INTEREGATING INTEGRATION: EXAMINING THE COSTS OF INTERDISCIPLINARY EDUCATION

BRANDT, MELANIE
DIVISION OF HUMANITIES, ARTS, AND SOCIAL SCIENCES
COLORADO SCHOOL OF MINES
COLORADO

Prof. Melanie Brandt
Division of Humanities, Arts, and Social Sciences
Colorado School of Mines
Golden, Colorado

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Synopsis:

 This paper employs a pilot course that combines aspects of design engineering with the humanities to explore some of the costs and complications that are inherent in disciplinary integration.

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Abstract

The question of whether interdisciplinary classes are more effective than single discipline classes is worthy of contemplation for scholars in all fields of study. This topic is especially significant for scholars, educators, and administrators in higher education due to the fact that the complexities of interdisciplinary learning are often associated with more sophisticated levels of intellectual development and, therefore, this type of education may be desirable in college classes. In theory and on paper, interdisciplinary classes are full of merit and advantages that would seem to eclipse single discipline classes. In fact, there are no shortage of case studies where the combination of distinctly different courses has resulted in enhanced learning outcomes, improved assessments, and markedly satisfied students.

This paper examines some of the costs and complications of integration which may outweigh, or at least complicate, its benefits. I will be looking at my pilot course that combines design engineering with ethics and composition as a means for unpacking some of the difficulties of course integration. More specifically, I argue that the most important elements for interdisciplinary success are time, resources, and community. While these elements may seem obvious at the outset, they are often difficult to obtain for interdisciplinary classes in traditionally structured universities. Ultimately, a close examination of this course sheds light on the issue that the benefits of interdisciplinary learning come at a cost that deserves active recognition by those who are pursuing this type of education and those who are trying to determine its effectiveness.

In line with the development of interdisciplinary classes in higher education, my university has been dipping its toes into the waters of disciplinary and pedagogical combination. Over the last academic year, I took on developing and teaching a pilot class combining two of our cornerstone, first-year classes—one an engineering design and professional skills course and the other a composition and ethics course. These classes were merged together under an umbrella theme of the "Engineering Grand Challenges," which are a collection of 14 world problems ranging from accessing clean water to securing cyber space. The complexities of these problems provided the impetus for the combination of the humanities, social sciences, technology, and engineering into a singular course.

As is common in interdisciplinary courses, this venture was a collaborative effort and my own background in the humanities was balanced by my co-teacher who specializes in engineering. Our effort to construct working, integrated learning outcomes provided a pedagogical platform for our course and the explanation of integrating the two classes—which are compartmentalized and housed in separate departments and colleges—sounded reasonably convincing. An early description explained:

> "The combination of the learning outcomes from these two courses under the umbrella of the Engineering Grand Challenges is intended to enhance and deepen students' learning. The design engineering projects provide practical contexts for engaging with ethical theories and the humanities instruction provides depth, fluency, and critical analysis to design engineering projects."

In its execution, however, this integration proved to be substantially more complicated than the explanation let on.

This course will serve as the source for this paper that explores some of the complexities of interdisciplinary education. Given that this course has just completed its experimental pilot stage, there are no longitudinal data to help contemplate its complexities in comparison to its value. There are plenty of studies of other courses currently available that provide extensive and often

competing data of this sort. Rather, this paper seeks to offer experiential highlights to those teachers and administrators who are interested in or actively pursuing interdisciplinary initiatives at their institutions. This information might be particularly useful to those educators who are pursuing interdisciplinary classes in university environments that are not entirely developed to support them.

Defining interdisciplinarity

The very act of defining interdisciplinary education is a daunting, but necessary task. For simplification purposes, I borrow from the research University of Alabama professor Karri Holley and her condensed definition contained within some of the promises of interdisciplinary education: "The university community replaces the disciplines as the site of learning, professors engage with each other and their students in a variety of educational formats, and scholars select the best knowledge of the disciplines, using it to engage with widespread social challenges" (Holley, 2009). Granted, my experience is on a much smaller scale than what is proffered here. What I find particularly useful and pertinent in Holley's explanation is the recognition that interdisciplinarity is a multifaceted approach to education that resides in both the methods and use of knowledge as well as the distinctive outcomes. This understanding helps to set a precedent for developing courses that require: 1) a "community"; 2) knowledge from various disciplines unfettered by disciplinary boundaries; 3) inventive and fluid curriculum; and 4) real world influences. Beginning with these points in mind provides a bedrock for discussing the complexities of developing an interdisciplinary course and its requisite personal and institutional investments. In essence, integrating interdisciplinary classes into a traditional education system requires a tremendous amount of time, energy, and resources inside and outside of the classroom.

The process of developing interdisciplinary courses begins with the fundamental question, why? Determining the value and intention behind combining classes or disciplines provide the primary structure to build upon. This explanation may also serve as justification for disrupting an established, discipline-specific university structure. I have been questioned suspiciously by students, colleagues, and curious friends into the reasoning behind my combined class.

Interestingly, the process of responding to their questions, which occasionally felt more like defense than explanation, helped me to better determine my vision for the course. The question of "why are you combining the courses?" and "what are the benefits?" is often followed by "how well are you able to cover everything?" or "what do students think?" Finally, the ultimate question usually emerges: "Is the combination class better than the singular classes?" The act of responding to these sorts of questions provided insight into the poetics of the course and how it needed to be executed both in terms of teaching and learning. Furthermore, I have come to appreciate the process of questioning propositions for other new interdisciplinary courses at my university. While more in-depth research into the scholarship of interdisciplinarity is undoubtedly useful, I have found that a focused understanding of one's specific course is indispensable, especially in the initial phases of developing the course. The combination of disciplines into a single class should have intrinsic value above and beyond their traditional implementation. Deep, thoughtful construction of this reasoning in relation to one's specific course is an activity fundamental to developing course materials and inspiring its very pedagogical and epistemological foundations.

Community and Resources

The values, intentions, and reasoning behind an interdisciplinary course may also affect its community of support. In a university almost wholly devoted to science and engineering, it is unsurprising that a STEAM class would face skepticism at the role of humanities and its creep from a small isolated department onto equal platform with engineering design. Likewise, the pairing of the liberal arts with design skills was uncomfortable for some humanities faculty who feel protective of their disciplines. Professors and administrators from both courses expressed concern over the meeting of learning outcomes and discomfort over unfamiliar language and approaches in our course documents. Thus, the very suggestion of interdisciplinary classes can meet a reception of dubious uncertainty and defensiveness. Not only can this response create an initial turf-war hurtle for acceptance, but it makes the possibilities of establishing a community of support a matter of delicate diplomacy.

The lack of an extensive community can result in an unexpected obstruction to the long-term impact of the course. Students who receive interdisciplinary education only in select classes most likely return to traditional single-discipline classes for the majority of their academic careers. Recently, in a Q&A session with faculty that followed a presentation about our course, one professor questioned the long-term viability of the interdisciplinary connections we are teaching. The context for his concerns is an engineering class where his attempts to integrate relevant ethical issues into the fabric of an upper-level technical course were met with student resistance. Several students responded by indicating that he was violating the technical nature of the class by including ethics. They saw interdisciplinarity as a feature limited only to another combination class at our university. This and other similar anecdotes from my colleagues suggest that little or sporadic integration of disciplines may result in a form of compartmentalization whereby interdisciplinary learning is regarded as inhabiting a disparate educational world that is not applicable to single-discipline classes. If a university has limited interdisciplinary courses, or if it adopts a structure whereby these courses are limited to first year experiences, how might we avoid the disintegration and trivialization of the connections that we are making? How does interdisciplinary education find footing in larger organizational structures that have not been similarly modified? Future data will better speak to the likelihood of these outcomes, but the concerns are already grounded in relevant anecdotal experiences.

This point leads to addressing some of the challenges of interdisciplinary classes, especially early initiatives, within traditional university infrastructures. In the early phases, there is a constant question of where our class is housed within the traditional discipline-specific arrangement of the university. On a very practical level, there are the questions of who provides funding and support for the course. Even details as seemingly innocuous as scheduling, enrollment, and course numbers can become quite convoluted. Our first semester almost did not happen because of confusion with the course number and the inability for students to register themselves for the class. In a setting

where there are multiple departments, colleges, and administrators involved, maneuvering through red tape is even more complicated than usual. Holley aptly explains that existing in a liminal space within a university is ill-fitted for the typical disciplinary structure and can lack "the autonomy, stability, and definiteness awarded to the disciplines by their place in the institutional hierarchy" (Holley, 2009). While there is certainly more freedom in a "homeless" course, this situation can also lead to the feeling that there is uncertain support for the instructors and an ambiguous future for the course. Furthermore, some researchers have recognized that a successful interdisciplinary pilot does not guarantee the success of the course or the permanency of its curriculum even if the course endures (Froyd & Ohland, 2005; Clark, 1996). This uncertainty is due in part to the demands on teachers, students, administrators, and the requisite resources necessary to ensure the continuation and success of the course. Given all that goes into developing a wholly new course, it can be quite disconcerting to consider its vulnerability. Our course has received the green light to continue into the next academic year, however, its survival beyond that is uncertain.

Interdisciplinary teaching and learning challenges

On a more abstract level, teaching and curriculum development for the interdisciplinary class requires inventive, creative approaches that cannot rest on the laurels of established, single-disciplinary courses. Moreover, it is hard to justify an interdisciplinary class if it simply resembles the inclusion of two or more classes into the same physical space with their recognizable lessons and pedagogy. The interdisciplinary class needs to synthesize elements from its multiple disciplines into a coherent whole. Some other more extensive studies have reinforced the importance of the depth and breadth of the connections in interdisciplinary courses and the need to go far beyond the inclusion of multiple disciplines into a classroom (Holley, 2009; White, 1981). My own experience has emphasized the need for this synthesis to be expressed and continually reinforced by the teachers, the lessons, the learning outcomes, the title of the class, the content materials, the projects…in other words, *every* aspect of the course. The rationale behind this approach is to show how the disciplines are not just complimentary to one another, but rather that

they are cohesively inherent in one another. More specifically in relation to our class, this approach might look like learning that engineering involves engaging in the cultural and political dimensions of a problem or project. Or, that effectively communicating an idea in writing involves applying a design process to language.

Even in light of this constant reinforcement of the integrated nature of the disciplines, students were sometimes flabbergasted by the course. In similar ways that the university structure and other professors had difficulties with the class due to its lack of comfortable categorization, some students also had trouble recognizing it. Halfway through the first semester of the course, one student commented, "I still don't know what this course is supposed to be. It's confusing." This sentiment was echoed by other students as well. They expressed discomfort with assignments that did not seem to fit in any familiar paradigm. Their frustrations were revealed with survey comments such as this one: "I don't know why we are doing this assignment and what it has to do with engineering." Or, "We're not really doing ethics. I took an ethics class in high school and it was completely different." Our fluid treatment of the disciplines ran counter to the learning styles they had developed over much of their academic careers. They could not understand why aspects of the social sciences and the humanities would be part of engineering and vice versa. The same elements that we saw as strengths of the course, served as stumbling blocks for students.

Students' confusion revealed another unexpected element of the course: students need extra time and space to make sense of the connections and synthesis. We had provided extensive explanations in our conversations with students about the course and each assignment provided carefully crafted connections to our learning outcomes. We spoke in the language of educators; however, this was not enough. In response to students' declaration of confusion, we revamped the second half of the semester, removing some of its content, easing off on some of our learning objectives, and developing learning opportunities for students to make the connections themselves. What became clear as a result of this redevelopment was that the act of synthesizing various disciplines is itself a learning outcome. We had assumed that providing integrated teaching and

course materials would properly outfit students to accept and digest the connections that we had made in our conception of the course—instead, they needed to be allowed to find their own connections to build upon.

The learning experiences that we developed in response to this need revealed themselves as some of the most impactful lessons for students. We created problems and, other than some light-handed guidance, we let students grapple with and solve them on their own. This heuristic style of learning let students experience failures and successes according to their proclivities for making connections amongst the disciplines. For example, we developed a design problem entitled "The Cube Challenge" that could be solved with a purely technical solution. However, unless the students asked questions, which they were encouraged to do, they did not discover the cultural, social, and ethical issues that greatly affected the problem until the end of the process. Their ability to engage with and integrate various types of knowledge directly affected their success within the project. I mention this specific problem here because several students remarked on its impact on their understanding of the interconnectedness between engineering and the humanities in their final course reflections. One student commented that

> "The Cube Challenge seemed like such a simple project. Initially, I resented that all of the information was not presented to us. However, in hindsight I can see that this assignment taught me 3 important lessons: never assume that a design problem can be understood purely through technical information—it can't; engineering is about people and places not just things; ask lots of questions about every aspect of a problem and then ask some more questions about those answers, then repeat."

Another similar revelation emerged in a student's comment in relation to a similar project that involved applying the design process to writing a paper. The student reflected that she was never comfortable with terms like "audience" and "purpose" which were used in her English classes when writing papers. Yet, once she understood them in terms of "stakeholders" and "problem definitions," "the process of writing papers made more sense." These reflections suggest that the

act of learning the connections for themselves affected students' thinking processes in ways that our explanations never seemed to achieve.

Time Demands

Each of these "synthesizing" lessons required ample time for contemplation, reflection, discussion, and reinforcement for them to be useful. Skipping or minimizing any of these steps seemed to weaken the impact of the assignment and minimize its lessons—points that became clear later in our student surveys. As a result, we had to recognize the need to carve out extra time for this specific sort of learning. Synthesizing knowledge and disciplinary methods are complex intellectual endeavors often associated with the upper tiers of learning hierarchies such as those in Bloom's taxonomy. With this recognition, interdisciplinary teachers may need to build curriculum and learning outcomes that relate specifically to supporting students' understanding of the connections that the course is relying upon and the synthesis that is required for success. In our class, we had to sacrifice some of the content and re-prioritize the learning outcomes to provide these learning experiences.

The decisions of how to teach this class and to what ends were some of its most complicated aspects and they remained prevalent throughout both semesters. Many conceptions of interdisciplinary education associate it with innovative and unconventional curriculum and pedagogy (Smith, MacGregor, Matthews, & Gabelnick, 2004; Holley, 2009). While some researchers disagree on whether these are essential characteristics of interdisciplinary education, they were essential to for us to create a truly integrative class. The challenges students faced when trying to recognize our curriculum seemed minimal in comparison to the challenges we faced as educators trying to develop it. Each aspect of the class required far more time and effort than either my co-teacher or I had ever spent on course development, including new courses, within our disciplines. It challenged us to develop assignments that acknowledged, yet ignored, our disciplinary backgrounds and encouraged knowledge production and thinking skills outside of our specialties. And, like our students, we had to fail, regroup, and reiterate our attempts.

Constructing an interdisciplinary course is not only intellectually challenging, but it can be logistically demanding as well. The collaborative work of multiple teachers is necessary for the success of the course. In order to allow this work to happen and to provide equal contributions, we found that we needed to discuss and agree on all aspects of the course from scheduling to designing assignments to agreeing on feedback and grades. We estimate that collaboration increased our worktime commitments by at least 50%. For instance, an assignment that I wrote required approximately 6 hours to draft. Two phone conversations and several emails later, we agreed upon edits and scheduling, this was followed by my revision of the draft, another phone conversation, and a final rendering of the assignment posted to our course website. A grand total of almost 12 hours for this assignment which I would have completed independently shortly after the initial 6 hours. Co-teaching at this level required a concentrated dedication of mind, time, and spirit that often took up much of these resources.

Conclusion

The majority of what I have offered in this discussion focuses on the demands and difficulties of this class which I have then projected onto the development of other, like-minded courses. What may be noticeably missing is a discussion of the rewards of this class and interdisciplinary education in general. I could offer a much larger discussion of the positive outcomes of my experiences. In short, I am a better teacher and a better member of my university community because of this course. I am not expanding on these claims here for several reasons. Most notably is that there is an abundance of scholarly literature that focuses on the rewards and value of interdisciplinary education and provides best practices for its execution. However, there seems to be a dearth of information that can help one appreciate and prepare for the magnitude of developing an interdisciplinary course, especially as a new initiative in a traditionally-structured university. In light of this shortcoming, I offer my experiences without their seductive rewards and benefits which can obscure what is required in exchange.

1.   References

Clark, B. (1996). Substantive growth and innovative organization: New categories for higher education research. *Higher Education, 32*(4), 417-430.

Froyd, J., & Ohland, M. (2005, January). Integrated Engineering Curricula. *Journal of Engineering Education, 94*(1), 147-164.

Holley, K. (2009). Understanding Interdisciplinary Challenges and Opportunities. *35*(2), 1-131.

Smith, B., MacGregor, J., Matthews, R., & Gabelnick, F. (2004). *Learning Communities: Reforming Undergraduate Education.* San Francisco: Jossey-Bass.

White, A. (Ed.) (1981). *Interdisciplinary Teaching: New Directions for Teaching and Learning.* San Francisco: Jossey-Bass.