch their work to these gurus, and if they can make one of them interested, they may showcase their research and receive feedback. So *on their Safari in the GLocal problem domain, working on a problem they are passionate about, our learners will enjoy triple mentoring and guru lectures and some guru feedback on their work, participating in a community of likeminded professionals from a variety of disciplines, who are all on the road of becoming problem solvers.*

## 3 CREATIVE PROBLEM SOLVING

Now that we have briefly outlined how we envisage the teaching-learning process in our conceptualisation of the professional doctorate, we need to explain what we mean by the notion of problem solving which is at the heart of the whole school conception. In the English language problem solving means almost anything from substituting numbers into a formula, completing well-structured tasks, etc., but also creating a new educational concept or seeking the cure for cancer. For distinction, the latter two are sometimes labelled *creative problem solving*. Without aiming for mystifying creativity, we describe it as the creation of new knowledge which provides a solution to an ill-structured problem ([8], [9]), where the ill-structured means that there is no single right solution which can be verified, arrived at by algorithmic methods in a reasonable time, etc. as described originally by Simon [10]. While we do not aim at attempting to unpack the creative process here, we need to explore some characteristics of creative problem solving in order to clarify what we expect our learners to do for their professional doctorate.

We start from Popper's [11] that:

> *"... all scientific discussions start with a problem (P1), to which we offer some sort of tentative solution – a tentative theory (TT); this theory is then criticized, in an attempt at error elimination (EE); and as in the case of dialectic, this process renews itself: the theory and its critical revision give rise to new problems (P2)." (p. 152)*

This means, that at the beginning of the problem solving process, we cannot really strictly define the problem. We start with a vague description (P1), which is the best we can provide about the problem initially, and we attack it from a particular angle, and come up with a tentative solution. We then tweak and finetune this tentative solution, and by doing so we learn more about the initial problem. Gradually we realise that we see a different problem (P2); with our increased knowledge we attempt to solve the problem how we understand it now, coming up with a new tentative solution, which is subsequently further polished, during which process we learn again, understand the problem better, and eventually realise that in the light of the new solution we see a different problem again (P3), and so forth in iterative cycles, until we finally find a match between the problem that we can formulate and the solution that we can provide for it. This means that it is not at the beginning of the problem solving process but very near to the end of it when we can actually formulate the problem that we solved. [12] Furthermore, any solution at which we arrive in the end, will also provide us with new problems – sometimes additional problems that could not be seen before the solution was achieved, sometimes the new solution makes us question long accepted 'truths'. As a consequence, researchers must not be dogmatic, and have to consider any results they achieve as temporary, as they may be subject to new questioning and revision based on some future solutions to other problems. This view of research is subject to what Munz [13] calls 'evolutionary epistemology' or 'epistemological Darwinism', which can be derived from the dialectics of Kuhn's [14], Popper's ([15], [16]), and Lakatos' ([17], [18]) approach.

However, this train of thought started from Popper's assertion above, which refers to scientific problem solving; the argument gets an additional level of complexity, if we start from real-world problems, which are not necessarily scientific in the narrow academic sense of the term. We use Popper's [11] words once again to outline this additional complexity:

> *"I liked to sum up this schema by saying that science begins with problems, and ends with problems. But I was always a little worried about this summary, for every scientific problem arises, in its turn, in a theoretical context. It is soaked in theory. So I used to say that we may begin the schema at any place: we may begin with TT1 with EE2 and end with TT2; or we may begin with EE1 and end. However, I used to add that it is often from some practical problem that a theoretical development starts; and although any formulation of a practical problem unavoidably brings in theory, the practical problem itself may be just "felt": it may be "prelinguistic"; we – or an amoeba – may feel cold or some other irritation, and this may induce us, or the amoeba, to make tentative moves – perhaps theoretical moves – in order to get rid of the irritation. But the problem "Which comes first, the problem or the theory?" is not so easily solved. In fact, I found it unexpectedly fruitful and difficult." (p. 153)*

This assertion that frontally contradicts the expectation that problem solving should start from a neatly defined problem, particularly in the case of real-life problems. Furthermore, we cannot expect any decent degree of 'objectivity' in the strict positivist sense of the term, as we cannot approach the problem impartially and with an empty mind. We always have some pre-conceptions, whether there are formulated as neat theories, as in Popper's argument or they are simply a baggage that we carry from our education and previous experience. The same applies to the philosophical framing of our research, as Dennett [19] says:

> *"But there is no such thing as philosophy-free science; there is only science whose philosophical baggage is taken on board without examination."* (p. 21)

Naturally, we extend this assertion also beyond the realm of science, to all areas of human thought, including the creative problem solving as described here. Therefore we encourage our learners to make a conscious effort at verbalising their 'philosophical baggage', so that they can conceptualise its consequences. Of course, any philosophical approach is acceptable for pursuing the professional doctorate, only it is useful to reflect on the frameworks one uses and thus the assumptions one makes. We have broken down pretty much all the rigid methodological and epistemological barriers so far, we want to make one final step: we deny to existence of methods completely. [20] We believe that this is particularly important in the case of real life problems, and thus we side with Feyerabend [21] and accept that 'anything goes!':

> *"Successful research does not obey general standards; it relies now on one trick, now on another, and the moves that advance it are not always known to the movers… scientists will get a feeling for the richness of the historical process they want to transform, they will be encouraged to leave behind childish things such as logical rules and epistemological principles and to start thinking in more complex ways – and this is all we can do because of the nature of the material. A 'theory' of knowledge that intends to do more loses touch with reality."* (p. 281)

If we have no methodological requirements, and accept that 'anything goes!', we cannot formulate the problem until we nearly arrive at the solution, and there is no single verifiable solution for an ill-structured problem and we expect the real-life problems investigated by our learners are ill-structured – how do we judge the acceptable research result? Common-sense experience teaches us that a solution is acceptable if it works. If we cannot check whether it works without implementing it at great costs? We will probably try to identify the most knowledgeable people we have access to in the problem area and ask them for their opinion. In science this same principle is identified by Polányi [22]as "the principle of mutual control":

> *"It consists, in the present case, of the simple fact that scientists keep watch over each other. Each scientist is both subject to criticism by all others and encouraged by their appreciation of him… It is clear that only fellow scientists working in closely related fields are competent to exercise direct authority over each other; but their personal fields will form chains of overlapping neighborhoods extending over the entire range of science."* (p. 72)

In line with the 'triple mentoring' approach described in Section 2, we propose a *triple-interpersonal validation*. This means, that the learners pursuing a professional doctorate will need to present their findings to their fellow researchers in a workshop and be able to answer their questions (linking to the peer mentoring), and will be judged by an academic, who is prominent in the field (linking to the academic mentoring), and also by an experienced practitioner in the problem area (linking to the professional mentoring). We believe that *a research result which goes through such triple-interpersonal validation, will have a good chance for viability once implemented – which would be a single-instance quasi-validation*. While this final step cannot be a requirement for the professional doctorate, we believe that we will be able to showcase success stories in many cases of implementation.

## 4 TRANSDISCIPLINARY PROBLEM SOLVER

We have discarded the idea of a PhD due to its academic focus; and this is why we opted for a professional doctorate. However, we need to amend the usual conception of the professional doctorate, as due to its mono-disciplinary character. We are not creating an entirely new doctoral concept, only adapting the existing concept of the professional doctorate by attaching the label of *transdisciplinarity* to it. We believe that this is necessary, and in this section we put forward an argument why.

The notion of transdisciplinarity is not a new one [23]:

> *"The term transdisciplinarity first appeared three decades ago almost simultaneously in the works of such varied scholars as Jean Piaget, Edgar Morin, and Erich Jantsch. It was coined to give expression to a need that was perceived-especially in the area of education-to celebrate: the transgression of disciplinary boundaries, an act that far surpassed the multidisciplinary and the interdisciplinary approaches."* (p. 1)

The quote from Nicolescu suggests that from the early days there was an effort to distinguish transdisciplinarity from related concepts, such as inter- and multidisciplinarity. Here we offer a systematisation of these concepts, rather than simply stating that transdisciplinarity is better – although we certainly agree that it is – and we do this with reference to the above explored notions of problem areas, education and problem solving.

*Mono-disciplinary* would be a problem that resides within a single discipline, and thus it would require mono-disciplinary knowledge to solve it and the problem-solving process would also be mono-disciplinary. This sounds simple, there is only one problem with this: such problems do not exist. This is not entirely true, of course, there are mono-disciplinary problems, only they don't tend to be particularly interesting or significant. They are particularly rare amongst real-life problems. To be sure, there used to be interesting and significant mono-disciplinary problems, only it seems that most of them have been solved by now. And we want interesting and significant problems, otherwise research dies; as Popper [11] warns us:

> *"… what I regard as the ultimate cause of the dissolution of the Vienna Circle and of Logical Positivism is not its various grave mistakes of doctrine (many of which I had pointed out) but a decline of interest in the great problems: the concentration upon minutiae (upon "puzzles") and especially upon the meanings of words; in brief, its scholasticism."*

We do not aim for scholasticism, we want great problems. *Inter-disciplinary* means in-between disciplines, sometimes also interpreted as in the intersection of overlapping disciplines; the latter one is sometimes referred to as *cross-disciplinary*. It seems that most real-life problems today belong here. However, interdisciplinary knowledge and thus problem solving cannot exist.

*Multi-disciplinary* means that multiple disciplines are involved, referring to the entirety of these disciplines. So it does not make sense to think about multi-disciplinary problems. Multidisciplinary problem solving would be possible, albeit not particularly sensible. It would mean that the whole problem should be completely done from (or within) each one of the involved disciplines. However, there is one aspect for which the attribute of multidisciplinary is completely meaningful: it is the knowledge that is required for solving the problem. This will usually take the form of a multidisciplinary team, and only rarely a researcher with multidisciplinary background knowledge.

As it is probably clear by now, the label of *trans-disciplinarity* is reserved for the creative problem solving process. What this means? We adopt Nicolescu's ([24], [25]) approach to transdisciplinarity; however, we do not intend to engage in unpacking all of its details. Transdisciplinarity here means that practitioners from various knowledge domains (multidisciplinary problem-solving team) attack an interdisciplinary problem together, and collaborate synthesising components (conceptions, tools, solutions, worldviews, etc.) from the various disciplines in meaningful novel ways, creating solutions that have not existed before. Such problem solving process and the solution resulting from this process are transdisciplinary.

There is a small contradiction that we have silently slipped over. In Section 2 we said that the formal education, that produces the cultivated mind, is multidisciplinary. However, in this section we said that researchers with multidisciplinary knowledge are rare. This apparent contradiction, however, can be resolved. According to Nicolescu [26] in the middle ages there were only 7 disciplines, while today we have 8,000+ disciplines. For simplicity, we can say that the reason is that we have accumulated substantial amounts of knowledge, which caused the great increase of the number of disciplines. Thus although it is correct to say that the whole formal education is multidisciplinary, we can also observe that the scope of multidisciplinarity is decreasing with the higher level of education. In the elementary school there will be roughly the same proportion of mathematics, literature, history, arts and physical education. However, by the time one gets to the final years of university education, the disciplines other than the specialisation will only include some neighbouring disciplines, and these will cover much smaller proportion of the curriculum. For instance, an operational researcher may have a little bit of corporate finance and human resource management in their timetable but no arts or physical education anymore. This means that gradually, through formal education one becomes 'native' of a particular discipline, with some understanding of the related disciplines. Furthermore, these related disciplines are not those that are close to one another in a particular problem area, but those that branched out from the same parent-discipline. However, in transdisciplinary problem solving we need those disciplines that come close to one another in a particular problem area. For example, if we are in the problem area of cognitive sciences, (cognitive) psychology, computer science, artificial intelligence, philosophy, mathematics, language studies, etc. come together. It is unimaginable that anyone would have even a semi-decent understanding of all these areas for pursuing world-class research. What usually happens is that there is one person interested in a particular problem, being native in one of the disciplines around the problem area, and this person goes for a frontal attack of the problem. As the problem solving progresses, (s)he will need a model, a tool, an idea, or else from a nearby discipline and will consult with a native from that discipline with interest in the same problem (or, at least, in the same problem area). This is what we mean by transdisciplinary creative problem solving.

It is possible, however, to take a more proactive approach to fostering transdisciplinary creative problem solving. The essence of the idea is that the researcher who is native in one discipline, may not know that e.g. a tool exists in a nearby discipline that (s)he could use. Being proactive means putting forward insights from other disciplines, that the researcher may make use of. This can be done in the following way: If someone is at a sufficiently high level of expertise (a grandmaster) in a particular discipline, this person will be able to provide insight into some interesting topics of their respective disciplines painting a meaningful big picture with only a few details, thus conveying the essence without needing to build up the disciplinary knowledge from the basics. In the language of cognitive psychology (one of our neighbouring disciplines in the problem area of informal learning) we would say that this person can provide high-level meta-schemata that the audience can contextualise according to their level of expertise. This is why we intend to include the world-leading gurus in our school; their job is to provide insights that the learners may find useful or that may trigger another idea or a direction to pursue. Naturally, if there are learners from different disciplines interested in problems from the same or related problem areas (which is likely), they can provide each other with similar inputs at peer level. This way triad that was first introduced in terms of mentoring and then considered again in terms of the validation, can get a role again; we call this triple-triggering, which, again, includes professional-, academic- and peer-triggering. Therefore we envisage *a GLocal* *transdisciplinary community, Safari-style, where gurus are bringing deep insights from a variety of disciplines, while professional and academic mentors foster the transdisciplinary creative problem solving process of our learners, who also intensively interact with each other in various peer-processes.*

## 5 CONCLUDING REMARKS

Although we want to provide the maximum freedom to our learners in the Professional Doctoral School (PDS), it is also useful if there is at least some degree of similarity between the problem areas to make the most out of the peer processes. To this order the offered research area is broadly defined by the Investor as the society with particular emphasis on the economic aspect. We used our approach of the five curriculum design concepts ('quasi-algorithmic', 'quasi-heuristic', 'quasi-incremental', 'quasi-abductive', and 'quasi-validated') develop the curriculum. At its centre is the process of creative problem solving, and it is all embedded in the notion of transdisciplinarity. In the interrelation of the two the students are expected not only to transcend the global-local gap but also a variety of disciplinary gaps, while pursuing a meaningful solution. The two pillar-concepts that we work from ate ethics and complexity. The two pillar-concepts are associated with four cornerstone-concepts, economy, anthropology, epistemology, and physics/biology, with various linking concepts between them; and these are then further broken down to into topics. We are more flexible about the particular topics than about the framework; it is more important to bring in the best minds than what they will talk about. As we suggest an open-ended structure, the learners may 'customise' their own concept maps, include only some of what is there, add further concepts, bring some to the focus and push others into subsidiary positions. Essentially, *the curriculum is constructed by the learners through their collaborative transdisciplinary research*.

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