Interdisciplinarity

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Definition

Interdisciplinarity is both a programmatic term in higher education policy and a catch-all phrase across disciplines and fields. Hence, it labels many types of beneficial cooperation between forms of expertise, including equality among participants in teamwork. Further read through an etymological lens, the term implies a process conceived as operating *between* (lat. *inter*) and across *disciplines* (lat. *disciplinae*), even in some instances independently of them. Whether the process results in methodological connections between disciplines or even new communities of practice depends on the complexity and purpose of a given activity (Apostel 1972; NASEM 2005). Interdisciplinarity has also been presupposed in the past semantically and conceptually. Disciplines are individual bodies of knowledge, defined within their boundaries. Increased cross-fertilizations, however, have fostered and facilitated greater boundary crossing, ranging from assimilating approaches borrowed from other disciplines to formation of interdisciplinary fields.

Beyond this broad definition, however, a linguistic question arises from inconsistent terminology across domains and a political question marked by diverging research and education policy interests. The range of intentions and outcomes varies by context. Interdisciplinarity can refer to an act of translation between representatives of individual branches of knowledge, a methodical way of acquiring and generating new knowledge, a normative organizational and top-down objective, the answer to a complex question or solution to a complex problem, dialogue about preconditions and possibilities, limits for collaboration between disciplines, implications for teaching and research, and a transitional phase in the emergence of new disciplines or new interdisciplinary strands. Thus, interdisciplinarity can begin with exchanging ideas about complex problems or questions, continue formally integrating methodologies and epistemologies, be applied in exchanges of data, and ultimately even restructure research and teaching.

From a historical standpoint, interdisciplinarity has been predominantly construed as an academic endeavor that combines openness and contextual aware-

ness, while still recognizing disciplinary boundaries. The combination influences willingness and ability to cooperate in collaborative work (Briggs and Michaud 1972, 192).

Background

Regardless of approaches or contexts, the most common motivations for transdisciplinary work are criticism of narrow approaches in single disciplines, rigid and inappropriate institutional structures, and excessive specialization and isolation of individual disciplines. Furthermore, indicating a gap between current needs and traditional classifications (Barthes 1987, 15), interdisciplinarity – similarly to transdisciplinarity – emerges in response to problems and questions too complex to be assigned to any one discipline or to be solved by any single branch of knowledge. Thus, interdisciplinarity is also an outgrowth of realization that traditional disciplinary patterns of thought and practice are inadequate in pressing global issues such as climate change, disease, urbanization, migration, food insecurity, and digital transformation. At the same time, interrogating and challenging established organizational systems of academic research and education fuels demand for transcending disciplinary boundaries and bridging the divide between society and science.

Here too, a historical perspective is illuminating. The term interdisciplinarity is conventionally dated to the 1920s in the context of social-scientific research on problems of the day and in alternative forms of general education and core curricula. During the 1930s and 1940s, the new field of area studies also arose, as well as problem-focused research such as the Manhattan Project to create an atomic bomb. Discussions around it, though, are much older and have influenced development of modern disciplines since their beginnings (Klein 1993, 19). By the 1960s and early 1970s the word appeared more widely as a level for educational experimentation and new fields such as environmental, urban, and culture-based topics that arose from sociopolitical movements outside the academy. From the 1980s onward, the term became more prevalent in industrialized nations in science-based fields and, concomitantly, philosophy of science and science policy.

Up to this historical point, subject differentiation and organization according to disciplines had been regarded as indispensable, while failure to adhere to disciplinary boundaries was deemed pejoratively as incompetence, "outsiderism", and dilettantism (see Hentig 1971, 866). Like any system, disciplines are decision- and experience-based constructs whose influence, stability, and boundaries result from socialization and institutionalization: power and resources, monopolization of knowledge, path dependencies, and hegemonies shape parameters of research and education. As a result, early interdisciplinary initiatives were regarded as anomalous or marginal. It has become apparent, not just since Foucault's habilita-

tion thesis was rejected at Uppsala University in 1958 because it was deemed irreconcilable with the self-image of history as a discipline (Edelberg 2017, 286; Eribon 1989, 106–9), that disciplines can be used effectively as instruments of power to deny recognition and exclude the participation of alternative practices. Popper's dictum – "We are not students of some subject matter, but students of problems" (1963, 88) – captures the criticism of failure to respond to societal challenges.

Moreover, when interdisciplinarity is associated with innovation, and heightened in funding policies and grant applications, thinking within disciplinary boundaries is rather associated with amateurism, and narrow and decontextualized objectives (see Davis 2007; Nissani 1997; Palang 2003, 56). Nonetheless, the connecting threads across motivations and contexts is the responsibility for questions and problems that rigid disciplinarity cannot address. Interdisciplinarity is thus also a result of continuous accountability renegotiation. From a philosophical standpoint, since the world in its complexity can be apprehended neither encyclopedically nor categorically, interdisciplinarity does not represent overcoming, let alone abolition of disciplines. Rather, it explores their non-linear rhizome-like connections (see Deleuze and Guattari 1976): Individual disciplines remain the dominant structure of organization and classification. Interdisciplinarity is thus not just a program to reform university structures and educational systems, but should also be understood as a learning mode to recognize and deal with justice conflicts, path dependencies, hierarchies, control regimes, and techniques of marginalization.

At the same time, the increased number and size of scientific and professional teams has also resulted in increased awareness of collaborative learning dynamics and research. Moreover, heightened attention is being paid today to the involvement of stakeholders in government, industry, and communities, including the co-production of knowledge in transdisciplinary problem-oriented research. In fact, inter- and transdisciplinarity originate from the same malaise and offer different, complementary though interconnected methods of dealing with it. While interdisciplinarity originally encompassed purely scientific exchange, transdisciplinarity aims at the collaboration of diverse knowledge producers at the interface of science and society, theory and practice. A semantic, conceptual, and historical discernment, though, remains difficult. In contrast to earlier emphasis on epistemology, problem-solving today looms larger in interdisciplinarity discourse. This development is apparent on a global scale.

In the past, literature has been dominated by accounts from Europe and North America and in the English language. However, as examples indicate, boundary-crossing discourses are expanding awareness of inter- and trans-disciplinarity in the Global South. A growing body of reports from science-policy bodies and educational commission documents increased calls for support in both research and education. Gleed and Marchant's (2016) interdisciplinarity survey report includes examples from the Americas, Europe, the Asia-Pacific, the Middle East, and North Africa.

Debate and criticism

It is no surprise that the postulate of interdisciplinarity has spawned a plethora of literature, but a systematic definition of terminology and practices remains elusive. Attempts at systematization are numerous, misunderstandings emerge, and some argue "Babylonian confusion", despite clear patterns of consensus (Klein 2017, 21). In addition, appropriate evaluation criteria need to be used in assessing funding, publications, research performance, and program review. Disappointments are hardly surprising in light of the high expectations associated with interdisciplinarity. They include communication issues, empty phrases, political declarations of intent that dominate "interdisciplinary hype" (Jacobs 2009), and alignment with innovation and commercialization. The overarching concept has been misinterpreted as a panacea (Segal 2009). Some claim that it has supplanted disciplinarity as the primary *raison d'être* of research and education. The paradox of interdisciplinarity, however, refutes the latter claim. Science-policy bodies and educational commissions are increasingly endorsing it. Obstacles persist on all levels.

Key continuing hindrances include jargon and translation problems, discipline-based publication criteria and rigid discipline-based worldviews, concern about lack or loss of hierarchical status, insufficient incentive structures, and inadequate compensation structures accompanied by the need for increased financial support. In addition, cooperation across disciplines requires time to build trust in teams and wiliness to compromise, as well as joint goal setting, power sharing, and equitable work distribution. Sufficient opportunities for profile and career promotion are also needed. Since interdisciplinarity is aligned increasingly with complex and often global problems, long-term change in institutional structures is essential, too (Abbott 2007, 134). Mindful of the many obstacles and disincentives, Gleed and Marchant (2016, 7ff.) call for a robust "architecture" of programs in all countries, facilitated by physical and social spaces including centers, networks, and graduate education and research training. On the other hand, scholars, practitioners, and educators disagree on when students should be exposed to interdisciplinarity. The traditional hierarchy of expertise prioritizes mastery of a specialized body of knowledge first. However, pertinent skills are called for across contexts.

To illustrate, the Education Reimagined's *Partnership for 21st Century Learning* cited four significant competencies that are also aligned with interdisciplinarity: communication, collaboration, critical thinking, and creativity. In comparison, the World Economic Forum's *Future of Jobs Report 2020* (Zahidi et al. 2020) listed critical thinking, creativity, and coordination in problem-solving as among the top-ten skills students need. Spelt et al.'s (2009) systematic review of relevant literature in higher education spans multiple contexts. Some are not exclusive to interdisciplinarity, including disciplinary knowledge, ability to communicate, and critical thinking. Recently, though, there has been increasing interest in understanding

the nature of interdisciplinarity, integration, and collaboration. Other abilities deemed crucial for dealing with complex questions and problems include curiosity and respect for other disciplines, empathy and emotional intelligence, and ethical concerns. Spelt et al. add the pedagogical goal of fostering collaboration in curriculum development and teaching, whereas Borrego and Newswander (2010) include capacity for teamwork, along with grounding in disciplines, integration and broad perspective, interdisciplinary communication, and critical awareness.

Current forms of implementation in higher education

Given the plurality of approaches, forms of implementation differ as well: from student-initiated research and living labs to large-scale inter-institutional programs and projects. They also include new subdisciplines and disciplines as well as integrated fields. Interdisciplinarity in research was initially organized in graduate colleges and project-based clusters of limited duration, but it has become well-established in dedicated units such as Berlin's Einstein Center Digital Future, Stanford University's Bio-X institute, and the Global Institute of Sustainability and Innovation at Arizona State University. Furthermore, it increasingly gained a place in curricula of many universities. In Europe, more study programs with interdisciplinary aspirations have emerged since the introduction of bachelor's degrees. For example, Philosophy, Politics, and Economics, developed at Oxford in 1920, then subsequently adopted in one form or another by several other universities. Attempts to establish the Anglo-American liberal arts tradition in other countries (e.g. since 2012 at University College Freiburg) follow a similar trajectory. All of these examples, however, do not conclusively prove that interdisciplinary aims are always achieved. In many cases, the term is merely a catchphrase. Proactive attention is required.

Universities and colleges need discursive spaces where experiences are shared and exchanged across boundaries, and integration and collaboration are explicitly cultivated in educational and training programs. Otherwise, thought patterns formed by preparation in individual sciences are not overcome, or at most are relativized and reorganized only to a modest degree. As a result, the goal of integrating interdisciplinarity into students' personal and professional identities diminish. Interdisciplinarity is often viewed solely as a phenomenon of application, while theory-building and reflection on epistemological, didactic, and methodological dimensions is short-changed (Philipp 2021, 169). Interdisciplinary learning further requires expansion of university-based counseling and guidance services and exposure to a range of forms and methods (Briggs and Michaud 1972, 228–29).

Two accounts in the authoritative *Oxford Handbook of Interdisciplinarity* furnish deeper understanding of current forms and strategies of implementation. In

reporting on administrative structures, Holley (2017) sketches a typology of interdisciplinary programs organized into categories of students, faculty, curriculum, funding, and institutional location. Curriculum spans institutional- and student-designed programs and activities, theme-based learning communities, capstone or culminating classes within disciplinary majors, topic-based multidisciplinary course sequences, and prescribed coursework in recognized interdisciplinary fields or on emergent topics or interests. Holley concludes that no single model exists: forms may be autonomous, freestanding units or located within an established college or university, including new and renovated buildings that are centers for theme-based research with some educational and training opportunities. Institution-wide prioritizing of interdisciplinarity is rare. Related pedagogies are also implementing interdisciplinary learning.

DeZure (2017) reported that interdisciplinary teaching and learning do not claim any unique set of pedagogies. Following suit, teachers employ an array of instructional methods to support integrative learning outcomes. Dubbing them "productive pedagogies", DeZure aligns them with a broad-based shift from mastery of content to competencies, and the elevated importance of integrative and interdisciplinary learning outcomes. DeZure also reports proliferation of interdisciplinary curricula and programs both in disciplinary departments and beyond them, as well as pedagogies that promote active and discovery-based learning. Illustrating the constructivist philosophy of learning, teachers also engage students in team- and problem-based learning. The more the pedagogy engages students in experiences based in the complexities of the real world, DeZure adds, the more interdisciplinary approaches to problem solving and authentic assessment are advanced. "Inclusive pedagogies" also recognize multiple perspectives, to ensure all voices are heard.

Finally, Vienni Baptista and Klein (2022) illustrate the expanding scope of examples in a wide range of countries, spanning Africa, Europe and the United Kingdom, Russia and the South Caucasus, Latin and North America, Australia, and Japan. The overarching commonality is the need to address complex societal problems, including the global pandemic, climate change, and sociopolitical inequities. However, contexts differ in individual chapters. Political history, for example, was a decisive factor in countries where universities reflect top-down, centralized, and hierarchical relationships from the Soviet system. Mokiy and Lukyanova (2022) report a continuing authoritarian leadership style in Russia, though autonomous nonprofit organizations are advancing the potential for problem-focused interactions with civil society – even though transdisciplinary participation with stakeholders is a new concept in Russia, Armenia, and Georgia. Further south, in Ghana, Akua-Sakyiwah (2022) situates reform efforts against the backdrop of dependence on colonial masters and development partners and the dominance of Western forms of knowledge. Yet material realities differ from the North, including irregular financial support from the government.

Brazil also illustrates the impact of political history and, today, international momentum for solving complex societal issues. Since the 1980s, after 21 years of military dictatorship, reform has occurred against the backdrop of redemocratization. Litre, Lindoso, and Burstyn (2022) characterize several Brazilian universities as avant-garde social spaces. Interdisciplinary initiatives have grown in graduate programs, but they are subject to centralized government regulation of education. Innovative programs are also judged by traditional metrics, regarded as incubators rather than mature initiatives, and stigmatized as too general, shallow, and unevenly institutionalized. The Center for Sustainable Development at the University of Brasilia, though, illustrates potential in a geographical area rich in ecological and social diversity, while located strategically in the country's capital.

Accounting for China, Pearce (2022) cited precedents for interdisciplinarity and transdisciplinarity in the conception of knowledge as an integrated corpus, the common good, and holistic knowledge and education for character development and ability. However, dominance of the Soviet model of higher education between 1949 and 1966 prioritized a socialist agenda for economic development. Between 1966 and 1976, the Cultural Revolution shut down higher education, except for military institutions. In addition, China's state-driven technocratic approach does not foster holistic consideration of complex societal and cultural factors. At the national level, interdisciplinarity is aligned more with solving problems than a general concept.

As these case studies indicate, it is critical to recognize similarities and differences when comparing lessons from different countries and regions. Interdisciplinarity will have to prove itself less as a method and more as a fundamental academic and everyday attitude of graduates, particularly in post-secondary education. It is not the abundance of areas of application, but the ability to reappraise scientific methodology and to provide reflection spaces for interdisciplinarity-induced learning experiences which will determine whether the university remains the most crucial pillar of disciplinary *and* interdisciplinary knowledge structures.

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