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To cite this article: Paul Gibbs (2023) Transdisciplinarity as subversion: in space and place, *Quality in Higher Education*, 29:3, 374-389, DOI: [10.1080/13538322.2022.2156027](https://doi.org/10.1080/13538322.2022.2156027)

To link to this article: <https://doi.org/10.1080/13538322.2022.2156027>



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Published online: 19 Dec 2022.



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Transdisciplinarity as subversion: in space and place

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ABSTRACT

This article considers the conception of transdisciplinarity as a knowledge distinct from disciplinary knowledge modes and especially drawing a distinction with interdisciplinarity. Such critical analysis assists in the recognition of the importance and value of transdisciplinarity within the ecology of knowledge in the complex systems of university education. Using emergence as a framework, the paper explores how emergent properties are generated and assist in problem solving, creating an ethos for the university and how a transdisciplinary currere can be settled in such a space.



KEYWORDS

Emergence; transdisciplinarity; interdisciplinarity; ethos; university

Introduction

This article considers the conception of transdisciplinarity (TD) as a knowledge distinct from disciplinary knowledge modes and especially drawing a distinction with interdisciplinarity (ID) as the most integrated disciplinary knowledge approach to problems. Both are within the genus of knowledge or geosology.

This article is not about quality processes but a reconceptualisation of disciplinary knowledge that arguably leads to a significant improvement in the quality of learning. The distinction between TD and ID hinges on considering knowledge as a complex system and the notion of weak and strong emergence of situated knowledges in attempts to solve problems within the complex systems that create them. In using this distinction, the article dispels any consideration that ID and TD are the same, or continuous extensions of the same thing. It further then suggests that, through the contribution of TD's strong emergent properties (a property that a complex system or collection of system parts has but which individual parts do not possess),

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universities should help us to ‘cope with the traumatic experience of having to readjust the totality of our conditions of existence’ (Latour, 2016, p. 10).

This article is restricted to an investigation of the inappropriateness of considering ID and TD as interchangeable, as is often done in the education literature and policy documents. In doing so, transdisciplinarity is conceptualised as an exploration of ontology rather than a distinctive epistemological method, as proposed in some of the literature, and is an additional feature to a knowledge ecology that embraces disciplines’ hegemony of verifiers of knowledge while suggesting that they operate in different categories of knowledge within one multi-layered knowledge ecology as one integrated gnoseology.

A clarification of the conceptualisation of the concept of TD and of disciplines

At the core of this TD concept is the idea of ‘concept’ itself. This is central to the arguments in this article, which uses the term conceptualisation of TD as ‘making us aware of new variations and unknown resonances’ (Deleuze & Guattari, 1992, p. 28). Further, concepts are ‘connected to problems without which they would have no meaning and which can themselves only be isolated or understood as their solution emerges’ (Deleuze & Guattari, 1992, p. 16). Furthermore, ‘The relativity and absoluteness of the concept are like its pedagogy and its ontology, its creation and its self-positing, its ideality and its reality—the concept is real without being actual, ideal without being abstract’ (Deleuze & Guattari, 1992, p. 22). TD is different conceptually from that of ID, which remains representational, albeit relational. This requires a conceptualisation of TD where knowledge and reality should be considered ‘as part of the same emerging complex system which is never fully ‘present’ in any (discrete) moment in time’ (Osberg *et al.*, 2008, p. 213).

Turning to disciplines, there are many histories of what disciplines are and how they have developed in the university (Vellodi, 2019), Vellodi’s chapter entitled ‘Diagrammatic Transdisciplinary’ summarises discipline growth in a chapter which develops an argument for thought outside discipline. Moreover, Vellodi attributes Deleuze and Guattari with the conceptualisation of TD into thought which is ‘irreducible to disciplines and not dependent upon its framework’ (Vellodi, 2019, p. 113) but it is the thinking of the not thought within the discipline. This article adopts a conceptualisation that mirrors the observations made by Foucault on disciplines and the orthodoxy they perpetuate.

The inherent powers of disciplinary discourse prohibit radical changes as might be experienced in TD and hastens change in ID. As Foucault (1972, p. 224) stated, ‘Disciplines constitute a system of control in the production of

discourse, fixing its limits through the action of an identity taking the form of a permanent reactivation of the rules'. They do this, according to Foucault, in opposing TD knowledge as not being not '*dans le vrai*' (Foucault, 1972, p. 224) of disciplinary hierarchies but being a different concept.

For clarity, this article uses the conventional meaning of ontology (theory of the nature of being), epistemology (theory of the nature of knowledge) and gnoseology (philosophical study of knowledge).

What conceptually are we talking about?

The initial task then, is to understand what, for TD, the concept of knowledge might be, its distinctiveness from ID and how both constitute different forms of the categories in a knowledge ecology. This is not a new task: Piaget pointed toward the relationship between ID and TD in the seminal International Conference on Interdisciplinary Research and Education hosted by the Organisation of Economic Cooperation and Development (OECD) in 1970, where he wrote:

we hope to see succeeding to the stage of interdisciplinary relations a superior stage, which should be 'transdisciplinary', i.e., which will not be limited to recognize the interactions and/or reciprocities between the specialized researches, but which will locate these links inside a total system without stable boundaries between the disciplines (Piaget, 1972, p. 135).

Together, both (ID and TD) provide a more pragmatic, democratic, participative and applied way of thinking that brings political, social and economic actors, as well as ordinary citizens, into the research process from a problem-solving perspective.

ID and TD reflect how people create knowledges by their engagement in their everyday lives and contribute to the construction of solutions of social problems, yet whilst TD is conceived as thinking without disciplinary boundaries excepted in the codified form of disciplinary knowledge of institutions and its, 'system of control in the production of discourse' (Foucault, 1972, p. 224). This disciplinary and potentially limiting enframement seeks to increase knowledge through adherence to the powerful forces that determine disciplinary knowledge and limit the scope of inquiry. The interweaving of disciplinary perspectives and methodologies in ID does encourage an epistemological restructuring of knowledge but the interacting disciplines retain their independence and so fail to achieve a comparative novelty which might be found through bringing together disciplines and problems as a systematic, and complex, whole. The aggregativity of ID might provide methodical sources to explore a problem and may, as developed below, create conditions for weak emergence. This is a distinction that is not made clearly in the literature

and has significant structural issues for the university, due in part to the irreducibilities of disciplinary discourses and the tension this creates within the vortex of complex systems.

If the notion of ID is considered as either aggregative or weak emergence, participants join in the knowledge they are going to work together: structures are delineated, roles are defined, common goals established and working practices discussed. As the work progresses, tensions in disciplinary and knowledge hierarchies are tested, new forms of the exciting process of communication and engagement are developed and individuals take on the shape of the project, but the outcomes are modally the same as the input model of knowledge. The project comes together and goes to be reconvened in a new place and time. There may be some transformation but the identities of the participants are not developed or changed. In this case there is a supervenience relation (List & Pettit, 2011, pp. 64–72) that should be understood as follows: properties at one level of explanation supervene on properties at a lower level of explanation when they are entirely determined by those lower level properties; that is, it is necessarily the case that if the lower level properties were to be replicated exactly, the higher-level properties would be replicated as well. So, we get a solution that is clear of the lower level and not transformative: for example, the rearrangement of a group of pixels to make meaning images which are no more than pixels differently arranged through external forces but remain pixels.

ID remains grounded in this disciplinary discourse which is not inconsequential but at best it is weak TD. This, Max-Neef (2005, p. 10) found praise for, but concluded that ‘Although, perhaps practical, it is insufficient’. This insufficiency if unresolved is problematic, for not to recognise an ontological difference, and justify it, retards the benefits, in practice, of both ID and TD. Not to seek this ontological difference means that we talk of them as part of the same categorisation within the knowledge ecology in the same knowledge species and often in equivocal terms. Many definitions separate mono-, multi-, inter- and trans-disciplinarity but this is done along a gnoseology continuum and allows distinctiveness, especially between ID and TD, to be blurred.

This is blurring to the lack of clarity of meaning, as Klein *et al.* (2022, p. 1) argued, ‘that neither the academic nor the policy literatures develop cohesive understandings about the nature of these research practices or even agree upon how to define ID and TD’. This issue is simplified by Max-Neef (2005, p. 5), when he speaks to ID in that it ‘can be applied following traditional methods and logic, and is essentially practical’ whereas TD ‘represents epistemological challenges that introduces a kind of quantum logic as a substitute for linear logic and breaks with the assumption of a single reality’. The first situates ID in a disciplinary framework (or species) in the genus of

knowledge whereas the second indicates moving beyond the categorisation of disciplines at one level and using them as a base for the emergence of transdisciplinary knowledge, which is interwoven with the context at a different level. Barnett highlights the issue differently, but with the same intent, when he says, '*Transdisciplinarity is in the world, whereas — at most — interdisciplinarity is a spectator on the world (while in multidisciplinary, the world as such may be present not at all)*' (Barnett, 2022, p. 662, [italics in original]).

Complexity theories and emergence

In complexity theory, society can be thought of as a dynamic, open, complex, adaptive system wherein agency and structure combine and wherein a system has to be addressed holistically rather than as the sum of its parts. Moreover, Mason (2008, p. 38) proposed that 'it is in the dynamic interactions and adaptive orientation of a system that new phenomena, new properties and behaviours emerge, that new patterns are developed and old ones change'. Further, Morrison (2005, p. 315) has argued that:

in complexity theory, agency and structure, externality (objectivity) and subjectivity inform each other and co-evolve; the individual shapes the environment (however defined) and vice versa.

And, that it is

through feedback, recursion, perturbation, auto-catalysis, connectedness, interdependence and self-organization, differentiated, new forms of society, behaviour, systems and organizations arise from lower levels of complexity and existing structures, which are not reducible to these.

These systems have their own holistic ecology, and one of the most important insights of complexity theory (and the one this article concentrates upon) is this notion of emergence. In general, the conditions for emergence are dependent upon it being relational and resulting from something else, that emergent properties are characterised by their novelty, and usually have a coherence within the world (Humphreys, 2016).

If the components of a complex knowledge system (poetics, metaphors and analogies, of folk knowledges and of the spiritual, mystical) are within, presenting problems rather than outside, then static methodological interventions risk failing to reveal the actual issue to be resolved. It is knowledge derived from, and using, the complexity of the open social system that supports it. Osberg *et al.* (2008, p. 22) defined such open systems as those 'that interact with their environment and that have interconnections which extend not only internally and between systems, but also across different hierarchical levels, complex behaviour is not so easily reduced to a system of rules'. Complexity ruptures simple cause-and-effect and linear predictability, and a reductionist approach to understanding phenomena. Complexity embraces

non-linear and holistic approaches that are central to transdisciplinary knowledge, which is proposed to be integrated within the system from which it emerges complex. In this sense, the noun transdisciplinarity is a metaphorical tool (Fletcher, 2021, p. 874).

Given the many forms of emergence Bedau (2008) and Chalmers (2006) classified the forms into those that might be considered weak emergence and those that might be considered strong. This frame will be used in relation to ID and TD, suggesting that ID is a form of weak emergence and TD of strong.

The rationale relies on weak emergence's upward causation from a lower level of reality, which has different kinds of things with different properties to higher levels but are not transformed in the process of emergence between one level and the higher. For example, birds are not transformed ontologically when they flock in flight, nor cars in traffic congestion. For strong emergence the higher-level emergent property is not causally reducible to the lower level but autonomous of it, and the higher level ontological changed property does affect downward causation on the lower level. A more detailed definition of strong emergence is one borrowed from Sarternaer (2015, p. 33) in that it is the 'relation between an emergent and its emergence basis such that (a) the emergent is ontologically determined by its emergence basis, and (b) it is not possible to trace the determinative chain that goes from the emergence basis to the emergent (or, put differently, it is not possible to provide a complete and adequate account of the successive relations of determination that lead—or have led—from the emergence basis to the emergent'. What this might mean for disciplinary knowledge, discipline-derived rationales for knowledge and discipline-based epistemic practices may, in some important ways, be insufficient and undeveloped unless they are conceived as constitutively part of the problem in a particular and changing complex system. They may be perceived as causal in the integration of knowledge rather than constitutive of the emergence of new knowledge entity and overcomes disciplinary autonomy in the emergent properties from more complex understandings of an integrated and ontological different whole.

This new knowledge ecology embraces emergent forms of knowledge at a different level whilst also incorporating disciplinary generated forms at lower levels but is liberated from the constraints and rules of a Foucauldian interpretation of disciplinarity. It is the different levels necessary to the understanding of the emergent object that allows for different rules to pertain at the higher levels, resulting in a phenomenon of woven systems of levels of reality and, importantly, for the higher level to causally change the lower levels.

This chimes with Latour. For him, the meaning of public engagement is not an afterthought added once research has been completed but ‘toward which basic research is directed’ (Latour, 2016, p. 10) and in the mode of performance he advocates ‘the development of transdisciplinary skills that provide players and audience with a sensitivity for situations where there was none before’. In this context, a term such as emergent knowledge is more helpful for TD, for it distances TD anchored from a continuum of disciplinary knowledge. Moreover, it suggests that TD is an ontologically different form of knowledge where the emergent features for the system are ‘real features of the world and their status as emergent does not depend either on the state of knowledge of cognitive agents or on the degree of sophistication of the representational apparatus employed by such agents’ (Humphreys, 2016, p. 56). This also creates independence from any epistemological limitations.

In context

An example might help as to how people behave in different settings. Individual students’ identities help shape the way they engage with the institution and learn, but in the classroom they may take on a more collective identity in groups (Hager & Beckett, 2022). Difference emerges when assessment is set up not at the individual but at the group level. The student participants are different as team members than they are as individuals (or at least those who embrace the change). A new relationship is formed, both positive and negative, which, while the assessment is in place, changes the nature of all or some of the players. So, teaching has to change, for to teach individuals within a team is different from teaching *as* a team. This is a form of weak emergence as the student individual behaviour is different in a group assessment but is not transformative in the sense of the permanent changes in the student’s identity and world view in the way that a one-year job placement might be.

Strong emergence requires engagements with a nexus of realities and creates the conditions where new modes and forms of knowledge emerge into our understanding and where gnoseology relationality dominates, offering an extension to the specific forms of knowledge and power favouring certain paradigms of causality within discourses of disciplines. As this process appears in, and defines, places such as higher educational institutions and especially where generative knowledge creation dominates in the form of disciplinary environments, it creates tensions in these institutions. The new forms of understanding find spaces for discourse that are existential, sensory and relationally otherness. Here ideas can find expression, concepts formed and views and visions explored that are not mediated by those powerful

disciplinary gatekeepers that control the structuring of knowledge within methodological and epistemological closed systems. This understanding, as Steelman *et al.* (2019, p. 783) stated, 'would mean accommodating the knowledge system within which the knowledge is created to allow it to be expressed without fragmentation'. These knowledge systems (indigenous knowledges and, more generally, spirituality, culture, revelation, intuition, custom, relationships, emotions and faith) may collide yet the relational nature of knowledge that they contain, through emergence, fuses into the unity of being. This collision is of complex realities and leads to 'emergent knowledge' (which has an unpredictable outcome that Barrett (2017) called its 'transrational knowledge') in order to include different levels of reality through visions, sensation, myths and dreams. It is in the clarity of difference that the concept of TD knowledge can open the places of these institutions to spaces that transcend disciplinary boundaries within a multi-reality, complex world.

In this transformative emergence, the identities of the participants are intentionally suspended. Knowledge hierarchies are dismantled and trust in what might emerge is enhanced. Expectation of the form of the outcomes are open and are developed in research creativity; the being of participants is uninhibited by place and their endeavours are shared in space created by the members. Participants' knowledges are shared in collective collaboration without compromise or forced dilution of the beliefs. In doing so, the different realities and levels of realities create a complex nexus of world views from which can emerge creative understanding of that complexity in the openness of the collaborative present. This moves the emergent from an interplay to an emergent property. Barnett (2022a, p. 213) has suggested the same thing when he advocated transdisciplinarity within the higher education curriculum as part of a knowledge ecosystem.

Such existential freedoms allow knowledges to emerge potential to solve a problem in unthought and unplanned methodologically ways; creatively, imaginatively and within a concept of wholeness. Such knowledge insights are not predictable but offer difference in the problem-solving event. It is a process not of pushing an outcome but awaiting one based on the integration of being in transit or embracing the complexity of the group in relation to the problem to be addressed. It is important to emphasise that emergence is where the whole, including the new knowledge, is greater than the sum of its parts. This recognises the merging of the subject, object and ways of knowing as justification for acting.

The emergence of TD in the university

The complexity of the higher education environment as an open system has increased over the recent past. Shifts in the role, purpose and impact of

universities has seen them either pushed, or jumping into, a new model of effectiveness, manifest in a swing away from public good to private good under a neo-liberal credo. For most, they are now recognising and actively embracing a more explicit economic role in the creation and transfer of knowledge. This initially created tensions in those institutions that may have seen their mission to be the pursuit of knowledge for its own sake, yet that are now recognising and actively embracing a more explicit economic role in the creation and transfer of knowledge. As Latour (2016, p. 9) claimed, 'Universities no longer offer a preview of what will become future common sense, but rather isolated archipelagos in a sea of discontents.

In so doing they set up a discourse of exclusion that makes the development and dissemination, especially of TD as a concept presented here, from gaining currency. Moreover, and as will be discussed next, the forms and modes of disciplines do not recognise the modes and form of emergent knowledge. This alienation forms both the spaces, intellectual and physical, in which its laboratories and its journals prevent real change and the different to flourish.

This exclusion from the spaces within the institution has recently been evidenced in two recent books attempting to understand the institutionalisation of transdisciplinarity and interdisciplinary: *Institutionalizing Interdisciplinarity and Transdisciplinarity* (Baptista & Klein, 2022) and *Interdisciplinary and Transdisciplinary Failures* (Fam & O'Rourke, 2021). Both provide excellent case studies and narratives from across the world but discuss aspects of both ID and TD in forms of methodology grounded in a concept of disciplinarity and with neither indexing a reference to emergence. Indeed, Baptista and Klein (2022), in their conclusion, continue using two embracing terms for both ID and TD: cross-disciplinary and cross-sector, ensuring that they are categorised within the same genus and have met the same criteria of a form of epistemology and causality. This is counter to the distinction made in this article and made by Max-Neef, which facilitates an onto-epidemiologic shift from reductive logic toward views of reality in the complexity of intermingling of meaningful knowledge ecologies.

Furthermore, Ross and Mitchell (2018, p. 50) argued that the axiological, ontological and epistemological axioms of strong transdisciplinarity should be transformative in 'which the entirety of the meaning systems of our paradigms and worldviews are stretched'. This is a claim hard to make for ID. Closing their very interesting paper on the issues of situated TD in a Latin American university, Riveros *et al.* (2022, p. 1020) stated that '[U]nderstanding the processes of integration into university policy of a new knowledge regime such as TD contributes to the discussion on institutionalization and the future of public higher education'.

This begins to build a strong argument against the reality of a learning institution identified as dependent on one or many different yet separate forms of knowledge. It does not deny that one form may be dominant nor does it not deny the existence of the other forms of knowledge and their relation to understanding and agency. Certainly, Masschelein argued that a reconfiguring of the place of the university can facilitate the way of being a student and scholar but this requires a change in the ideology of the university from student focus to scholarly focus. Moreover, it moves toward a feasible explanation of why the constricts of the university resist TD and encourage ID, which is created and located in the same species of disciplinary knowledge, whereas TD threatens the boundaries of the place. TD is disruptive in the struggle for intellectual space within the horizons of the university, which are fixed by disciplinary powers, economics, managerial control. Not to understand this is to adopt a cross-disciplinary approach that recognises the compromise of knowledges through an epistemic colonisation rather than the emergence of new ways of knowing (Gibbs, 2022). This led to the idea that place and its organisational structures express different ways of knowing and forms of knowledge. For example, boundary objects such as furniture take on different meanings dependent on the places that are used to define them. As proposed by Yeoman and Wilson (2019, p. 2019), ‘each arrangement supports the emergence of qualitatively distinct forms of learning activity, and this learning activity is indirectly influenced by the material properties and spatial distribution of these’. Or consider the emergence of grammars: those of the street and those of the academy. As Nowotny (2005, p. 6) suggested, ‘transdisciplinary research needs to follow this path to be able to address the management of complexity in a public space, which is neither state, nor market, neither public, nor private, but all of this in different configurations.

An education open system where emergence can occur

Nicolescu’s *Manifesto of Transdisciplinarity* states that ‘Rigor, opening, and tolerance are the three fundamental characteristics of the transdisciplinary attitude’ (Nicolescu, 2002, p. 119). This has resonance with the Charter of Transdisciplinarity (de Freitas *et al.*, 1994) where rigour is argued as the best defence against possible distortions, and openness involves an acceptance of the unknown, the unexpected and the unforeseeable. Tolerance implies acknowledging the right to ideas and truths opposed to one’s own. This is a central concept for Nicolescu’s *Homo sui transcendentalis*; a concept within which he explores the integration of potential realities, understandings and perceptions. This is transdisciplinarity and it ‘opens an unlimited space of freedom, understanding, tolerance and love’ (Nicolescu, 2002, p. 74).

This contrasts with the attitude perceived in contemporary universities that Rider (2022, p. 35) suggested is 'proprietary, entrepreneurial and autocratic'. Given this article's stance on gnoseology it is clear that an advocacy of a TD university has a place in a diverse higher education sector but not that universities should become TD. This is a place where the space of TD can be nurtured. This maintains the requirement of a hierarchical system where macroscopic and a microscopic description can be offered, which Gignoux *et al.* (2027) argued is a necessity for emergence to occur.

This article advocates the need to consider the wider effect of a TD attitude towards the ethos of universities and the way that might shape them. This is elaborated through a brief discussion of universities as a space for embracing an ethos of TD and considering teaching and learning through a curriculum or currere of TD. Nevertheless, embracing a TD with the intricacy of properties in the complex system of the university will change the whole approach.

The emergent space of the university

Since emergence is an important feature of human life, all knowledge development which is concerned with human beings and their activities in the world might be derived from a transdisciplinary emergent ontology. It is certainly not the intention to assert that causal powers are in direct competition with empirical science and its claims of truth and knowledge known through experience. However, TD is distinguished from disciplinary knowledges in the complex and hierarchical system of higher education. Taking such a position creates issues for the structure pillar of universities and challenges such things as peer review, specialisation, scientific consensus, funding agencies and guardianship of journals. These are set or 'starved' on continuity and not in the risk-taking of TD knowledge. This idea settles transdisciplinarity as an exploration of ontology rather than a distinctive epistemological empirical method as is ID. TD offers an alternative to disciplines' hegemony of verifiers of knowledge.

Ethos

Those institutions that want to embrace TD need a TD organisational ethos, a lack of which contributes to the failures of institutions already mentioned. Merton, in *Science and Technology in a Democratic Order* presented the basic principles upon which an ethos of TD can be claimed (Merton, 1942). This ethos is comprised of a set of four institutional imperatives: universalism, communism, disinterestedness and organised scepticism. To talk of TD in the sense offered by Merton warrants a form of university where autonomy for

the institution and its stakeholders to seek truth can be assumed, but it requires considerable moral courage as well as creativity for it will change the hegemonies within the university, directly affect its positioning in society and with political policy and, in so doing, radically change the power structures that pervade contemporary institutions. As Lyall (2022, p. 23) observed, transdisciplinary research is ‘effectively discouraged by prevailing institutional structure’ in the United Kingdom. This insufficiency may lead to uncritical approaches to research communication, or by an outside demand requiring conventional research communication format in the same way Eikeland *et al.* (2022) talk of action research.

Such an institutional ethos would directly affect the institution’s attention to its students and its wider community as a moral agent, not just as a provider of knowledge and skills to benefit society. It would lead to more heads of institutions embracing the TD attitude and focusing not on the barriers to engagement with others to retain their competitive positions but in-depth and authentic collaborations. Its impact on curriculum and assessment would bring into context the societal and political goods needed for communities to flourish and stop the deceptions encouraged by the need to compete, not for solutions to problems but for financial rewards. It would help students to become more critical of the world in which they live, and encourage them to act. Research would be more focused on the ‘good’ needed for all in societies, approach altruistically major issues facing humanity with focus and a credo of social justice. In many cases, such action may be evident in universities and where it occurs this is clearly positive but, with the drift in universities from public to private concerns, this is far from universal. Rather, the subject-object fusion is not merely the alteration of the organism but the fusion of pan-experiential reality. We thus do not simply observe realities, we become one within the emotive, purposive, creative realities operating around and through us: ‘Thus, as disclosed in the fundamental essence of our experience, the togetherness of things involves some doctrine of mutual immanence ... We are in the world and the world is in us’ (Whitehead, 1968, p. 62). Indeed, what we take as radical creativity are the emergent properties of the complex systems.

Currere

The following preliminary idea of how such a curriculum might proceed framed as a *transdisciplinary currere* is not to be found in separating out the preparation of professional candidature from the context of the working environment of that profession (the assumption is that graduate employment may be termed higher-level engagement in society and may be considered as professional endeavour). The preparation has to be flexible in

duration, location and practice. It needs assessment by achievement and by all those whose judgement on the professional candidate's practice is required for admittance to a particular community of practice. It requires the deconstruction of the role of the institution of higher education as a sole provider of higher conceptual learning and of the corporation as self-servicing, profit-optimising entity. It is in this sense that it is important to explore knowledge that is transformative and translational, as well as transdisciplinary.

Art as an expression of the complex nexus of forces that create complex systems has representation in forms of art and in the creation of art. Ombler and Sarah (2018, p. 179) suggested how art may function as a facilitator of the transdisciplinary imagination and argued that it has the capacity to articulate complex social issues and processes: art can help provoke self-reflexivity about our own practices and worldviews. It can provoke reflection on the hidden relationships between individual lives and the bigger picture (including economic processes, capital, social position, power, ethnicity, gender, life chances, and good health).

The inclusion of art and art making as a joint expression of a struggle to find a praxis for TD in the face of complex problems and for it to act as the frame for action has much to recommend itself in the development of a TD currere. Many examples can be found in the literature but Midgelow's (2017, p. 122) embracing of improvisation in dance is one striking example.

I propose that improvisation as emerging from dance practice has the potential to foster learners who exhibit characteristics that are key to the knowledge economy: deep conceptual and applied understanding, self-awareness and an ability to 'listen', collaborative know-how and flexibility, within frameworks of embodiment, responsibility, play and criticality.

When potentialities are actualised by the positive emergent powers of the TD, individuals can flourish. These actualise and manifest themselves in multi-forms, shaping the patterning of ways of becoming, and are implicitly linked to an educative appreciation of the attitude towards the transcendentals shaping identity. This attitude may well seem from other people's world view to be inconsistent, yet still careful of others, for it is not intended to mirror the reality of other people's worlds but to be an expression of one's personal stance within the wholeness of the cosmos.

The exploration of the ways these causal powers bring humanity into becoming beings provides the potential for humanity to understand life's project and, through will and freedom, achieve it. This requires a blending of knowledges and realities in order that the power of reflection and deliberation can impact in agency. This process is captured by Nicolescu (2005,

p. 202) when he argued that change does not create a new person but a person reborn.

Exploration of humanity provides the potential for understanding and to seek it. It is not unencumbered: it requires a blending of knowledge, realities and the unpredictability of the causal powers in complex systems. Recognising the sameness and the personal identity of students, and building time into curriculum for both, is suggested here as a way to open the potentiality of personal encounter being to the world and act authentically on what is apprehended.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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