

Learning to work across and beyond disciplines: A framework for investigating interdisciplinary expertise and facilitating its development in higher education

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Complex real-world problems such as those associated with chronic and pandemic diseases, climate change or AI do not align neatly with academic disciplines. Responding to them effectively depends on individual disciplines but also on high-trust interdisciplinary collaborations. Progress requires sustained interactions between disciplinary experts, professionals and other people and organisations involved in co-designing, making and testing systems, services and products. People need to be skilled in working across diverse knowledge boundaries, using novel combinations of disciplinary, interdisciplinary and local knowledge. Such interdisciplinary work is often seen as challenging, requiring capabilities that are not well articulated, largely tacit, and hard to teach. This presents issues for research leaders, educators and others who need to facilitate interdisciplinary teamwork and foster interdisciplinary expertise among researchers or students.

We present a novel conceptual and methodological approach for a research program aimed at creating a knowledge-base on interdisciplinary expertise, and research-informed design resources for interdisciplinary learning—in research settings, university courses and teacher education. Our program, implemented by an interdisciplinary research team, draws on collaborative ethnographies. It aims to answer four related questions:

1. What exactly constitutes the expertise needed to work across disciplinary boundaries?
2. How do researchers and university students learn to work across disciplinary boundaries and develop this expertise?
3. How can the development of interdisciplinary expertise be better supported in research teams and university courses?
4. How can we prepare preservice and inservice teachers for integrative cross-curricular teaching in schools?

In contrast to disciplinary capabilities, which are often seen as individual cognitive accomplishments, interdisciplinary expertise is intertwined with broader social and material arrangements, practices and cultures. These include institutional politics, research infrastructures, and local knowledge production—what people accomplish with the tools at hand. Our conceptual framework, therefore, adopts an ecological perspective on expertise and situates it within sociomaterial approaches to knowledge and knowing. At the core is the view that learning and knowledge creation are distributed and embodied sociomaterial practices. We conceptualise and research interdisciplinary practices at three interrelated levels: 1) institutional cultures and knowledge infrastructures, 2) local interdisciplinary practices, and 3) personal resourcefulness. Each level adopts a set of unique but tightly interrelated methods for depicting sociomaterial

aspects of knowledge practices within and across institutions, groups and individual activities. This conceptual and methodological framework brings two benefits: it allows ethnographic work to be carried out simultaneously by multiple people across levels and sites; and it leverages findings more readily for the creation of design resources.