

# Exploring the Transdisciplinary Learning Experiences of Innovation Professionals

Mariana Zafeirakopoulos and Mieke van der Bijl-Brouwer

“ *The personal foundation of experience of the learner comprises what learners bring to any event: their history in learning situations and more generally, their assumptions, values, conceptual frameworks, etc. They carry both the capabilities for learning further and constraints such as conceptual and emotional baggage that will make learning more difficult for them. Learners are only partially aware of their personal foundation of experience and may have great difficulty in articulating any of it.* ”

David Boud (1993)

Professor of Education and Professional Development

Transdisciplinary innovation inherently involves learning how to integrate disciplines towards exploring a problem or towards developing a solution or technology. Thus, transdisciplinary innovation and transdisciplinary learning are practically interchangeable. Although transdisciplinary learning has been studied and experimented with in educational research, the understanding of it in a professional context is limited. We therefore aim our research at addressing this question of how people shift their practice towards other disciplines to address complex issues. We chose to focus on a particularly challenging context – the shift from positivist to non-positivist learning across the career of transdisciplinary innovators when addressing complex problems. What makes this context challenging is that the siloed and heavily specialized nature of working within a disciplinary construct discourages collaboration on real-world complex problems. This context is also challenging because the analytic focus from positivist disciplines results in a reductionist approach, which limits an innovator’s ability to explore problems holistically and abductively. An understanding of the learning experiences of practitioners in these contexts will inform the identification of relevant variables and attributes that encourage innovative learning for ultimately innovative practice. This identification might help us develop better support and education for innovation professionals who want to adopt transdisciplinary practices for the purposes of addressing complex problems. In this article, we discuss the results of a series of in-depth interviews to understand the learning experiences of design innovation practitioners who experienced a shift away from positivist approaches towards transdisciplinary innovation practice. We explore the research approach undertaken to study the motivations and drivers, the emotions experienced during the shift, and the implementation and dissemination of the new learning into professional practice.

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## Introduction

With our society becoming increasingly interconnected through advances in technology and social media, the problems that our global communities face are increasingly open, complex, dynamic, and networked (Dorst, 2017). However, complex real-world problems typically do not yield to approaches that attempt to apply existing solutions. Thus, what is needed is a way to help re-frame problems, and transdisciplinarity has emerged as a promising approach to meeting this need.

Since the early 1970s, when the concept of transdisciplinarity was introduced to address real-world complex problems (Piaget, 1972), several frameworks to inform transdisciplinary practice have been explored. However, this literature (e.g., Binder et al., 2015; Nicolescu, 2008; Polk, 2015) has tended towards theoretical rather than practitioner-based reflections on how transdisciplinarity is experienced by innovation professionals. There is a gap in the literature in terms of how professionals emotionally experience transdisciplinary learning to innovate for complex problem solving; for example, emotional insight reveals our likes, dislikes, underlying preferences, and values, and it ultimately determines the choices we take in what and how we learn (Moon, 2004). By exploring professionals' emotions, preferences, and values, we can better understand how transdisciplinary learning aids innovation in complex problem settings and how we might bring others – who do not apply transdisciplinary approaches – into the fold of transdisciplinary practice. Understanding the personal and emotional experiences before, during, and after learning can better inform how transdisciplinary innovation is experienced and therefore how we might embed transdisciplinary approaches in the workplace.

Complex problems require transdisciplinary approaches (as opposed to multidisciplinary and interdisciplinary approaches) such as working collaboratively across disciplines rather than “a specialisation in isolation” method (Max-Neef, 2005), adopting a systems view (Ackoff, 1999), or working continuously for a common human and social purpose (Jantsch, 1970). At the individual level, this means professionals will need to step outside their area of specialization and learn how to continuously adjust their practice with others. This type of learning goes reflecting on what we have done and how it may have contributed to an unexpected outcome (Schön, 1983). Unmet outcomes or surprising incidents occur when people offer their existing knowledge (which they know works in a specific con-

text) to a different context where their existing knowledge is seemingly inappropriate or ill-fitting. Rather than using preconceived thinking about what should be done in a specific context, these professionals need to reflect on what works best for that unique situation, and transdisciplinarity approaches enable this reflection.

Transdisciplinarity differs from interdisciplinarity and multidisciplinary. Interdisciplinarity integrates “information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice” (Andreasen et al., 2004). Conversely, with multidisciplinary, each discipline makes a separate contribution (Andreasen et al., 2004). By contrast, transdisciplinarity has been defined as efforts conducted by actors from different disciplines working jointly to create new conceptual, theoretical, methodical, and translational innovations that integrate and move beyond discipline-specific approaches to address a common problem (Aboelela et al., 2007).

A key feature of transdisciplinarity is the importance of continuous learning and discovery, which is especially relevant to today's workplace. Now, more than ever, professionals need to be agile in their learning and practice given they work on new challenges in new contexts, often with fewer resources, shorter timelines, and higher demand for quality outcomes. However, transdisciplinary approaches are constantly evolving (Jantsch, 1970), transcending individual disciplines and adapting to the changing reality of the complex issues that practitioners aim to address. This changing reality means that transdisciplinary practitioners will constantly need to adapt their practice, which requires them to become effective learners. In the context of innovation, the focus is currently on teaching professionals specific innovation methods and tools, such as design thinking and lean and agile methods and principles. Although these methods are useful for obvious or complicated problems, practitioners often struggle to integrate them or learn to adapt them to changing complex problems and their contexts (Snowden & Boone, 2007). We therefore argue that, to support transdisciplinary innovation, we need to better understand how we can support practitioners to become transdisciplinary *learners*. To achieve this goal, we start with building an understanding of the current learning experiences of practitioners who want to shift their practice towards transdisciplinary innovation.

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Understanding the emotional experience of learning is important because, as Boud (1993) argues, “feelings and emotions are probably much more significant influences over what and how we learn than the ostensible cognitive content”. Without an understanding of experience, the successful teaching and application of transdisciplinary processes and practices may be limited to “tools” and “methods”. These alone do not provide support for stepping out of comfort zones and into a dynamic learning process that underlies transdisciplinary innovation. We therefore need to include a focus on learning experiences, as Ackoff (1974) argues, to promote sustainable and systemic practice to address future complex problems. Failing to understand the emotional learning experiences of innovative approaches represents a particular challenge for structured and rules-based disciplines (e.g., engineering, medicine, or law) in which practitioners are being asked to respond innovatively to increasingly intractable problems. For these disciplines, transdisciplinary learning is less intuitive or seemingly less possible compared to non-positivist disciplines (e.g., business, design or anthropology).

As we have argued previously (van der Bijl-Brouwer, 2017), to advance transdisciplinary approaches such as those required in public and social innovation, we need to develop a more complete understanding of how and why innovation practitioners work by including the “internal view” of this practice. This is in line with the views of Wilber (2006) and Laloux (2014), who argue that effective organizational management requires an understanding of people’s beliefs and mindsets, and of their collective culture. This will not just help us understand what people do in transdisciplinary innovation, but also why they do it. In seeking to define the experience of learning, we find definitions of emotion relative to learning. Emotion is defined as a multifaceted phenomenon (Scherer, 2005) and has three properties: immediate awareness, phenomenal quality, and intentionality (Reisenzein & Döring, 2009) Here, we define the experience of learning as how professionals feel during their encounter with transdisciplinary learning before, during, and after the transdisciplinary approach has been applied, and how these feelings influence transdisciplinary behaviours in practice.

In this article, we examine the learning experience provided by transdisciplinary innovation in a professional context. We explore the variables and attributes underpinning transdisciplinary experiences through the personal narratives of seven innovation professionals currently employed in areas of health, taxation, de-

fence, bioscience, tertiary education, crime profession, and management consulting. These professionals were initially trained in rules-based disciplines such as mathematics, science, and engineering and, later in their careers, adopted transdisciplinary approaches to address complex social problems.

## Methodology

The objective of this research was to identify the learning experiences of transdisciplinary innovation that could help inform how practitioners become comfortable with the uncertainty and learning required for transdisciplinary innovation and how transdisciplinary approaches are learned (beyond knowing the theoretical subject matter). The focus question guiding this research was: How do innovation professionals experience transdisciplinary learning? We theorized that this question could be examined across three phases of the learning experience to explore how innovation practitioners shifted from their original rule-based practice (positivist) to transdisciplinary ways of working (non-positivist). The three phases are explained below and illustrated in Figure 1:

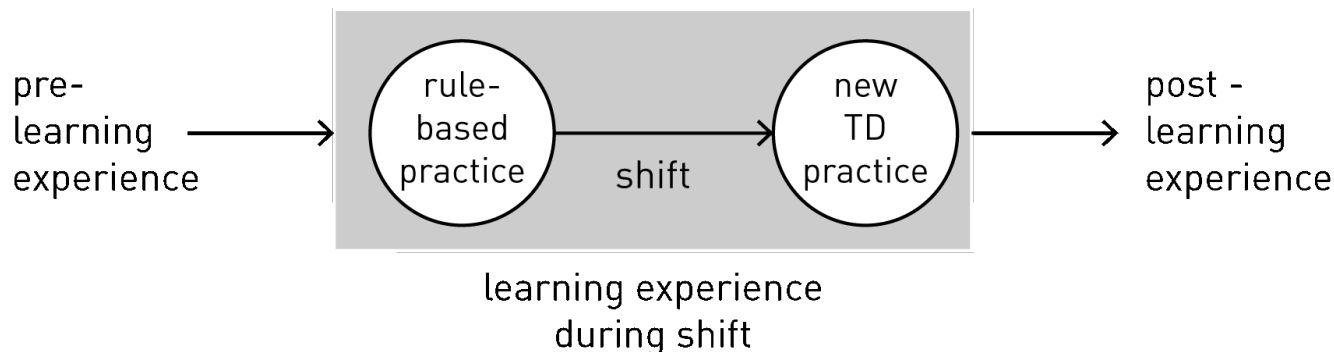
1. **Pre-learning phase:** exploring the motivations and attributes of professionals that lead to transdisciplinary behaviours and ways of working
2. **During-learning phase:** exploring the process of transition between disciplines
3. **Post-learning phase:** exploring how new knowledge, practice, and ways of knowing are realized and implemented to address complex problems

To explore these focus areas, semi-structured and in-depth qualitative interviews were conducted with seven innovation professionals working in complex social problem areas across health, community justice, and public service systems. Semi-structured in-depth qualitative interviews were selected to allow subjective insights and feelings to be revealed (Neuman, 2000).

The innovation professionals were selected based on their common attribute of applying design to systemic, structural, and complex social problems and their shift away from their original “rules-based” (or positivist) discipline of study. The original disciplines of study that participants shifted away from were engineering, economics, mathematics, biosciences, science, and psychology; two participants also had additional experience in non-positivist disciplines (religion and

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**Figure 1.** Conceptual research framework for examining the phases of the transdisciplinary (TD) learning experience

communications). The subjects were recruited with a snowball approach and were identified to take part in the research for their work as known senior innovation leaders currently working in innovation with a focus on addressing complex social problems such as health, population growth, crime prevention, and environmental issues.

The intent of the interviews was to unearth the feelings experienced by the professionals while undertaking their transdisciplinary innovation journey over the course of their careers. To encourage participants to discuss sentiments and reflections on their learning experience, they were asked to share their personal stories of how they came to adopt new disciplines and practices. These personal stories often included historical timelines and explanations of decisions and turning points, such as employment leaps, job changes, or moments of awareness that compelled participants to pursue one opportunity over another. These interviews were conducted over audio-visual conference calls or in person. In addition to audio recordings, hand-written notes were taken to allow the interviews to be synthesized later. In addition to taking notes about the participants' comments, observations of non-explicit communication such as tone, posture, facial expression, and vocal volume were also noted.

An inductive thematic approach was used with iterations of the analysis. First, the notes were reviewed to identify individual themes from each interview. These individual themes were then analyzed to identify commonalities or patterns across the interviews. Once this list of consolidated themes was identified, each audio file was replayed to test the themes identified – whether there were missing themes or patterns or conversely any themes that conflicted with the ruling hypothesis.

The interviews were reviewed a third time for verbatim quotations as evidentiary support of the analysis.

### Results

The results from the pre-learning phase highlighted the importance of emotional attitude and the influence of family in creating the appropriate environment and mindset as motivators for pursuing transdisciplinary learning. In the during-learning phase, we see participants identify the limitations of their original discipline of choice through their “doing” learning strategy and a drive to identify other approaches to bridge the gap in solving complex problems. In the post-learning phase, we identified emotional attitudes towards transdisciplinary learning as optimism, curiosity, excitement, and determination as enablers for transdisciplinary learning but also attributes that encouraged professionals to continue with their transdisciplinary approaches during challenging times.

In the pre-learning phase, there were three main motivations and attributes that led professionals to transdisciplinary behaviours and ways of working. The first attribute was the motivation for pursuing transdisciplinary learning being a curiosity in complexity, systems, and relationships. Four out of 7 participants discussed their interest in complex adaptive systems as a motivator for further problem exploration and complexity. Similarly, 6 of 7 participants interviewed discussed an interest in understanding “the system”, particularly because of an interest in connections and relationships. The interest in complexity or applying a systems-view to problems affirms that it is an essential ingredient for a transdisciplinary way of working and learning, given its focus on addressing complex problems. As highlighted in McGregor (2015), “complexity is a modern

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form of universal interdependence... nothing is separate... and disparate viewpoints must be voiced and integrated to solve complex human problems.”

A second attribute that led professionals to transdisciplinary behaviours was the motivation to address complex problems as influenced by family when they were young. During the interviews, it was revealed that participants had rich personal stories revealing how disciplinary and future career pathways were shaped. The example quotation below demonstrates how curiosity fuelled by family influence motivated an interest in systems. This interest eventually led to the adoption of design as a way of applying transdisciplinary ways of working to address intractable complex problems:

*“As a child, I had long experiences of hospitalization and isolation...I got through it by patterning. I started collecting insects. I identified with systems much earlier than I knew what the word meant. I chose rural science at [university] because I was home-sick and I heard a person on the ABC who said he studied rural science because he was interested in systems, so I thought I would go and study that. I was a fiddler and inventor and dad was a good companion in that. We invented stuff out of stuff. That was how I grew up! Working with dad a lot became part of my DNA as a designer.”*

In another example, a participant shares their reflections on how family played a role in their motivation to address social justice “real-world” problems – a key characteristic of transdisciplinary ways of working:

*“My value base is very much set by my mother, my grandmother, my great-grandmother... My values come from the Welsh community, which is very much matriarchal – I spent a lot of time with my great-grandmother until she died when I was 12 and then was [best friends] with my grandmother until she died when I was in my mid-20s. My grandmother was an activist. Only in retrospect do I understand that.”*

It seems, therefore, that purpose and attitude toward learning and experimentation seem to originate in people’s upbringing.

An awareness of the limitation of the participant’s core discipline to address complex problems’ was a third attribute that bridged the pre-learning and during-learning phases. Participants identified how initial learning choices or influences were made and shifted away from

those choices to find other disciplinary methods that bridged the gap. For example, participant 7 described their initial attraction to mathematics and the certainty it provided in its answers, but he then recognized as his career unfolded that, for him, mathematics had limited focus on real-world application. It was this turning point that influenced the exploration of other approaches such as design to fill this gap. This shift was common with almost all participants who looked to other fields when they realised the shortcomings of their original disciplinary pursuits. Interestingly, no participant was able to recall or describe a time when their original discipline of study was applied to design to address an identified complex problem, but 4 out of 7 participants stated that their original disciplines provided “conceptual inspiration” for transdisciplinary learning. For example, participant 3’s reflections on the rules-based discipline of biomedicine helped them to become the type of design practitioner who worked on complex problems, applying methods and tools from a range of disciplines and approaches:

*“I run experiments all the time – that’s creativity... and I thought ‘that’s right’ – I have been designing stuff ever since I left university! I now embrace the scientist in me.”*

In summary, it appears that flexible, collaborative, and iterative principles as found in design can be applied to rules-based disciplines to create new ways of working, thinking, and addressing complex real-world problems. As Dorst states, design is ideally positioned to contribute as a bridge builder between technology and humanity to help deal with complex social issues (Dorst, 2017). But the reverse – the application of rules-based disciplines to design and transdisciplinary practice – does not intuitively work to address complex real-world problems. Therefore, although not all participants applied their procedural knowledge from their rules-based disciplines, the principles, familial influences, or innate characteristic that guided their original disciplinary choices provided an enduring motivation to pursue a transdisciplinary way of working.

In the during-learning phase – exploring the process of transition between disciplines – the learning strategy that participants undertook to employ transdisciplinary learning in practice was identified. Most participants reflected that their most notable experiences of transdisciplinary learning were when they were “doing” it. Five of 7 participants described their way of “learning by doing” and an additional 3 participants reflected that their approach to learning content was

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through other learning styles such as auditory or visual means, for example, undertaking prolific reading and then drawing models to interpret this reading. Although most participants described their transdisciplinary learning as learning by doing, we also witnessed that participants generated their ideas, concepts, and theories about ways to tackle complex problems in different ways, for example, reading, drawing, and sketching models or through conversations with others. It therefore appears that transdisciplinary learners (and practitioners) source their ideas in different ways but rely on learning by doing to learn from how theory is applied to complex contexts.

In the post-learning phase, we identified that learner attitude toward the learning process played an important role in adopting transdisciplinary approaches. Attitude, in this context, is defined as a settled way of thinking or feeling about their transdisciplinary learning experience. Overwhelmingly, participants described having a positive attitude towards their learning. Their positive outlook was spurred on by their desire to learn new approaches generated by feelings of excitement, anticipation, and optimism towards their learning. Participant 7, for example, described their experience as *“exciting because we were breaking new ground...doing things that others hadn’t done before. Although it took several years to embody the design way... [in other words, transdisciplinary practice], there were clear Aha! moments.”* Participant 4, for example, talked about the learning experience as exciting because *“I felt like the half of my brain which was suppressed during my structured schooling was finally freed.”* Six of the 7 participants spoke of their naturally inquisitive nature and how curiosity was not only an aide to help them pursue their learning interests but also helped them to persist during times of uncertainty or difficulty. For example, participant 3 stated: *“I saw my learning journey as a continuum, I didn’t know what I wanted to be in 1985 but there was always [curiosity] that drew me down that path.”*

Participants acknowledged that, after reflecting on their learning experiences, not every experience was guided by positive emotions. Participants reported experiencing challenges when it came to external influencing factors, such as convincing colleagues of the merits of undertaking a transdisciplinary approach or pursuing organizational change in favour of more transdisciplinary innovative approaches. Five of 7 reported feeling frustrated and challenged and experiencing scepticism or self-doubt, particularly in circumstances where they needed to convince their organization or unit that

transdisciplinary ways of working would be worthwhile. For example, one participant reflected on their professional experiences in facilitating a design-led workshop aimed at brokering new solutions to enduring organizational problems in the health sector. The participant reflected that few in their workshop were convinced of the merit of transdisciplinary approaches because they were wed to their world views of approaching problems in particular ways, even if these approaches failed to work. They also noted that the challenge in generating supporters and advocates of transdisciplinary approaches limits organizational transformation: *“there are always only one or two participants in a room that are converted advocates to our way of working; for most people they might find it interesting... learn a new tool or two, but they don’t take it any further.”* Indeed, some participants found that there were organizational barriers that represented challenges. These challenges related to how clients or partners struggle with adopting change and implementing the new tools, models, and ways of thinking they learned in the workplace, particularly if the translation to profit or improved business outcomes could not be immediately seen: *“the challenges exist when I work with clients and they experience organizational barriers... [a focus on] increasing revenue or market share...it is hard for them [to implement new ways of working].”*

The challenges experienced with seeking organizational change in favour of transdisciplinary and innovative ways of working had personal implications for 4 of 7 participants. These participants reported feelings of self-doubt, reduced confidence, frustration, or confusion. For example, some participants experienced frustration and confusion due to the learning curve in the new context within which they were working. Some participants were challenged to create a shift in this context by focusing on how knowledge could be applied to real-world contexts, which was different to the normative stance of their peers, which was to specialize in their respective field of knowledge. To quote one participant, they stated that they experienced challenges in *“trying to convince others of the merits of design... of making my knowledge and approach stick. I have had some great successes but also significant challenges; it has been a slow burn.”* These participants persevered rather than abandoned a transdisciplinary way of working due to the advocates they found in a like-minded colleague, client, partner, or student. These individuals became advocates because they held similar attitudes – a curious mindset, an interest in exploration, and desire to realize novel outcomes for profound change. Interestingly, the same feelings of excitement, anticipation, and

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optimism that promoted their learning were also the same attitudes that helped participants through these challenging times.

### Discussion

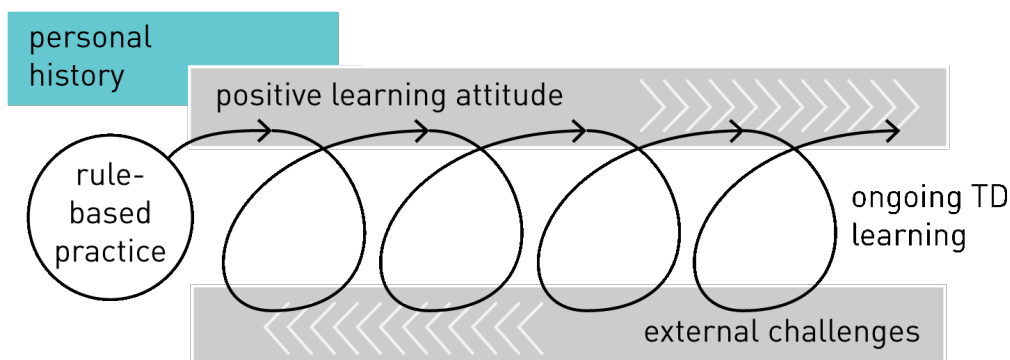
Our initial research design suggested linear shifts between the pre-learning, during-learning, and post-learning phases of transdisciplinary learning. However, the results reveal a clear feedback loop where attitudes in the pre-learning phase are enablers for a continuous learning cycle throughout the transdisciplinary practitioner's learning experience, which begins with personal histories but never actually ends (Figure 2). This feedback loop raises questions about how we amplify traditional learning approaches to better support professional learning as well as identifying the optimal tension between appropriate challenges and attitude as an enabler to constructive transdisciplinary practice.

The results of this research also generated two questions that are worthy of further exploration in the study of how transdisciplinary approaches might be shared and learned:

1. If transdisciplinary learners and innovators are driven by innate traits (for example, curiosity) shaped by early experiences and the influence of family, to what extent can these traits be taught (if at all) or reactivated in cases where innate traits in youth were trained out by specialized training in adult years?
2. If the main challenges that participants experienced are extrinsic, what are the best ways to engage with others (particularly those with different drivers) to explore transdisciplinary approaches and overcome these challenges?

The first question on teaching intrinsic drivers or traits also raises the related question: can values be taught or reactivated? Morrison (2001) posits that “we teach values by having them”, whereas scholars such as Schrier and Gibson (2010) offer that values can be taught through play and gamification. It is arguable that the personal stories of youth and familial connection that participants cited were attributes, traits, and behaviours learned because of behaviour *taught* by family members. Indeed, as Adriani and Sonderegger explore in their paper on social learning, understanding parent-child relationships is an area of increasing focus for economists to explore how and which information, attitude, norms are shared across generations (Adriani & Sonderegger, 2011). If this is the case, it is questionable how formal structured learning approaches such as McCall's 70:20:10 model for learning and development – an approximate ratio that suggests for optimal learning, the majority of learning (70%) should be on the job, 20% of learning should occur through learning from others, for example, peer and mentoring support networks, and the final 10% only should be through formal learning, for example, with formal coursework – would work to create the same intrinsic drivers fused during youth (Clardy, 2018).

Transdisciplinary innovation is impossible without collaboration. This research shows that, currently, transdisciplinary innovators have very specific attitudes and motivations. Chances are that not every team member will hold those attitudes and motivations, which might impact transdisciplinary collaboration. Current transdisciplinary learners are the “early adopters” of transdisciplinary innovation, which raises the question about how these learners are going to bring others along on this journey. Indeed, the study provides anecdotal evidence that this is a key challenge for transdis-



**Figure 2.** Enablers of the transdisciplinary learning framework

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ciplinary innovators. We therefore need to understand how transdisciplinary learning can move beyond an individual activity, to a team or group activity, building on theories such as organizational learning (Argyris & Schon, 1978), leadership theory (Dinh et al., 2014), and contemporary management theories such as Teal organizations (Laloux, 2014).

Finally, these variables verify what we intuitively assume to know about transdisciplinary innovation practices – namely, that a positive attitude toward learning is likely to yield more positive application of innovation approaches. They also verify what is known in the literature about the experience of learning more generally, which is that positive learning experiences commence with concrete experiences (Kolb, 1984). These variables also highlight a previously unidentified enabler of transdisciplinary innovation practice – the importance of familial experiences and influence in youth. These trusted family networks of support (guardian, friends, or others) are key to creating future practitioners with an innovator’s mindset and a yearning interest in systems and relationships (people, process, product, etc.) and an exploratory mindset to address enduring complex problems. Familial influences embedded at youth present interesting challenges for training adults with incongruent values or adults who, as children, were subject to what Elliot Eisner refers to as the “null curriculum” – the creative learning that children “miss out on when educators lack the subject knowledge, skills, and self-confidence to deliver this learning” (Lindsay, 2015); or adults who need to be “retrained” in these variables that had them “trained out” of them during formative years.

We argue that the success of today’s innovation practitioner as established transdisciplinary innovation thinkers and workers are based on their access to and involvement in supportive personal networks during their youth. But this postulation raises the question: what happens to children who have the world of possibility closed to them, whose personal networks discourage creativity, curiosity, and a drive to seek out knowledge and understanding of complex contexts? We speculate that these youth groups are less likely later in life to intuitively adopt different values, ways of working, or ways of thinking that promote innovation without external intervention, such as exposure to trusted networks that open to the possibility of working innovatively, access to an education system that further cements and celebrates the enablers of innovation, or formal training. Indeed, even formal transdisciplinary innovation training has its limitations in embedding in-

novation in organizational practice if it does not target the other variables highlighted in this article. There is opportunity therefore to take a collective impact approach – bringing together different organizations to achieve long-lasting social change – to the “cradle to career” student journey. The various intervention points from early education, through to secondary, tertiary, and professional education represent opportunities to spark, revive, or amplify the required attitudes that enable innovation. These intervention points can help level the playing field by providing children with equitable access to education through to adulthood that fosters and promotes curiosity, an interest in systems and relationships, and an understanding of complexity.

### Conclusion

Although the search for insights into how learning is experienced is not new, this research has initiated exploration into how the experience of learning is relevant to transdisciplinary innovation. From this research, we learn that there are at least three variables of transdisciplinary learning experiences that might enable innovators to shift towards more transdisciplinary ways of working. aligned to the transdisciplinary framework of pre-learning, during-learning, and post-learning. First, participants’ motivations toward transdisciplinary learning have roots in family influence, generating an interest in areas such as complexity, systems, and working on real-world problems. Second, in the during-learning phase, we see that a “learning by doing” strategy helped participants identify the limitations of their original area of disciplinary study. The consequence of these limitations resulted in participants shifting toward more generalist, holistic, and collaborative ways of working to enable a more transdisciplinary way of working. In the post-learning phase, we see that learner attitude underlies both the pre-learning and post-learning phases, playing a critical role in how professionals work in a transdisciplinary way – a learning loop rather than a linear shift from traditional discipline to transdisciplinary approaches. Moreover, the participants’ emotions guided their attitude toward learning; the participants’ overall learning experience was positive due to intrinsic feelings generated from making a new discovery, creating change, or pursuing curiosity. These positive emotions included optimism, curiosity, excitement, and determination. When learners faced extrinsic challenges, these positive attitudes and emotions helped them persevere with the difficulty of creating organizational change or persuading others of the merits of transdisciplinarity despite negative feelings such as self-doubt and frustration.



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These variables are ultimately important because they help us to draw from what we already know about the general emotional experience of learning as well as reflect on ways in which we can promote these variables in early childhood education through to professional adulthood. They help pinpoint enablers for transdisciplinary innovation learning and practice and help us reflect on intervention points throughout the whole-of-life education journey that practitioners undertake to spark, revive, or amplify the required attitudes that enable innovation.

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## References

- Aboelela, S. W., Larson, E., Bakken, S., Carrasquillo, O., Formicola, A., Glied, S. A., Haas, J., & Gebbie, K. M. 2007. Defining Interdisciplinary Research: Conclusions from a Critical Review of the Literature. *Health Services Research*, 42: 329–346. <https://doi.org/10.1111/j.1475-6773.2006.00621.x>
- Ackoff, R. L. 1974. *Redesigning the Future*. New York: John Wiley & Sons.
- Ackoff, R. L. 1999. *Ackoff's Best – His Classic Writings on Management*. New York: John Wiley & Sons.
- Andreasen, N. C., Brown, T. L., et al. 2004. *Committee on Facilitating Interdisciplinary Research, Committee on Science, Engineering, and Public Policy. Facilitating Interdisciplinary Research*. National Academies. Washington: National Academy Press. <https://www.nap.edu/read/11153/>
- Adriani, F., & Sonderegger, S. 2011. *Setting the Right Example: A Signaling Theory of Parental Behavior*. Working paper. SOAS University of London, University of Leicester, and University of Bristol. <https://sites.google.com/site/silviasonderegger/software>
- Argyris, C., & Schon, D. 1978. *Organisational Learning: A Theory of Action Perspective*. Reading, MA: Addison-Wesley.
- van der Bijl-Brouwer, M. 2017. The Power of Trust and Motivation in a Designing Social System. In *Proceedings of Relating Systems Thinking and Design (RSD6) 2017 Symposium*. Oslo, Norway, October 18–20, 2017.
- Binder, C., Absenger-Helmi, I., & Schilling, T. 2015. The Reality of Transdisciplinarity: A Framework-Based Self-Reflection from Science and Practice Leaders. *Sustainability Science*, 10(4): 545–562. <https://doi.org/10.1007/s11625-015-0328-2>
- Boud, D. 1993. Experience as the Base for Learning. *Higher Education Research and Development*, 12(1): 33–44. <https://doi.org/10.1080/0729436930120104>
- Clardy, A. 2018. 70-20-10 and the Dominance of Informal Learning: A Fact in Search of Evidence. *Human Resource Development Review*, 17(2): 153–178. <https://doi.org/10.1177/1534484318759399>
- Dinh, J. E., Lord, R. G., Gardner, W. L., Meuser, J. D., Liden, R. C., & Hu, J. Leadership Theory and Research in the New Millennium: Current Theoretical Trends and Changing Perspectives. *The Leadership Quarterly*, 25(1): 36–62. <https://doi.org/10.1016/j.leaqua.2013.11.005>
- Dorst, K. 2015. Frame Creation and Design in the Expanded Field. *She Ji - The Journal of Design, Economics, and Innovation*, 1(1): 22–33. <https://doi.org/10.1016/j.sheji.2015.07.003>
- Dorst, K. 2017. Design Beyond Design. In *Proceedings of Relating Systems Thinking and Design (RSD6) 2017 Symposium*. Oslo, Norway, October 18–20, 2017. <https://systemic-design.net/wp-content/uploads/2017/12/Kees-dorst-RSD-Oslo-paper.pdf>
- Gardener, H. G. 2004. *Changing Minds: The Art and Science of Changing Our Own and Other People's Minds (Leadership for the Common Good)*. Boston, MA: Harvard Business School Press.

# Exploring the Transdisciplinary Learning Experiences of Innovation Professionals

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Jantsch, E. 1970. Inter- and Transdisciplinary University: A Systems Approach to Education and Innovation. *Higher Education Quarterly*, 1(1): 403–438.  
<https://doi.org/10.1007/BF00145222>

Laloux, F. 2014. *Reinventing Organizations*. Brussels: Nelson Parker.

Lindsay, G. 2015. “But I’m Not Artistic”: How Teachers Shape Kids’ Creative Development. *The Conversation*, January 8, 2015. Accessed August 20, 2018:  
<https://theconversation.com/but-im-not-artistic-how-teachers-shape-kids-creative-development-34650>

Manzini, E. 2016. Design Culture and Dialogic Design. *Design Issues*, 32(1): 52–59.

Max-Neef, M. A. 2005. Foundations of Transdisciplinarity. *Ecological Economics*, 53(1): 5–16.  
<https://doi.org/10.1016/j.ecolecon.2005.01.014>

McGregor, S. L. T. 2015. *Transdisciplinary Knowledge Creation*. Cham, Switzerland: Springer International Publishing.

Morrison, T. 2001. How Can Values Be Taught in the University? *Michigan Quarterly Review*, 40(2): 273.  
<http://hdl.handle.net/2027/spo.act2080.0040.201>

Neuman, W. L. 2000. *Social Research Methods: Qualitative and Quantitative Approaches* (4th Ed). Needham Heights, MA: Allyn and Bacon.

Nicolescu, B. (Ed). 2008. *Transdisciplinarity: Theory and Practice*. Cresskill, NJ: Hampton Press.

Piaget, J. 1972. The Epistemology of Interdisciplinary Relationships. In L. Apostel, G. Berger, A. Briggs, & G. Michaud (Eds.), *Interdisciplinarity, Problems of Teaching and Research in Universities*: 127–139. Paris: OECD Publications.

Polk, M. 2015. Transdisciplinary Co-Production: Designing and Testing a Transdisciplinary Research Framework for Societal Problem Solving. *Futures*, 65: 110–122.  
<https://doi.org/10.1016/j.futures.2014.11.001>

Reisenzein, R., & S. A. Döring. 2009. Ten Perspectives on Emotional Experience: Introduction to the Special Issue. *Emotion Review*, 1(3): 195–205.  
<https://doi.org/10.1177/1754073909103587>

Scherer, K. R. 2005. What are Emotions? And How Can They Be Measured? *Social Science Information*, 44(4): 695–729.  
<https://doi.org/10.1177/0539018405058216>

Schön, D. 1983. *The Reflective Practitioner: How Professionals Think in Action*. London: Temple Smith.

Schrier, K., & Gibson, D. 2010. *Ethics and Game Design: Teaching Values through Play*. Hershey, PA: IGI Global.

Snowden, D. J. & Boone, M. E. 2007. A Leaders Framework for Decision Making. *Harvard Business Review*, 85(11): 68–77.

Wilber, K. 2006. Introduction to the Integral Approach (and the AQAL Map). *KenWilber.com*.  
[http://www.kenwilber.com/Writings/PDF/IntroductiontotheIntegralApproach\\_GENERAL\\_2005\\_NN.pdf](http://www.kenwilber.com/Writings/PDF/IntroductiontotheIntegralApproach_GENERAL_2005_NN.pdf)

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