



Editorial

to the special issue: Decoding across disciplines: New developments from all over the world

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Editorial

zum Themenheft Decoding über Grenzen von Disziplinen hinweg: Neue Ent- wicklungen aus aller Welt

1 Decoding the Disciplines

Disciplines are more than collections of specific knowledge; they can be understood as distinct cultures (Prediger, 2001) or tribes (Becher & Trowler, 2001), requiring students to navigate intercultural situations during their academic journey. Students enter universities with socialization rooted in everyday cultures and must adapt to the discipline's culture by building knowledge, developing competencies, and adjusting attitudes and behaviors. Learning in disciplines thus involves cognitive, emotional, and even embodied processes, making it insufficient to merely absorb abstract or canonical knowledge (Rhein, 2013).

The Decoding the Disciplines framework reflects this perspective by focusing on "bottlenecks"-specific obstacles that hinder student understanding (Pace & Middendorf, 2004; Pace, 2017; Middendorf & Shopkow, 2018). These bottlenecks often stem from the implicit knowledge of experts, who may find it difficult to articulate what students struggle with due to the "curse of expertise" (Brown et al., 2014). Through a structured, seven-step process, Decoding the Disciplines helps instructors make their implicit knowledge explicit and create targeted teaching strategies to support students in overcoming bottlenecks (Riegler, 2020). The steps include defining bottlenecks, decoding expertise, modeling tasks, creating active learning opportunities, motivating and lessening resistance, assessing learning progress, and sharing insights (Fig. 1).

- It enables experienced educators to gain new perspectives and innovate teaching methods.
- It fosters disciplinary thinking and supports students' expertise development.
- It facilitates collaborative changes in teaching across courses and disciplines.

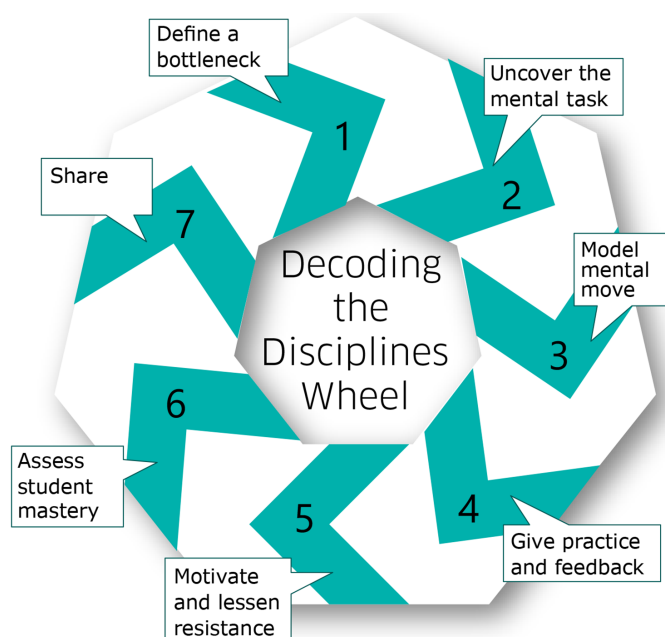


Figure 1: The Decoding the Disciplines Wheel

This framework offers several benefits:

The approach moves away from blame, recognizing that neither students nor instructors are inherently at fault for learning challenges (Kaduk & Lahm, 2018). Instead, it focuses on actionable strategies to bridge gaps between expert knowledge and student understanding. By grounding itself in the lived experiences of instructors and emphasizing the Scholarship of Teaching and Learning, this framework provides a practical, reflective, and collaborative approach to improving education within and across disciplines (Barnat, 2024; Waldherr et al., 2020).

Why would instructors and researchers at any level of education, in formal or informal settings, want to use Decoding? Instead of being overwhelmed with a firehose of ideas, Decoding takes a strategic approach that organizes research on teaching and learning. The framework prioritizes difficulties so that learning can be appropriately scaffolded and assessed to maximize student success. Starting from the bottleneck, one uncovers the mental moves that guide pedagogical choices. Decoding organizes theories and principles of learning and can serve as a solid start for scholarly teaching and for the Scholarship of Teaching and Learning.

Decoding the Disciplines is a promising approach to advance disciplinary university teaching in all its potentials (Chick et al., 2012). Since its conception in the late 1990s, the Decoding the Disciplines paradigm has provided a framework for a broad range of explorations of implicit teaching knowledge and practices. In particular, the Decoding interview process has allowed researchers to make more explicit the ways of operating that underlie work in specific disciplines. On the other hand, the methodology of Decoding also includes the aspect of creating and reviewing a teaching intervention (Shopkow & Middendorf, 2019). Another valuable contribution of the Decoding the Disciplines approach is that it enables research into the educational effects of teaching disciplinary thinking.

Furthermore, it is often not recognized that the paradigm has undergone enormous development since its appearance. The original model has been clarified and perfected, but the scope of this work was also expanded to include emotional, bodily, and social learning; it created new roles for students in these investigations; and it explored learning beyond the individual (Pace, 2021). The framework has been developed even further to use it as a tool for decolonizing disciplinary thinking (Lindstrom et al., 2022). These Disrupting Interviews helped them identify Eurocentric epistemological biases in their teaching practices.

Some of these changes have been so transformative that they may be regarded as a new iteration of the paradigm: Decoding 2.0 (Pace, 2021). This wealth of innovative approaches to utilizing Decod-

ing the Disciplines to help students unlock their potential underscores the need for extended discourse within the field of education. To foster such dialogue, the first international Decoding conference was held in November 2023 in Aachen, Germany. Scholars from all over the world convened to present new bottlenecks, explore novel applications of the Decoding framework, and engage in discussions on Decoding and Disrupting the Disciplines. A selection of the conference papers underwent peer review and has been included in this special issue.

The Decoding community has now solidified and grown: a second international conference was held in 2024 in the United States; a wiki (Decoding the Disciplines, 2025a) was created to collaboratively gather knowledge about Decoding, complementing the website (Jong et al. (n.d.)) and YouTube channel (Decoding the Disciplines, 2025b). Another publication, focusing on scholarly reflections on Decoding the Disciplines, will be released as a special issue of DiNa (BayZiel, 2025) in the beginning of 2025. Furthermore, there is a collaboration with the journal *Transformative Dialogues: Teaching and Learning Journal*, ensuring that an issue dedicated to Decoding the Disciplines will be published annually. Additionally, there is an international Special Interest Group that meets monthly (details can be found in the wiki) and a German working group hosted by BayZiel. Everyone interested in contributing is warmly invited to join us in learning together and further developing the framework.

This special issue of *die hochschullehre* aims to highlight the connections between diverse approaches to Decoding while inspiring a new generation of scholars to further advance the paradigm.

2 The articles

The article by Itow et al. (2025) offers an important contribution to educational research and practice by describing the *Decoding Transitions to College* initiative, which bridges the gap between high school and college education. The initiative's uniqueness lies in its collaborative approach, where college professors and high school teachers work together to identify and address discipline-specific learning bottlenecks that hinder students during the critical transition to higher education. Using a design-based implementation research methodology, the project enabled educators from both levels to engage in structured dialogues and collaboratively identify shared learning challenges. The redesigned teaching and learning scenarios were conceptualized as well as implemented and reflected upon in real classroom settings. The article provides two concrete examples that illustrate the practical applicability of the developed strategies. Additionally, the project's commitment to supporting educators extended beyond the development phase, including dissemination activities such as mini-workshops. The article highlights the added value of collaboration between university instructors and school teachers, thereby illustrating the potential of Decoding the Disciplines as a driver of effective innovations across various expertise-driven systems.

Darcy's (2025) article is part of the *Decoding the Transitions to College Project* initiative described by Itow et al. (2025) and provides a much more detailed account of a specific bottleneck. It makes a significant contribution to educational practice by describing and evaluating an intervention aimed at improving first-year students' ability to interpret graphs—a key bottleneck in their transition to university-level learning. The intervention focused on first-year biology students and employed a graphing checklist developed through Decoding interviews. When implemented in an introductory biology course over two consecutive years, the tool proved highly effective. Beyond its practical impact, the article also highlights the crucial role of metacommunication in fostering student acceptance of and engagement with such interventions. By explicitly addressing students' thought processes and providing structured tools, the study demonstrates how tailored interventions can simultaneously improve competencies and gain acceptance. Importantly, the study illustrates how decoding-based interventions can inform teaching methodologies across disciplines, bridging gaps between secondary and tertiary education and fostering critical competencies for student success. By translating research into actionable teaching strategies, this article exemplifies the transformative potential of educational scholarship.

Cameron and Duffy (2025) also address the question of how students read graphs, albeit from the perspective of various other disciplines. Using the Decoding the Disciplines framework, the authors engaged faculty from three disciplines in decoding interviews, uncovering the mental steps involved in reading graphs. The study highlights that graph reading is an iterative rather than a linear process, challenging common assumptions among faculty that students intuitively understand graphical data without explicit instruction. A notable strength of the paper lies in its interdisciplinary approach, shedding light on both the similarities and differences in how various disciplines—such as chemistry, environmental science, and psychology—approach graph reading. This perspective not only deepens our understanding of the bottleneck but also provides educators with insights into how disciplinary contexts shape students' learning experiences. By carefully documenting how the decoding interviews helped faculty articulate their own expertise, the article demonstrates the broader potential of this methodology to refine teaching practices, address hidden challenges in student learning, and foster collaboration across disciplines. They make a valuable contribution to the field of quantitative literacy by addressing graph reading as a key bottleneck in students' academic development.

Pelmar and Cameron (2025) provide a third and novel perspective on graph reading by integrating two unique dimensions: 1. The involvement of student interviewers, offering a peer-led approach to data collection. 2. The focus on interviewing students themselves, providing insights directly from the learner's perspective. Involving students as both researchers and participants helps create a more accessible and equitable dynamic, reducing the risk of power imbalances and fostering open, authentic dialogue. One of the most striking findings is the misconception held by many students that graph reading is a skill one simply acquires naturally over time, without requiring specific expertise or deliberate effort. This misconception aligns with the observed difficulties students face in mastering graph reading. Experts allocate significantly more time to orient themselves within the graph, underlining the importance of deliberate and systematic engagement with the data. Many participants noted they had never been asked to reflect on their mental processes while reading graphs, highlighting a lack of metacognitive practice that may hinder the development of effective graph-reading strategies. The study also highlights directions for future research, such as exploring the alignment between faculty perceptions and students' actual strategies.

Elliot and Middendorf (2025) provide a valuable contribution to the understanding and application of the Decoding the Disciplines framework by focusing on its use in psychological statistics. It complements other studies in the collection by delving deeper into the structure of graphs and offering a detailed explanation of how pattern recognition functions in the context of graph interpretation. Notably, the article introduces an innovative alternative to the traditional Decoding interview—the Trading Analogies method—broadening the methodological toolkit available to educators. In addition, the article showcases the full cycle of Decoding, from identifying bottlenecks to implementing interventions and evaluating their impact. By emphasizing the advantages of cross-disciplinary collaboration and exploring various applications of Decoding in the Scholarship of Teaching and Learning (SoTL), this work underscores the versatility of the framework and its potential to enhance teaching practices across disciplines.

Finally, Nel (2025) makes an innovative and essential contribution to higher education pedagogy by focusing on emotional bottlenecks in learning—an often-overlooked but critical factor strongly intertwined with cognitive challenges. Emotional bottlenecks can hinder learning and lead to student resistance, yet they remain underexplored, particularly in technical fields such as computer science. The author introduces the Disciplinary Dream-Drawings (DDD) methodology within the Decoding the Disciplines framework, further innovating the latter by integrating visual and narrative approaches to uncover unconscious thoughts, emotions, and experiences. This pilot study conducted at a South African university involved first-year computer science students drawing their dreams and narrating their interpretations. The paper underscores the critical interplay between personal and academic challenges, offering valuable insights into students' behavior and guiding the creation of more supportive learning environments. Notably, a focus group allowed students to reflect on common themes

and contributed ideas for improving computer science programs. In addition to exploring these bottlenecks, the paper provides practical recommendations for educators interested in implementing the DDD methodology. It highlights its potential to uncover hidden emotional challenges, inform pedagogical strategies, and enhance students' emotional and academic development. By addressing an area traditionally neglected in computer science education, this article represents an important contribution to the field and offers actionable strategies for educators seeking to better support their students.

3 Contribution to the field

In this outstanding collection of articles, some of the most significant advantages of *Decoding the Disciplines* as a framework become strikingly clear. The four articles on graph reading (Darcy, 2025; Pelnar & Cameron, 2025; Cameron & Duffy, 2025; Elliot & Middendorf, 2025) examine this skill from various disciplinary perspectives. While graph reading should not be assumed to be the only or most significant bottleneck, the analysis and exploration of this specific challenge highlight the framework's remarkable versatility. These four articles reveal both similarities and differences in how graph comprehension and interpretation can occur, providing valuable insights. Additionally, the inclusion of the student perspective offers a complementary viewpoint. Both perspectives—those of students and teachers—underscore that the traditional notion of learning as merely acquiring knowledge or practicing procedures is incomplete, if not fundamentally misleading. This shared blind spot perpetuates persistent learning obstacles and leaves education far from reaching its full potential.

Although science often revolves around numbers, facts, diagrams, and language, analytical thinking is not the sole pathway to accessing implicit knowledge or elevating teaching to a new level. Two articles (Elliot & Middendorf, 2025; Nel, 2025) emphasize the transformative potential of imagery—whether linguistic or truly visual—in addressing learning bottlenecks and enriching teaching practices.

Cameron's (2025) article, alongside those by Itow et al. (2025) and Elliot and Middendorf (2025), illustrates the transformative nature of engaging in deep interdisciplinary exchanges. One of the strengths of *Decoding the Disciplines* lies in its focus on active and intensive listening—embracing the unknown without needing to fully understand it and providing space for others to reflect. This process fosters new perspectives on the subject matter or teaching. At the same time, the listener benefits profoundly—first, through a sense of self-efficacy that sparks new ideas, and second, by discovering connections to their own work. These connections may stem from similarities across disciplines or entirely new ideas inspired by encountering the unfamiliar.

Although the foundational works by Middendorf and Shopkow (2018), as well as Pace (2025), have already explored the topic of emotional bottlenecks, the articles by Elliot and Middendorf (2017) and Nel (2025) in this volume offer fresh and exciting insights into this rich and expansive field.

On the one hand, *Decoding the Disciplines* is a deeply disciplinary practice, designed to address truly discipline-specific learning bottlenecks. On the other hand, several articles in this volume clearly demonstrate the benefits of transcending boundaries—whether between disciplines or between school and higher education. The introduction of new actors, such as students and teachers, into the framework opens up innovative ways to rethink teaching and learning.

Ultimately, the framework provides a robust foundation for interdisciplinary collaboration, as awareness of one's own discipline is a crucial prerequisite for constructive and impactful scholarly cooperation across fields. This makes *Decoding the Disciplines* an essential tool for shaping the teaching of the future.

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