Navigating pedagogical dilemmas in interdisciplinary education: a reflective practice perspective

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Abstract

Interdisciplinary education is increasingly recognized as essential in higher education for addressing complex real-world issues. Although this paradigm shift began in the 20th century, challenges in interdisciplinary pedagogy persist, including classroom preparation, delivery, assessment, and feedback. One significant challenge is disciplinary distance, the disparities between disciplines that hinder effective interdisciplinary teaching and learning. Additionally, the varying degrees of disciplinarity—from intradisciplinary to transdisciplinary—complicate this landscape. Despite interdisciplinary pedagogy's potential to enhance critical thinking and problem-solving, it presents numerous dilemmas. As a graduate teaching assistant, I have faced several such dilemmas. This reflection discusses these interdisciplinary dilemmas and explores epistemological and pedagogical practices to navigate them. Leveraging my experience as a PhD researcher and educator, I examine how teachers with multidisciplinary backgrounds can navigate the complexities of interdisciplinary education.

Keywords:

pedagogy, interdisciplinary, dilemma, reflection, education

Background:

Disciplinary dilemmas in education

In universities across the globe, a shift away from mono-disciplinary and towards multi-, cross-, inter-, and transdisciplinary education has been observed. This shift is driven by the belief that addressing complex societal issues requires more than a single disciplinary perspective (Vereijken et al., 2023). In today's professional environment, employees are adept at leveraging interdisciplinary knowledge to tackle challenges and convey their discoveries effectively, thus, schools should prepare students for such environments (Warr & West, 2020). Practical arguments for interdisciplinarity highlight that real-world problems are not confined to academic disciplines and require diverse perspectives (Stember, 1991). However, the specialization and segregation of academic disciplines over time have led to siloed academic structures, making true interdisciplinary studies difficult. To compound the problem, the terms multi-, inter-, cross-, and transdisciplinary are often used interchangeably and without a clear understanding of their distinctions (Hollmén, 2015). Furthermore, there is a lack of clarity surrounding the term interdisciplinary education, with some critics arguing that it has become too vague and that universities' commitment to it is almost meaningless (Wasserstrom, 2006).

Another primary challenge of interdisciplinary education is effectively bridging the gap between disciplines to generate novel insights and understanding (Hollmén, 2015). Additionally, it is crucial to consider the differing signature pedagogies across disciplines. How can we achieve a balance in light of these differences? Hence, this is exacerbated by the challenge of the lack of pedagogical training for university teachers, which can hinder the development of cross-disciplinary teamwork and education (Hollmén, 2015). Despite these challenges, interdisciplinary education is considered a more productive approach to disciplinary studies, as Stember (1991) noted, hence the focus of this critical reflection. However, before engaging in the critical reflection, it is crucial to establish clear definitions for the respective disciplines.

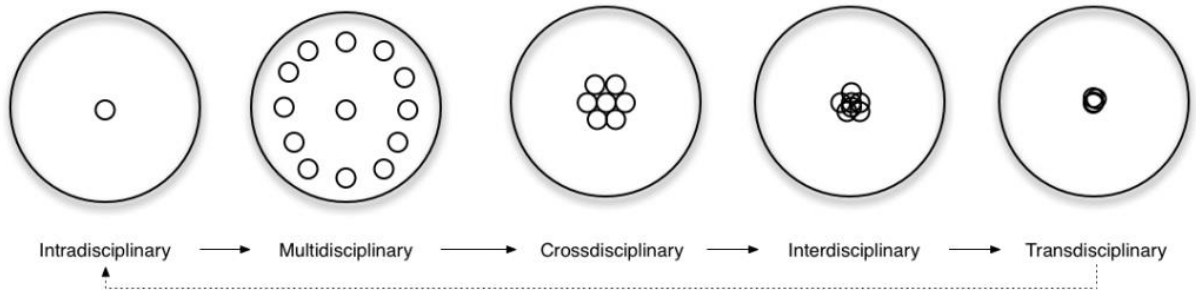
Defining disciplinarities

Disciplines are the basic units in the knowledge structure that have been “historically delineated by departmentalization. Within each discipline, “there are rational, accidental, and arbitrary factors responsible for the peculiar combination of subject matter, techniques of investigation, orienting thought models, principles of analysis, methods of explanation, and aesthetic standards” (Miller, 1982 in Miller, 2020). In this critical reflection, I use the term ‘disciplinarities’ to describe the whole spectrum of multi-, cross-, inter-, and transdisciplinary. The subsequent section delves into typologies of disciplinarities to lay a foundation before the critical reflection, and to clarify the dilemma of using the disciplinary terms carelessly and interchangeably.

A typology of disciplinarities

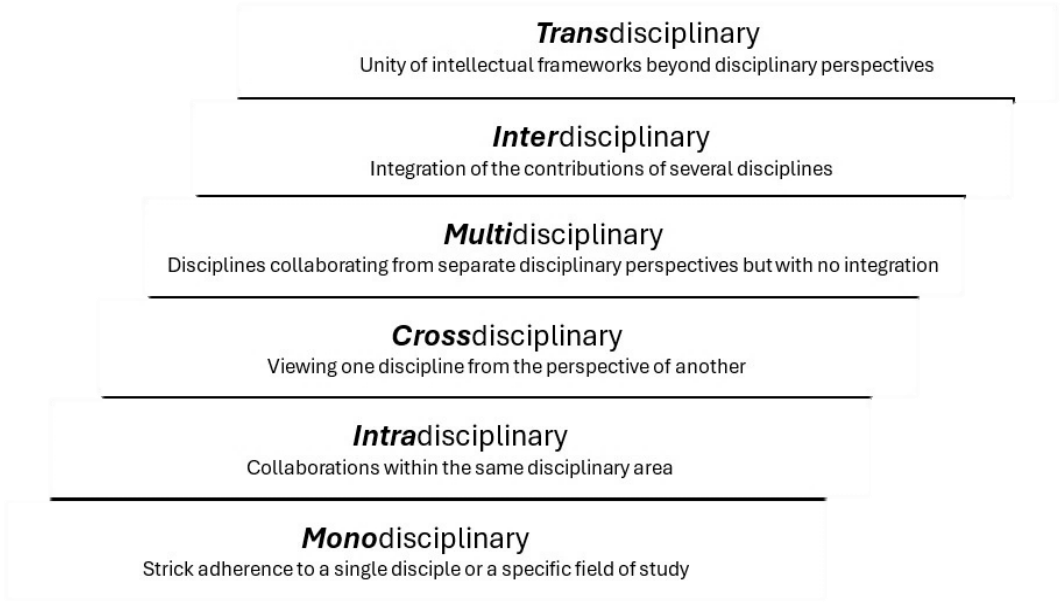
Marilyn Stember's paper from 1991 described a five-step typology for ‘enterprises within and across disciplines’ including intra-, cross-, multi-, inter-, and transdisciplinary. This hierarchical structure runs from intradisciplinary to transdisciplinary, with each step requiring ‘increasing integration and modification of the disciplinary contribution’ (Stember, 1991, p.5), as shown in Figure 1. In her paper, Stember argues that many people believe they work interdisciplinary, while in fact, it is more common to work multidisciplinary.

Figure 1: The interdisciplinary scale (Source: Marilyn Stember, 1991)



Drawing from September 1991, Figure 2 shows an adapted ladder of disciplinarities with the addition of monodisciplinary, which entails strict adherence to one specific discipline. The ladder shows that the higher up you go, the more complex the disciplinarities become.

Figure 2: Ladder of disciplinarities (Source: Author, adapted from Stember, 1991)



Each of these disciplinarities has been expounded in Table 1.

Table 1: Defining disciplinarities (Source: Author)

Disciplinarity	**Explanation and Implications**
Monodisciplinary	This approach involves strict adherence to one specific field of study. It emphasizes using methods, theories, and knowledge from a single discipline to address problems or conduct research (Chen & Luetz, 2020).
Intradisciplinary	This approach also focuses on a single discipline but involves collaboration within that discipline (Stember, 1991). For instance, various branches or areas of expertise within a single field collaborating on a specific research endeavour (Moș, & Crașovan, 2015). https://rse.uvt.ro/pdf/2015/NR1/tot1_2015.8.pdf
Crossdisciplinary	Cross-disciplinary approaches involve looking at one discipline from the perspective of another (Stember, 1991). They entail real interaction across traditional disciplines, involving extensive communication. Therefore, combining, synthesizing, or integrating concepts and/or methods can vary considerably (Miller, 2020).
Multidisciplinary	Multidisciplinary methods juxtapose parts of various disciplines to better understand a common theme or problem (Klaassen, 2018; Miller, 2020; Stember, 1991). However, no systematic effort is made to integrate these disciplines, which maintains the identity and practices of each field (Miller, 2020).
Interdisciplinary	Interdisciplinarity applies the epistemological methods of one discipline within another, leveraging multiple perspectives for comprehensive understanding. Unlike

	multidisciplinarity, it integrates disciplines to address problems single approaches cannot resolve effectively (Miller, 2020). This flexibility enhances collaboration, creativity, and communication skills
Transdisciplinarity	Transdisciplinarity, a meta-level approach to interdisciplinarity; prompts students to tackle real-world problems through various disciplines, revealing new knowledge. Transdisciplinarity extends the scope of mono-, multi-, and interdisciplinary approaches to include broader societal involvement (government, industry, citizens, and civil society) (Vereijken et al., 2023). Characterized by complex stakeholder involvement, transdisciplinarity spans from expert knowledge to that of laypeople (Klaassen, 2018). This lens is essential for educators and students to engage beyond traditional academic boundaries (Miller, 2020; Radakovic et al., 2022).

Personal reflections

As a postgraduate researcher with a different disciplinary background, I struggled to imagine how to effectively deliver an inter/transdisciplinary module. It was a research project module aimed to strengthen students' research skills through a combination of assessed online activities, taught workshops, an assessed reflective journal on the research process, and a mini-group research project. The module was focused on sustainable transport. In my teaching, one of the most challenging dilemmas was to balance the disciplinary perspectives, considering the diversity among students in my classes. However, the diversity of students also meant that there was more to be offered by each one of them. In this vein, collaborative activities among the students worked best to promote peer learning. I could allow them to discuss in pairs, trios, or groups, and those who wish to speak to the class share what they have discussed were allowed to do so. Smaller groups, especially pairs, worked very well to get

everyone engaged in the discussions, as Crisianita and Mandasari (2022) recommend. In doing this, I also tried other strategies to make sure that students were not grouped in the same usual groups as friends. In as much as students who already know each other are freer to have a discussion, I found that varying their groups every time helped them to widen their interactive networks and benefit differently from each other each time. This approach resonates with the agentic dimension of the student-centered education framework by Starkey (2019), which entails giving students a choice, seeing them as resources or experts in their own right.

The interdisciplinary nature of the module meant that students were also from various disciplines ranging from economics, health, education, sociology, and business studies among others. Hence this approach helped them to know each other more as I could observe random introductions among themselves as I was moving around the class. This helped to balance the level of understanding and allow the students to move at the same pace. Nevertheless, the specific methods of delivery largely depended on the content to be delivered for that specific day, hence the need for flexibility. For instance, where students needed to practice using Excel, they had to work independently; where they needed to have critical reflections, students had to be grouped, and they could even have debates to stimulate critical thinking. This also was helpful in line with the Universal Design for Learning (UDL), which primarily focuses on what, why, and how students learn. Similarly, implementation techniques like team-based and inquiry-based learning, along with practical assessment, are also useful as they methods enhance group learning, critical thinking, creativity, collaboration, and communication skills in interdisciplinary education. Nonetheless, like any other education, even with these techniques, there were always some students who dominated discussions all the time while some were consistently silent. This challenge cannot uniquely be attributed to interdisciplinary education, but many factors including different personalities come into play.

Still on teaching and supporting learning, I was challenged in relation to the research-teaching nexus, signature pedagogies and the epistemologies of interdisciplinary education (Hollmén, 2015), and their influence on practice. For

instance, drawing from the research-teaching nexus by Healey (2005), I found that research-oriented teaching, research-based teaching, and research-tutored were more practical in my interdisciplinary teaching than researcher-led teaching. Specifically, for the module I was handling, the goal was to help students learn about the research process so that they could carry out their own research. Hence, students learned through inquiry-based activities because, in one of the summative assessments, they were required to carry out a group research project as researchers under the supervision of PGRs (postgraduate researchers) and staff. This is supported by literature; for instance, Corbacho et al. (2021) and Klaassen (2018) highlight that teaching strategies for interdisciplinary pedagogy include teamwork, problem-based learning (PBL), and activities to foster academic motivation and working with diverse perspectives. Teamwork was found to be a central aspect of interdisciplinary experience, positively influenced by group diversity and the development of a learning community. Often, teamwork activities support knowledge integration while enhancing the development of collaborative and problem-solving skills (Lyall et al., 2015).

Most importantly, interdisciplinary education also concerns assessment and feedback. Assessments, in this case, include both formative and summative. To begin with, formative assessments, as well as screening and initial assessment at the beginning of every lesson before I share learning outcomes, helped to check the student's level of knowledge and assess lower-order thinking skills in the students, like remembering and understanding (Bloom’s Taxonomy). Nevertheless, these assessment methods have a potential downside. They may lead to inaccurate evaluations of knowledge levels for students who are introverted or less outspoken. Referring further to Bloom’s Taxonomy, I also found that providing students with formative assessments allows them to engage in higher-order learning by analysing and applying concepts. Further reference to Bloom’s taxonomy, with the group research, project the students were doing; they were more exposed to higher-order thinking skills beyond applying and analysing to evaluating and creating (Chandio et al., 2021). They successfully conducted research projects in their groups by applying what they learned in class.

Finally, summative assessment and reflective writing worked best as they allow for capturing the individual's experience and a deeper understanding of the value students attributed to the interdisciplinary course since students are free to write on any aspect of the course (Corbacho et al., 2021). Nevertheless, marking reflective writing assessments becomes a challenge because you are not looking at the correct answer, rather the focus is on the uniqueness and quality of each person's reflection, which introduces some subjectivity. Regardless, giving students assessments that require them to practice what they have learned is beneficial for interdisciplinary education. As the literature highlights, extant knowledge about interdisciplinary learning indicates that the learning benefits are greater when students can do interdisciplinary work, not just learn about it (Smith et al., 2024). In this case, students are active agents using a free space, promoting their agency.

Conclusions

To conclude, mono-, multi-, cross-, and interdisciplinary still fall short as solutions to complex challenges; hence some authors have argued that transdisciplinary is desirable (McGregor & Volckmann, 2013). Transdisciplinary pedagogy helps students to learn to codesign, co-disseminate, and cocreate transdisciplinary knowledge, which emerges from the iterative interactions between disciplines and the rest of the world (McGregor & Volckmann, 2013). Nonetheless, the relevance of a discipline highly depends on the problem intended to be addressed. Similarly, Vereijken et al. (2023) argue that multi-, inter-, and transdisciplinary approaches each have their own value for teaching, learning, and science and society; hence, choices should be tailor-made or outcome-oriented. Therefore, having discussed disciplinarity dilemmas, this reflection asks whether effective multi-, cross-, inter-, and transdisciplinary education calls for different epistemological and pedagogical approaches, which could be considered for further studies. Moreover, empirical research on the best practices for assessing interdisciplinary learning outcomes is needed to guide GTAs and institutions in refining their assessment strategies.

Practical implications

The reflections in this piece have significant implications for GTAs and provide important lessons for their practice. Firstly, interdisciplinary education requires shifting from traditional, discipline-specific methods to more adaptable pedagogical strategies to address disciplinary distance, integrate multiple perspectives, enrich the learning experience, and cater to diverse student needs and backgrounds. Hence GTAs should centre their teaching on complex, real-world issues that require knowledge from various disciplines. This makes learning more relevant and engaging. Secondly, GTAs should invest in personal and professional development to enhance their interdisciplinary competencies, focusing on designing and delivering courses that bridge disciplinary gaps, incorporating research-based learning, and implementing suitable signature pedagogies.

Thirdly, assessment practices in interdisciplinary education face unique challenges, requiring formative and summative assessments that emphasize higher-order thinking skills and reflective writing with different grading rubrics. Therefore, GTAs should develop assessment frameworks aligned with interdisciplinary learning goals. Lastly, different disciplinarities suggest a deeper epistemological shift in knowledge framing and teaching, requiring GTAs to reconsider disciplinary boundaries and promote an integrative approach where new knowledge transcends academic silos. Thus, GTAs should introduce students to research methods and tools from various disciplines (such as qualitative analysis and statistical methods) and show how they complement one another. In doing so, GTAs encourage multiple perspectives and **f**acilitate discussions where students can compare disciplinary approaches. Through embracing flexibility, collaboration, and continuous learning, GTAs can better prepare students to tackle complex, real-world problems that transcend traditional academic boundaries.

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