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Interdisciplinary learning in industry and community projects

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Abstract

The world is increasingly facing complex problems which cannot be solved by one discipline alone (Brassler et al, 2017). University graduates need to develop skills to tackle these challenges, including problem-solving, inventiveness and collaboration. Designing a course which embraces interdisciplinary learning is one way to equip students with the skills they need to overcome challenges they will face in the future. Interdisciplinary learning draws on and synthesises concepts, theories and/or methodologies from different disciplines and gives a more complete, multi-perspective and holistic analysis of a complex problem, in ways that may not be achievable through a single disciplinary lens (Spelt et al, 2009).

In this paper, we share our experiences of working on industry and community projects. As interdisciplinary educators, we developed these units in collaboration with industry partners, to engage students from various disciplinary backgrounds in creating innovative solutions to "real-world" problems such as the future of healthcare, the war on waste, social housing, open data disruption, and climate change. We observed the different ways of thinking students brought with them from their respective disciplines, and how they used their discipline-centric knowledge, varied backgrounds, experiences and abilities to construct "new" interdisciplinary knowledge and work effectively together with their peers (Markauskaite & Goodyear, 2014). We also discuss how, as interdisciplinary educators, we perceive our role to be different in an interdisciplinary context from what we are used to in discipline-focused contexts (Healey, 2005). Based on our own reflections, we apply an interdisciplinary framework that demonstrates how these units prepare students for the changing world of work using interdisicipilinary learning.

1 Introduction

The world is facing a growing number of complex social, political, health, economic, digital and environmental problems, which cannot be solved by a single discipline (Brassler et al, 2017). Acknowledging that university graduates will need to develop the skills to tackle these challenges, higher education institutions have increasingly turned to different pedagogical and experiential learning approaches (National Academy of Sciences, National Academy of Engineering, & Institute of Medicine, 2005) that include synthesising disciplinary skills to

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enable students to develop competencies for 21st century "work-readiness". The most prominent skills have been identified as inventiveness, critical thinking, problem-solving, metacognition, communication, collaboration, information/digital literacies and social responsibility (Binkley et al, 2012).

One approach adopted has involved including "mixed" discipline learning in curriculum design, through the adoption of multidisciplinary, cross-disciplinary, or interdisciplinary approaches to learning. Although these terms have been used interchangeably, there are key differences between the different approaches (Klein, 2017; Kidron & Kali, 2015) which warrant brief explanation. Multidisciplinary learning involves combining disciplinary perspectives but without integration (Klein, 2017), so the identity of each discipline and its knowledge structures are preserved. Cross-disciplinary learning focuses on an issue that is germane to one discipline through the eyes of another discipline (Klein, 2010). Interdisciplinary learning, however, entails some kind of "integration" (Holbrook, 2013), through the transfer and sharing of knowledge across disciplinary boundaries (Kidron & Kali, 2015; Boix-Mansilla, 2017).

2 Industry and community projects

This paper focuses on how industry and community projects create interdisciplinary learning opportunities in an undergraduate unit of study. This unit involves the co-development (by academics, students and industry/community partners) of projects based on authentic, complex problems. These projects have focused on real-world issues such as the future of healthcare, the war on waste, disruptive technologies, and social housing. Enrolment is open to students from all disciplines, and students may preference their interest in specific complex problems. Students are allocated to groups which are created to ensure diversity of thought through consideration of their discipline and identified skills. In addition to groupwork, students also attend "all of class" sessions where they learn how to build successful groups; identify and work with different ways of thinking; unpack complex problems using systems thinking and design thinking; and (as they would in the real world) manage their projects.

Assessments in this unit are aligned to authentic workplace outputs including a project plan, presentation and report. The plan is pitched to the industry partner in the early stages of the project and is followed by regular touchpoints. In the final stages of the project, student groups formally present their findings and recommendations to the partner and provide a written report that explains their project objectives, approach, methods, findings, analysis and recommendations for future work. The assessments also require students to reflect and explain how they have drawn on and used relevant concepts, theories and/or methodologies from their different disciplines to co-develop a holistic analysis of the problem, in ways that would not have been achievable through a single disciplinary lens (Spelt et al, 2009).

3 Framework for interdisciplinary teaching and learning

We have chosen to draw on Burch et al's (2016) Lotus conceptual framework (pp. 241-242) to explain how industry and community projects can develop and create interdisciplinary learning through multiple layers of learning: the foundations, catalysts, drivers and pillars of practice. Setting the foundation, learning objectives focus on the attributes that all graduates are encouraged to develop during the course of their studies: communication; critical thinking; information/digital literacy; cultural competence; interdisciplinary effectiveness; and influence. These learning outcomes set this unit apart from discipline-focused units which often focus on the development of content knowledge. The catalyst for students' interdisciplinary learning is the experiential and collaborative model, whereby students come together in interdisciplinary teams to battle the uncertainties of complex problems in partnership with industry. This collaboration drives their interdisciplinary learning by empowering and challenging them to think differently and to recognise and respect the ideas of others. Interdisciplinary learning is promoted as student groups are actively engaged in applying knowledge, rather than acquiring or memorising content (Manathunga, Lant, & Mellick, 2006). Finally, the learning activities and

assessment items (as described earlier) refer back to the learning outcomes and foster critical pillars of practice, offering students the opportunity to have agency in their learning, engage in meaningful reflection and co-create new knowledge. All layers of the framework are facilitated by educators and integrated across the unit to create an environment where interdisciplinary learning can grow and thrive, much like the Lotus flower.

4 Role of interdisciplinary educators

An important aspect of this interdisciplinary learning approach is the role of the interdisciplinary educator. Unlike in traditional academic roles, disciplinary content expertise is not required; in these units, the educator's role is to facilitate the inquiry, research and problem-solving process. Collaboration is essential between the educator and the industry partner, whose role is to act as a mentor by offering feedback and direction throughout the process. The partner provides the context to the complex problem, while the educator fulfils the role of a project supervisor by supporting and guiding learning to enable the integration of disciplinary knowledge, methodologies, tools and language, facilitating the co-creation of new interdisciplinary knowledge across disciplinary boundaries (Kidron & Kali, 2015; Boix-Mansilla, 2017).

Supervising industry and community projects that are outside our areas of disciplinary expertise can be uncomfortable, but serves an important purpose. Firstly, it normalises the discomfort for students, who also cannot rely solely on their disciplinary expertise. This shared discomfort, combined with team-building activities, creates a safe space for learning. It also helps the supervisor facilitate interdisciplinary discussions by challenging ideas and assumptions and encouraging students to share the reasoning behind their thoughts. We observed how students brought their disciplinary perspectives, experiences and abilities together to construct interdisciplinary project methods and solutions. For example, in a project focused on the future of health, students drew on their disciplinary backgrounds to investigate unintentional medication non-adherence among independent, older adults. The group comprised students from science, business, arts and law, and together they used their diverse backgrounds to design an interdisciplinary strategy for considering the economic, social, legal and technological implications of this problem. They drew on their science and business backgrounds to collect and analyse large data sets and validate assumptions about their problem, and used their expertise in business, arts and law to research the addressable market trends, evaluate the economic and social burdens of the problem, and examine the feasibility of technological-enabled solutions. One student offered a background in machine learning, which enabled the group to examine how artificial intelligence algorithms can provide a real-time reflection and analysis of patients' medication history. Using their collective experiences, all students also contemplated the impact of COVID-19 on the future of healthcare and how it could potentially affect medication adherence. Their recommendations were therefore grounded in an integrated and holistic, interdisciplinary approach that considered both the external, lesser-known impacts of non-adherence and the more obvious economic factors.

5 Conclusions

This paper describes how industry and community projects have been designed to support interdisciplinary learning through the use of real-world, complex problems and collaboration with industry partners. Using the Lotus conceptual framework, it is evident how educators used the drivers, catalysts and pillars of practice within industry and community projects to encourage students to think differently and work effectively with their peers. Our observations confirm that students constructed new interdisciplinary knowledge by integrating their different perspectives, experiences and abilities.

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