Transdisciplinarity

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Definition

The term transdisciplinarity has been complementing the landscape of research approaches since the 1970s. It joins a steadily growing list of terms that refer to the concept of discipline – such as multidisciplinarity, pluridisciplinarity, cross-disciplinarity, interdisciplinarity, supra-disciplinarity, antidisciplinarity, meta-disciplinarity, and post-disciplinarity. Discipline refers to a field of research defined by content and institutions (Hacking 2010). It derives from the Old Latin *disciplina*, where it means "instruction, tuition, teaching", and in a metonymic sense also "learning, knowledge, science, discipline" (Lewis and Short 2020). The term discipline, however, has another, metaphorical meaning that goes back to Christian origins. It means to educate, to discipline, and to punish. A *discipulus*, a *discipula*, is a disciple, a pupil. And an undisciplined person is considered one who does not fit into existing orders and follow established rules. This context of meaning occupies an important position in the discussion of social orders (Foucault 1970; Horkheimer and Adorno 1972). It is of particular importance for the topic of transdisciplinary higher education, especially since the research areas designated by the concept of discipline are followed by educational organizations. They serve the diffusion and reproduction of disciplinary organized expertise in social orders (Nowotny 1999). The prefix *trans* is also taken from Latin, where, in connection with verbs of movement, it refers to going "beyond", and, in connection with verbs of rest, it means lying "beyond" or "on the farther side of" (Lewis and Short 2020, 1097).

Etymologically, the term transdisciplinarity can thus be read in two ways: (1) as a positioning term, denoting lying across or beyond the disciplines; (2) as a movement term, describing a movement out of the discipline. These different etymological readings of the term are reflected in the various discourse streams on transdisciplinarity. Transdisciplinary research is conceptualized as complementary, existing alongside disciplinary, multidisciplinary, and interdisciplinary forms of research and as one that not only refers back to to the basic building block of modern scientific organization, but does so to change disciplines or – even more

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comprehensively – the disciplining of science. Verbs such as transcend, transgress, and transform are used to characterize transdisciplinarity (Klein 2014). What they have in common is that they all carry an element of movement, although different paths and goals are addressed. With regard to transdisciplinarity in higher education, this etymological distinction is relevant in several respects. It raises questions of how educational organizations must be situated and structured within existing knowledge orders to be transdisciplinary and how disciplinary knowledge bases and research practices matter in teaching and learning transdisciplinarily.

Background

Taking the concept of discipline as the starting point for the discussion on transdisciplinarity ties in with numerous works from philosophy and science studies (Bernstein 2015; Osborne 2015). However, these were not the fields in which the term was first used, but in the context of an OECD conference that addressed issues of education and innovation (Apostel et al. 1972). The emergence of terms, however, is not a singular moment; rather, it reflects conditions that enable certain forms of thought and practices to appear. By 1970, an intense examination of the claims, practices, and organizational forms of science had taken place for a long time. And precursors can be identified in both theorizing and research practice that are written in one way or another in transdisciplinary terms (Osborne 2015; Streck et al., forthcoming). Conceptual elaborations of transdisciplinarity, however, have been a long time coming. In what follows, we elaborate on main discourse streams that shaped the conceptual evolvement of transdisciplinarity.

Mittelstraß (1987) first framed transdisciplinarity as a principle of research in the late 1980s. It was intended to serve the overcoming of cognitive boundaries through constrictions in the organizational system of science, to become effective where subject or disciplinary perspectives are too narrow to solve problems. Transdisciplinarity is grounded in the critique of the internal organization of science and research, but remains oriented to the idea of occidental reason and scientific rationality. In stark contrast, a Charter of Transdisciplinarity was adopted in 1994, which is grounded in open rationality and based on a dialogue of epistemic cultures between sciences, philosophies, arts, literature, poetry, and religions (Nicolescu 2002). What is considered transdisciplinary is "the semantic and practical unification of the meanings that *traverse* and *lie beyond* different disciplines" (Nicolescu 2002, 149) and based on in a specific vision, attitude, ethics, and open mindedness. The inclusive logic that underlies this discourse shakes central axioms of modern science and is oriented toward their transformation.

In the 1990s, the concept of transdisciplinarity is positioned in the formulation of a Mode 2 knowledge production. Michael Gibbons and colleagues (1994) dis-

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tinguish between a classical, occidental complex of ideas, methods, values, and norms, referred to as Mode 1, which emerged from the search for universally valid explanatory principles, and Mode 2, which is produced in the context of concrete application. Transdisciplinarity is understood as research that is "grounded in a shared axiomatics and permeation of different disciplinary methods of knowledge" and oriented towards the production of socially robust knowledge (Nowotny 1999, 106, own translation). Mode 2 is seen as a response to downsides of Mode 1 knowledge production – the concealment of historical contingency, strategic essentializations through posits such as objectivity, universality, and purity of method, the appropriation of the concept of research for a social institution (Gibbons et al. 1994) and the associated reinforcement of the "sense[s] of superiority of the Western world" (Nowotny 1999, 77, own translation). The authors thus bring into the field those critiques of the constitution of occidental-modern science that have been developed, among others, in post- and decolonial studies as well as in feminist and gender studies.

The relationship of science to other areas of society is at the center of a discourse that is currently unfolding, predominantly in sustainability-related research fields. In the face of highly complex and pressing problems, the question of how to do research becomes a question of sustainability in itself. Transdisciplinarity is conceptualized as society-oriented research that complements the spectrum of research forms. It is realized in cooperation between scientists and practitioners. Transdisciplinary research should bridge the growing gap between science and the public, promote social learning and negotiation processes, consider scientific and life-world problems as well as abstract and case-specific knowledge in participatory processes, and make knowledge efficiently accessible for decision-making (Hirsch Hadorn et al. 2008; Scholz 2011). This is framed in the so-called ISOE model of the transdisciplinary research process, elaborated by the Institute for Social-Ecological Research (ISOE) (Jahn et al. 2012). It describes the integration of life-world and science-centered approaches to problems. Methodological approaches to this are introduced in Bergmann et al. (2012) and principles and practices by Lang et al. (2012). Transdisciplinarity is understood as a reflexive, integrative principle oriented towards scientific methods, in which a clear science-centeredness is brought to bear.

The search for adequate answers to change, acceleration, spread, and aggravation of problems proves to be a shared motif in the development of transdisciplinarity. While diagnoses of its justification are similar, very different therapeutic proposals can be identified. On the one hand, one opts for flexibilization and expansion of the internal organization of science and research, while holding on to scientific rationality. Here, transdisciplinarity is about overcoming the drawing of boundaries *within* an institutionalized body of scientific knowledge. On the other hand, science's claim to legitimacy as the highest knowledge sys-

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tem is fundamentally questioned and an expansion of participants in knowledge production and related decision-making processes is demanded. In consequence, boundaries of the scientific system itself are tackled. In research approaches at the science–society interface we can observe two fundamentally different ways of dealing with epistemic-political questions regarding the value and legitimization of different knowledges: An additive understanding of transdisciplinarity is that scientific knowledge production is embedded in larger social research constellations, but scientific rationality remains unaffected. An entangled understanding of transdisciplinarity, however, is grounded in an open relationship between epistemic cultures that does not grant primacy to any specific form of knowledge generation, which raises significant epistemological, methodological, and ethical–political questions, and opens up a space between institutions and knowledge cultures (Merçon 2022; Vilsmaier et al. 2017).

However, the increasing fanning out of transdisciplinarity discourses by no means results solely from the disintegration of established orders and problems to be tackled. Technological developments have opened up possibilities for participation in knowledge production that have led to far-reaching social shifts. Forms and actors involved in the production of knowledge have multiplied almost exponentially and mechanisms of justification and legitimation have also changed as a result. The concept of knowledge society and debates on the democratization of knowledge mark these shifts. For the probing of the discourses on transdisciplinarity, the reference to socio-technical transformations is significant insofar as it helps to broaden the view. The complexes of questions that evolve around transdisciplinarity are by no means to be negotiated in purely academic terms. Rather, they represent a task for society as a whole.

Debate and criticism

Since the 2000s, discourses of transdisciplinarity have proliferated across a broad spectrum of research fields. In addition to diversifying in sustainability sciences, the subject has become established in multiple fields, such as technology impact research, urban, regional, agricultural, and landscape research, medical research and epidemiology, architecture and design, gender and justice research, as well as in the arts and at the interface between science and art.

A conceptualization of transdisciplinarity that understands the cooperation of scientists with non-scientific actors as definitionally constitutive became widespread. Schmidt (2021) observes a domination of "instrumental or strategic viewpoints" in discourses of transdisciplinarity and a loss of the critical momentum that has been a "cornerstone" when discourses emerged. However, more recent works increasingly take up the foreshortening and shadowing of essential episte-

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mological, methodological, and ethical–political questions. Work on power relations, social and epistemic control, and social justice in transdisciplinary research processes is helping to illuminate these blind spots (e.g. Fritz and Meinherz 2020; Herberg and Vilsmaier 2020; Kareem et al. 2022). This is also true for conceptual and analytical approaches, such as research on methods (e.g. Defila and Di Giulio 2019; Pereira et al. 2021); quality criteria, impact, and evaluation (e.g. Lux et al. 2019); and the normative dimension of transdisciplinary research (e.g. Popa et al. 2015; Rosendahl et al. 2015).

Working on interfaces to related or neighboring research traditions also dynamizes the discourse. These include (participatory) action research, intervention research, integration and implementation science, science of team science, citizen science, and artistic research, amongst others. Critical engagements with the heavily Europeanized concept of transdisciplinarity by researchers from Africa, Asia, Oceania, and Latin America also bring to bear limits to the transferability of more techno-scientistic approaches to transdisciplinary research (e.g. Van Breda and Swilling 2018) and point to the danger that the concept itself could develop hegemonic power by displacing (at least discursively) non-Western research traditions (De Santolo 2018). Culturality, difference, multilingualism – related to regional, epistemic, and institutional origins – as well as work on post- and decoloniality (De Santolo 2018; Merçon 2022) make a contribution in considering sometimes rather abstract and static assignments, positing in a more differentiated way, and unleashing the socio-political and onto-epistemological potential of this form of research.

Interventions from the humanities in those discourses that have developed strongly out of transdisciplinary research practice offer particular potential for this. They strengthen the linkage of the conceptual unfolding of transdisciplinarity back to larger historical discourse contexts (Osborne 2015). That which is inherently transdisciplinary is worked up in the thought of Michel Foucault, Jaques Derrida, Michel Serres, Gilles Deleuze, Felix Guattari, and the educational approach of Paulo Freire (Serna 2016; Vilsmaier et al. 2020), among others. A central criticism is the extensive, theoretical underexposure of the concept of the problem in transdisciplinary research (Meyer 2020). The constitutive grounding of transdisciplinary research in lifeworld problems rests on a drawing of boundaries that the research form purports to overcome. These paradoxes point to the modern legacy of transdisciplinarity. It is the task at hand to clarify them. However, they in no way diminish the importance of testing transdisciplinary forms of research and teaching and of exploring new institutional configurations.

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Current forms of implementation in higher education

The discourse of transdisciplinarity took its origin in calls for reforms of the educational system (Apostel et al. 1972). In this respect, too, the appearance of the term can be located in the context of larger social upheavals. With the 1968 movement, reform pedagogical approaches experienced a strong upswing, and the learner as a person gained importance, as did the experiential and dialogical moment of learning. Since then, learning in formal and informal environments and also as a constitutive component of research has been processed in the transdisciplinarity discourse: as cooperative, mutual, situated, case-based, recursive, circular, and transformative.

With regard to implementations in higher education, individual-, group-, and process-centered approaches can be identified. The focus on the individual as a "transdisciplinary subject" requires not only the education of the intellect, according to Nicolescu (2002), but also of the emotions and the body. Transdisciplinary education – far from being limited to university education – has to be practiced as an attitude. Forming a transdisciplinary orientation requires learning environments that enable engagement with values, norms, beliefs, conceptual skills, and knowledge (Stokols 2014). We find transdisciplinary learning formats in all sorts of thematic fields and methodological approaches, ranging from dialogue centered *Empathetic–Reflective–Dialogical Restorying* in human rights education in South Africa (Jarvis 2018) to methodologically complex integrative formats such as the *Transdisciplinary Case Study Approach* (Scholz and Tietje 2002; Stauffacher et al. 2008), Living Labs (Fam et al. 2018), and the *Intercultural Education Approach* implemented in Mexico (Merçon and Alatorre Frenk 2019). Conceived as student-based research, these can be classified as inquiry-based learning formats (Mieg 2019), sharing the focus on societal problems with problem-based learning and the process-oriented organizational form with project-based learning approaches. They organize team research between students, university teachers, and actors from other sectors and enable students to conduct a transdisciplinary research process and to practice working in heterogeneous groups. However, the implementation of transdisciplinary case studies is dependent on curricular freedom.

This addresses a neuralgic point in the establishment of transdisciplinary forms of higher education. If study programs are highly interdisciplinary and application-oriented, for example in the sustainability sciences, there are greater opportunities and legitimacy for integrating extensive transdisciplinary courses into the curricula. In disciplinarily narrower fields of study, conflicts of objectives with disciplinary bodies of knowledge and teaching of methods can arise. In addition, possibilities for creating transdisciplinary learning spaces between study programs are often limited by administrative–legal hurdles. The question of institutionalizing transdisciplinarity in higher education is primarily framed as a debate on the right timing. Two diametrically opposed positions confront each

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other: While some consider a solid disciplinary education indispensable to qualify for (inter-) and transdisciplinary research, others see the earliest possible point in time as elementary in order to avoid disciplinary constrictions.

There will be no simple answer to the questions raised in this chapter, and, above all, no single answer. However, discussions of these issues will always concern knowledge orders and social regimes, values, and power relations and, ultimately, worldviews and conceptions of human nature. And these must be held in high esteem. Transdisciplinary research, teaching, and learning do not yet enjoy widespread approval. So far, they are marginal phenomena and are often perceived as competition to existing institutional orders and orientations – and an attack on values that have been established over long periods of time in the academic world and the social fabric at large. Efforts to implement transdisciplinarity in higher education, research, and societal transformation are confronted with persistent structures, while at the same time by rapid socio-technical change and its ecological, cultural, political, and economic consequences. Careful introspection of transdisciplinary research, teaching, and learning practices, as well as work on theoretical and methodological consolidations of transdisciplinarity, will help not only to celebrate it as a reinvention, but also to bear consequences – including the institutional, identity, and power shifts it entails. Undoubtedly, this is an intergenerational endeavor that requires one thing above all: epistemic curiosity and a breaking out of a "circle of certainty" (Freire 1996, 21) to critically change what exists and creatively engage with what is to come.

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