Complicated Spaces: Negotiating Collaborative Teaching and Interdisciplinarity in Higher Education

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Abstract

This study focused on the socially-constructed meanings, implications, and institutional factors that influence the extent to which faculty members engage in collaborative teaching at a research university. Drawing upon theoretical foundations of interdisciplinarity and collaborative teaching and in-depth findings from faculty focus groups, we illustrate the various models of collaborative teaching currently in use by faculty and the structural conditions governing these teaching experiences. Findings suggest that while collaborative teaching experiences are emerging as teaching innovation and are potentially beneficial to students, they are institutionally challenging and often incongruent to the dominant culture of the research university.

Keywords: Collaborative teaching, interdisciplinary teaching, higher education, innovative instruction.

The practice of collaborative teaching in higher education has developed significantly in recent years (Bacharach, Heck, & Dahlberg, 2008; Evans, Tindale, Cable, & Hamil Mead, 2009; Lester & Evans, 2009). Interdisciplinary and collaborative teaching, together, have emerged as an important theme in colleges and universities, including large research universities (Sapiro, 2004). For many institutions, beginning to meet growing demands for integrated and interdisciplinary education will require faculty and administration to redefine what the typical undergraduate experience looks like.

Despite this interest in developing a collaborative teaching and learning environment, the literature that supports the connection between interdisciplinary approaches and collaborative teaching is lacking. Even when interdisciplinary, collaborative teaching models exist, the assessment of their impact on teaching and learning is rare, and most assessments of interdisciplinary approaches to teaching or research have focused on tangible

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outcomes such as grants, papers, and patents, leaving intellectual outcomes largely unexamined (Lattuca, Voigt, & Fath, 2004).

In an attempt to provide further understanding of the relationships between interdisciplinary and collaborative teaching, our research explores socially-constructed meanings, implications, and institutional factors that influence the extent to which faculty members engage in interdisciplinary (and multi-disciplinary) collaborative teaching at a research university. To set the stage, we draw upon the theoretical and empirical foundations of interdisciplinary and collaborative teaching. We focus on the ways in which these educational approaches are currently defined, the necessary connection between these two ideas, and the suggestions for best practices. This literature review is followed by findings from faculty focus groups we conducted at a research institution. It is here we illustrate the various models of collaborative teaching currently practiced by faculty and the structural conditions governing their inter/disciplinary teaching experiences. Specifically, we provide insight into the conceptual orientations for these educational approaches, tie these models to the literature, and discuss "best practice" suggestions for continued collaborative and interdisciplinary teaching. We begin with a review of the conceptual and empirical literature of interdisciplinary and collaborative teaching.

Literature Review

Interdisciplinary Teaching and Learning

We found that definitions of interdisciplinarity applied in teaching and learning contexts span across several decades. For instance, Newell and Green (1982) define interdisciplinary studies as "inquiries which critically draw upon two or more disciplines and which lead to an integration of disciplinary insights" (p. 2). The integration aspect of this definition is crucial, and it is what differentiates interdisciplinary studies from multidisciplinary studies. In an interdisciplinary experience, the assumptions and perspectives of different disciplines must intersect and inform one another, and the instructors must make this integration explicit for the students. The responsibility for integration rests with the instructors; otherwise, integration will not take place (Minnis & John-Steiner, 2006; Oitzinger & Kallgren, 2004). Interdisciplinarity is useful in answering questions that are too complex for a single discipline by constructing a single "more comprehensive perspective" (Newell, 2010, p. 6).

Impact on Students

According to Minnis and John-Steiner (2006), interdisciplinary learning experiences should theoretically help students apply and integrate disciplinary knowledge to solve real-world problems, and equip them with the skills they will need to adapt and function in today's changing environment. Interdisciplinary programs and courses can help students develop critical thinking and problem-solving skills that they will need in their careers by requiring them to synthesize different disciplinary perspectives to create a new framework (Davis, 1995; Oitzinger & Kallgren, 2004). In a meta-analysis of available research, Johnson, Johnson, and Smith (2000) found that when students are asked to inte-

grate two different and opposing viewpoints, it can drive them to use higher-level reasoning strategies more often than in other learning settings. The students also showed better, more accurate retention, greater knowledge of the subjects studied, and better decision-making (Johnson et al., 2000). Evans, Tindale, Cable and Hamil Mead (2009) further found that an interdisciplinary approach to teaching professional communication skills to Master of Accounting students had a positive impact on the learners, who displayed gains in understanding, performance, and confidence in professional communication situations, evidenced by both student surveys and final grades.

Impact on Instructors

Although most of the benefits of interdisciplinary teaching in the literature focus on students, instructors stand to gain from interdisciplinary teaching experiences. While teaching such courses, instructors will often face issues on which they cannot reach an interdisciplinary consensus, and this divergence can lead to growth in the instructors (Lester & Evans, 2009). The integration of disciplinary perspectives, even when unsuccessful, can force instructors to re-examine their own disciplinary understandings, develop new understandings of their and others' disciplines, and navigate differences across departmental cultures (Burkhardt, 2006).

Despite the many benefits to interdisciplinary teaching and learning, there are several potential pitfalls and caveats that must be considered when implementing an interdisciplinary program. First, instructors must consider whether students will be prepared to integrate the material. In many instances, students have become accustomed to being the passive recipients of knowledge, not the active constructors. Oitzinger and Kallgren (2004) found that, in order for students to benefit from an interdisciplinary program, instructors first had to provide training on how to be an active learner. This required some deprogramming of the students' passive learning styles.

In addition to considering how interdisciplinary approaches may disrupt students' expectations for a course, instructors and program proponents must consider how such an approach may conflict with other faculty and administrative expectations. Interdisciplinary programs violate the status quo in many university and college cultures, where their departments exist in relative isolation from one another and often have their own values and norms (Burkhardt, 2006). As a result, interdisciplinary forays have a high tendency to struggle and eventually fail (Burkhardt, 2006; Wieman, Perkins, & Gilbert, 2010). According to Wieman et al. (2010) in their discussion of an evidence-based model for adopting innovative teaching methods in science education, "the department is the necessary unit of change" (p. 8), therefore it is essential for faculty to have departmental support in developing innovative programs such as interdisciplinary curricula, especially in more market-driven university settings where a focus on research is valued over a focus on teaching (Augsburg, 2006). Appropriate displays of support could include incentives for professors to teach with members of other departments, recognition for those who have shown dedication to improving their teaching, and openness to changes that may increase the expense of instruction, such as smaller or modified classes (Wieman et al., 2010).

Developers of interdisciplinary programs must also successfully integrate the disciplines engaged if the students are to do the same (Minnis & John-Steiner, 2006; Oitzinger & Kallgren, 2004), which is often more challenging than faculty anticipate (Minnis & John-Steiner, 2006). Integration of disciplinary epistemologies, methodologies, and often opposing perspectives must be built in to the curriculum. Newell and Green (1982) suggested that "the critical factor in successful interdisciplinary teaching seems to be the willingness to engage other disciplines and to adopt temporarily their assumptions and worldviews" (p. 8), indicating that student buy-in may also be critical.

The discussion of interdisciplinarity thus far reflects Newell and Green's (1982) assertion that collaboration is usually a requirement for interdisciplinary programs. Instructors are needed to provide their expertise in the disciplines involved, which ensures that students are immersed in the theories, methodologies, perspectives, and major tenets of the disciplines that they will be required to integrate throughout the program. The following section covers the foundations and practices of collaborative teaching, the benefits and difficulties related to this pedagogical approach, and suggestions within the literature for successful faculty collaboration.

Collaborative Teaching

Co-teaching began primarily as a special education endeavor, to help make inclusion a more successful practice (Cook & Friend, 1995). Cook and Friend (1995) defined co-teaching as "two or more professionals delivering substantive instruction to a diverse, or blended, group of students in a single physical space" (p. 2). As the literature on co-teaching began to evolve, so did the terminology. Co-teaching, team-teaching, and collaborative teaching have been used to define teaching that involves more than one instructor, and it is often difficult to differentiate between these three ideas. According to Cook and Friend (1995), team-teaching is a variant of co-teaching where both members share the instruction of the students. Collaborative teaching is often vaguely defined in the literature, and some have used co-teaching and collaborative teaching interchangeably (Stang & Lyons, 2008). Lester and Evans (2009) presented their collaborative approach to team-teaching wherein both instructors were responsible for planning the curriculum, coming to a consensus on how the class material should be presented, providing the instruction, and assessing student learning. Because their approach involved a more rigorous degree of collaboration than most team-teaching definitions, Lester and Evans (2009) defined their approach as *collaborative teaching*. Collaborative teaching is therefore viewed as including a level of cooperation not required by team-teaching specifically, or co-teaching in general.

Collaboration is the necessary underlying process for collaborative teaching to occur. According to McDaniel and Colarulli (1997), collaboration among instructors theoretically varies along four dimensions: 1) the degree of integration of ideas and perspectives; 2) the degree of interaction between faculty and students during the learning process; 3) the degree to which active learning and engagement is encouraged; and 4) the degree of faculty interdependence in the collaborative process. Higher levels of collaboration take place when faculty actively integrate their individual perspectives, both faculty interact

with students, active learning is built into the curriculum, and faculty move from an autonomous approach to planning and implementation to a more interdependent one (McDaniel & Colarulli, 1997).

Impact on Instructors

This high degree of collaboration may have its benefits. For faculty members, collaborative teaching can serve as a professional development experience, wherein each member learns from the other's teaching styles, can become more creative in delivering class materials, yet still receive feedback on their own performance (Lester & Evans, 2009; Neumann et al., 2006). Other research has shown that collaborative teaching encourages instructors to be more reflective in their practice (Lester & Evans, 2009).

Collaborative teaching can also provide moral support that college instructors may not otherwise receive (Neumann et al., 2006). Collaborating faculty have an avenue through which to address the problems and issues that arise in planning and facilitating a course. Lester and Evans (2009) found that a collaborative approach led them to develop an ebb and flow where they learned to both lead and follow one another. Additionally, they noted that a collaborative approach naturally created a more democratic classroom, and students became equally responsible in the process of the course (Lester & Evans, 2009).

Impact on Students

With regard to learning outcomes, Carpenter et al. (2007) found no significant difference between achievement scores for graduate students in a solo-taught course and a collaboratively taught course. There were, however, significant differences between the two groups in terms of students' expressed comfort with the material (Carpenter et al., 2007). This finding is especially important as these courses involved research and statistics, an area that can intimidate some students. Wenger and Hornyak (1999), using open-ended student evaluations, found that students enjoyed the learning environment of collaboratively taught classes. Collaborative teaching enhanced the students' interest and created a more informal classroom environment (Wenger & Hornyak, 1999). Dugan and Letterman (2008) found that student evaluations of collaboratively taught courses were higher than those of serially team-taught courses.

As with interdisciplinary approaches, there are difficulties related to collaborative teaching that instructors must take into account. Students of collaborative learning environments can experience confusion over which instructor to approach with questions about the class, and can feel extra pressure as a result of being graded by two different people (Bacharach et al., 2008). From an instructor perspective, collaborative teaching is time-consuming. In fully collaborative environments, faculty members plan, implement, and assess the course together. This process requires a time commitment above and beyond that of a solo-taught class (Lester & Evans, 2009; Neumann et al., 2006). During the instructors' first implementation of a collaboratively taught course, the time required is even greater. In addition to developing the curriculum, the instructors must also deal with the interpersonal issues inherent in collaboration (Lester & Evans, 2009; Neumann et al.,

2006). Communication is the key to successful collaboration, and members of the teaching team must learn to disagree amicably by developing trust (Robinson & Schaible, 1995). Neumann et al. (2006) also found that many faculty expressed concerns that having more than one instructor present may prevent students from developing rapport with faculty members.

Evolving Practices and Disciplinary Grounding

In exploring how interdisciplinary and collaborative teaching can help meet the evolving needs of higher education and its students, we also investigated programs and courses that touted successes in various areas of collaborative and interdisciplinary teaching and learning. Effective interdisciplinary and collaborative teaching endeavors that had some sustainability and were positive experiences for instructors and students were usually the result of two intentional activities of the instructor: taking responsibility for integration (Minnis & John-Steiner, 2006; Newell & Green, 1982), and commitment to in-depth collaboration (Lester & Evans, 2009; Neumann et al., 2006; Robinson & Schaible, 1995).

Taking Responsibility for Integration. As faculty in the Water Resources Program, Minnis and John-Steiner (2006) surveyed the students in the program's three interdisciplinary courses. Integration was not intentionally built into the course curricula, and they found that students were having difficulty synthesizing the information on their own (Minnis & John-Steiner, 2006). Newell and Green (1982) provide examples of programs where faculty made synthesis of disciplinary viewpoints explicit. In a sophomore-level Natural Sciences course on energy, students were asked to evaluate coal, oil, nuclear fuel and emerging alternatives from geological, physical, ecological, and political perspectives. In a freshman course on the autonomy of the individual, students were required to consider the question, "is the individual free?" from economical, sociological, and psychological perspectives. The literature suggests that, in many instances, it is a well-designed question that can drive students' integration of disciplinary ideas.

Commitment to In-depth Collaboration. Faculty undertaking an interdisciplinary, collaboratively taught course should also begin with the expectation to communicate and collaborate extensively (Lester & Evans, 2009; Robinson & Schaible, 1995). Benjamin (2000) argues that instructors must have the right intentions in approaching interdisciplinary collaborative teaching, and that these intentions should reflect a focus on improving teaching and learning and a commitment to in-depth collaboration. Within this extensive communication and collaboration, faculty should expect a period of trial and error in planning and implementation (Robinson & Schaible, 1995). In order for the teaching team to transition smoothly from one instructor to the next, construct consistent expectations of students, and synthesize their disciplinary viewpoints, faculty members must explore different approaches and techniques (Neumann et al., 2006). All of this experimentation takes place as instructors maintain course policies and expectations and learn more about their teaching. Faculty should also avoid viewing interdisciplinary collaborative teaching as a division of labor, as such an approach can impede not only the synthesis of disciplinary perspectives but also the teamwork necessary to collaboratively teach (Neumann et al., 2006).

The process of interdisciplinary and collaborative teaching can be very demanding for instructors, especially in the developmental stages of the course or program (Lester & Evans, 2009). Considering the commitment required to be successful, it becomes even clearer that departmental and administrative support is necessary for interdisciplinary and collaborative programs to succeed (Wieman et al., 2010). Departments must provide faculty with the time and resources to develop collaboratively taught courses and to learn to teach in this way. Department heads and administration must also provide moral support and show commitment for interdisciplinary and collaborative programs by making them a priority within departmental cultures (Kezar, 2005; Wieman et al., 2010). With this in mind, our project explored how and why interdisciplinary and collaborative teaching were currently being used through the lens of an in-depth case study at one institution immersed in the discourse.

Methods

The Research University as Research Setting

Our research was initially conducted based on emerging interests in interdisciplinarity and collaborative teaching at a Mid-Atlantic research university. Specifically, in 2009, a USDA Higher Education Challenge Grant was awarded in the College of Agriculture and Life Sciences (CALS) to develop an interdisciplinary, experiential-based curriculum in sustainable agriculture and food systems. An interdisciplinary group of faculty, staff and students from CALS departments, dining services, the college's farm, plus several community partners collaborated to develop this curriculum via a new college based undergraduate minor called Civic Agriculture and Food Systems (CAFS). The goal was to develop a curriculum that provided students with knowledge and skills to incorporate agriculture and food system sustainability philosophies and activities into practice.

The CAFS minor aims to engender an authentic, interdisciplinary teaching and learning experience for students across the university. To further develop this educational approach, the CAFS minor taskforce collaborated with the university's offices of teaching and learning and assessment to explore possibilities for improved collaborative instruction and evaluation of student learning. Funded by a 2010 Integrated Internal Competitive Grant program in the CALS, our interdisciplinary research team began to investigate the primary question: How is collaborative teaching being used on campus and by whom? Through a sequential, mixed methods approach, the research team drew upon survey and focus group data where several models were identified, and obstacles and opportunities related to collaborative and interdisciplinary teaching emerged. The remainder of this paper describes the quantitative data collection as a method for identifying focus group participants, but takes as its focus the qualitative aspects of our research in order to reveal the deeper meaning learned from faculty across the university who are currently involved in inter/disciplinary collaborative teaching arrangements.

Research Approach and Data Sources

The overarching purpose of our grant-funded research project was to investigate the role of collaborative teaching in enhancing interdisciplinary collaboration in education and scholarship. Both quantitative and qualitative methods were applied in our inquiry. The primary objective of the qualitative strand was to gain a deeper understanding of the collaborative and interdisciplinary teaching models currently being applied in a broad array of disciplinary contexts. In our Discussion section, we further develop these models by synthesizing them with the established trends we uncovered in the literature to present a set of best practice recommendations for both university and department administration, as well as instructors looking to incorporate interdisciplinarity and collaborative teaching in their own practices and policies.

Data collection for the quantitative strand took place during the spring semester of 2011. In the quantitative strand, a survey was employed to obtain a broad view of collaborative and interdisciplinary teaching currently taking place across disciplines in our institution. The survey included requests for demographic information and concluded with an invitation to participate in a focus group in which participants would discuss their experiences with collaborative and interdisciplinary teaching at significant depth. Focus groups were the chosen methodology for the qualitative strand of inquiry because it would allow us to get representation from a wide range of disciplines and see the interactions between participants' differing perspectives on interdisciplinary and collaborative teaching. Approval for the use of focus groups with human subjects was obtained through our university's Institutional Review Board.

The focus group invitation at the end of the survey resulted in 88 instructors expressing an interest to participate. We utilized the demographic information collected to ensure that faculty from a wide range of disciplines were present in the focus groups. Two focus groups were conducted in the summer of 2011 with a total of 11 faculty members participating, with seven participants in one group and four in the other. Participants were eight men and three women, and represented a range of years of experience, including assistant, associate, and full professors. Participants represented a wide variety of disciplines. A two-member team conducted each focus group. One member facilitated discussion while the other took detailed notes. All of the focus group facilitators were members of the research team and had in-depth understandings of the research questions. As part of the process, the audio of the focus group activities was recorded. The research team provided participants with an introductory writing activity as they arrived to the focus group. Participants were asked to consider two questions and take brief notes (*Please provide a description of your experience with collaborative teaching* and *How do you define interdisciplinary teaching?*), which were designed to help them begin to think about their previous interdisciplinary or collaborative teaching experiences, especially experiences that would fall into this category but that they had not previously considered as such. After participants had organized their thoughts and the priming activity concluded, the focus group was conducted. Each focus group took approximately one hour and fifty minutes.

Data Analysis

The audio recordings from both focus group activities were transcribed and coded by two of the focus group facilitators. The constant comparative method was applied to the data, and a family code list was derived through a two-phase, iterative process (Glaser & Strauss, 1967). We used the existing literature, expanded on in the literature review section, as a typology to explore our focus group data. The definitions of interdisciplinary and collaborative teaching derived from Lattuca (2001), Boix Mansilla, Gardner, and Miller (2000), and Lester and Evans (2009) served as the foundation for the theoretical lens that we applied throughout our coding process. The first phase in this process involved a series of reflections on the initial findings of the literature review, and the initial codes reflected a framework of the general experiences of instructors using collaborative and interdisciplinary teaching at the higher education level. The codes derived from the first phase in the process were used to inform and guide the coding of the transcript data. Through reflections on the literature review, it was anticipated that the focus group analyses would yield information relevant to the participants' personal definitions of collaborative teaching, the structural realities of interdisciplinary and collaborative teaching, and the student and instructor learning implications therein. In undertaking the second phase of the analysis, the family code list was revisited and adjusted during multiple read-throughs of the transcripts so that it would reflect the experiences of instructors specific to the institution, resulting in a code list that was both informed by the literature and responsive to the participants' experiences. Atlas.ti was used to categorize participants' responses into themes. Themed responses were then re-examined for an additional layer of sub-categories. Analyses of the focus group data yielded six themes, with 21 total sub-categories within these themes. The following section focuses on two of the six emergent themes that proved most relevant to discussing next steps and best practices for interdisciplinary and collaborative teaching in the higher education setting: *Meanings of Collaborative Teaching* and *Structural Realities of Collaborative Teaching*. The remaining four themes addressed issues related to the logistics of teaching collaboratively and the implications of its use. In an effort to increase the focus of our paper and to conserve space, the remaining four themes are not discussed here, as they are not directly related to the topic at hand. Additional analysis may continue in the future.

Results

Within the context of the larger research project, here we report on results that illustrate the meanings, motivations, and realities of collaborative teaching derived from the faculty in our study. We begin by revealing three different forms of collaborative teaching where faculty disciplines are integrated in varying ways according to the purpose of the collaboration—giving meaning to interdisciplinary collaborative teaching. We conclude with the administrative and bureaucratic conditions that appear to play a significant role in governing faculty's collaborative and interdisciplinary teaching experiences.

Meanings of Collaborative Teaching

Leader-based. Several faculty described their collaborative teaching experiences as a leader-based model. The leader-based model included both small (two instructors) and large (three or more instructors) teaching teams. This approach was further defined by the way in which the model was implemented. First, it was used as an approach for a lead faculty member to mentor instructors with less teaching experience, including new faculty members or graduate teaching assistants. When used in a mentoring capacity, the more experienced instructor served as a fail-safe for the novice instructor, who was still viewed as an active participant in the construction and delivery of the course, and was expected to make significant contributions. One passage from a faculty member explains the leader-based collaborative teaching approach well:

> R8: It varies each time we teach it in response to my interactions with my teaching assistant. I was sort of thinking about it as a collaborative teaching experience. It still has the hierarchy of faculty-assistant relationship, but the teaching assistants have a lot of flexibility to develop their own teaching styles, their own material. I sort of help to facilitate that…

Second, the leader-based approach was used as a way to provide cohesion for courses with a large teaching team (three or more instructors), where one instructor would become "the glue" for the course. "The glue" would provide oversight and/or introduce each new instructor and section of the course, making explicit connections to the material that had already been discussed and tying these sections back to the big picture or overarching theme. This instructor would also lead the teaching team and ensure that the curriculum for the course was being properly addressed. Faculty participants expressed that they felt that having "the glue" was necessary to have a successful collaboratively taught course with a larger teaching team. The leader would often help the team discuss and come to agreement about what material would be taught.

Modular. The modular model of collaborative teaching was commonly used and perceived by participants as a cost- and resource-saving measure. This model often, but not always, involved a large teaching team of three to six instructors. In the modular model, courses were broken up into multiple sections, and each section covered by one instructor. Each instructor would develop the lesson plans, deliver instruction, and evaluate learning for their section independently of the rest of the teaching team with, in some cases, "mini tests" implanted within the course. Overall, the module approach was very strategic and illustrated both teaching dependence and independence. This is well explained by one particular participant:

> R2: I taught one course where one person had half the course and the other person had half the course. And when the first instructor was done, he was out of there, and whatever I did, you know, was fine.

In spite of the instructors largely functioning independently of the rest of the teaching team, many still experienced intellectual constraints as a result of working with such a large group, such as feeling a lack of freedom in experimenting with different teaching

techniques. In departments that did not have enough faculty to cover all the necessary courses, the modular model of collaborative teaching was often used. From this perspective, faculty acknowledged that the experience was largely dependent on the way the modular model was constructed. A larger number of modular teaching team members was often associated with unwieldy and in-cohesive experiences:

> R10: It depends on the team, you know. I think it's a real difference whether you try to teach with two or three people focused, or you basically have a group of five to ten faculty. And with five to ten faculty, a good number of them don't know what the others are doing. You have absolutely no control over that.

Participants also expressed that, in modular models where instructors worked independently of one another, it was often difficult to know exactly what the students had been taught by the end of the course.

Traditional. The traditional model was viewed by participants as the best representation of what is meant by the term "collaborative teaching" as it is often used in the literature. The examples discussed typically involved a smaller teaching team, usually two instructors, who were both active and equal participants in the full timeline of the course. The instructors would collaboratively develop the course curriculum, develop lesson plans, deliver instruction, and evaluate student learning. The instructors shared equal responsibility for the decision-making within the course. In essence, as one participant stated, it is "more of a symphony than these separate players off doing their own thing." It is also explained well here with an emphasis on the continuality of the teaching approach: "It wasn't module or segmented, we were just, you know, right from conception to finish, we were both in there all the time teaching, sort of playing off each other."

Transparency, open communication, solid interpersonal relationships, and the ability to reconcile individual teachings styles were seen as vital to the success of traditional collaborative teaching. In fact, this model was not seen as appropriate for all teaching teams in all situations. Experiences using or witnessing the traditional model were often described as challenging but positive. Here a faculty member describes a course taken as a graduate student as the inspiration drawn upon to teach collaboratively from an interdisciplinary perspective:

> R10: …I had [a course] as a student with a collaborative teaching team, which [was] basically two faculty got together, which, first of all, [they] did that by choice. They choose each other as partners. It was a theorist and an experimentalist teaching the same topic, and that went exceedingly well. That was one of the best teaching experiences or learning experiences I ever saw as a student. It seems to depend a lot, at that level, on the chemistry between people and whether they do this on a voluntary basis or because they have to.

Structural Realities of Collaborative Teaching

Departmental/Administrative Support/Recognition. Although many participants expressed a belief that collaborative teaching could be beneficial for students, instructors, and the university, they noticeably expressed frustration with a general lack of support or recognition of collaborative teaching on the part of their departments and university administration. Most participants felt that their departments actively discouraged the use of collaborative teaching for budgetary reasons:

> R11: It doesn't happen easily. You know, it just doesn't happen easily. So I had to kind of get what I wanted by framing it in a different way so that it made financial sense. So the department could say "we're offering this course in all these sections, we know what's happening in every section, [and] we know the quality of it…"

In light of these issues, many of the participants who actively engaged in collaborative teaching felt that they had to provide extra justification to their department heads for choosing to teach a course collaboratively, or had to frame a collaborative course in such a way that it made "fiscal sense" for the department. Participants also felt that use of the traditional model was unlikely to become more accepted until department heads and university administration actively recognized the benefit from using this technique.

Other participants shared how their experiences in collaborative teaching were derived from courses that were created through new grant programs that emphasized innovation in teaching and learning, often drawing upon interdisciplinary program aims. Participants expressed concern, however, that after the grant funding was gone departments were highly unlikely to provide the funding to allow the course to continue unless student numbers were high. One faculty participant expressed this concern by way of recognizing the tension between innovation and resource constraints:

> R9: My frustration, in a lot of ways, comes from the fact that we love to put money into new initiatives, and then forget about the core educational minutia. All we want to do is get those numbers of students through the system.

The tension between resources and teaching innovation was further explored by another participant who called attention to the role of politics in making higher education decisions: "I hesitate to say this, but I do bristle when someone says it's a resource issue when it's a will issue. This is because we do find the resources when there is a will to put those resources somewhere."

Obstacles/Opportunities Related to On-line Course Scheduling (e.g. Banner) and Management Systems (e.g. Blackboard). Participants expressed frustration in dealing with course management systems in administering a collaboratively taught course. These systems, and the way they are currently used by university administration, cannot accommodate collaboratively and interdepartmentally taught courses in a seamless way. Many participants stated that they were forced to undergo elaborate processes in order to set up

collaboratively taught courses in the management system in a way that properly recognized all instructors on the teaching team. This sometimes involved dual-listing courses in different department headings or expanding enrollments in a course so each instructor could take half. Many stated further that this elaborate process had to take place every time the course was taught, and expressed frustration with the lack of responsiveness on the part of the system. Participants discussed finding resources within the registrar's office to help them navigate these processes, and that without help, the process could not be successful. The questions they ask of their systems managers are often left unanswered due to perceived ignorance or political willpower:

> R5: We just have to reinvent everything again and again and again as if people are having this problem for the first time. I don't know, as near as I can tell, the people that are in the driver's seat have never been in a classroom.

The participant later elaborates on this point:

> R5: I think, from the Banner point of view, I'm figuring they can fix this, but they just don't want to spend the time and effort to get some of these information system aspects right. And I think part of the reason that's the case is that they view this as a side issue.

The participants' responses emphasized that they perceived the problem to be both how the software systems were designed, and the policies and procedures that had been put in place to regulate their use across the institution.

Obstacles/Opportunities Related to Resources, Tenure, and Institutional Mission. Participants discussed both obstacles and opportunities related to the resources required to collaboratively teach. On one hand, the context of a research university was seen as an advantage to collaborative teaching in that instructors had the opportunity to coordinate with others from different disciplines and expertise. It was also seen as a barrier to collaborative teaching where some participants felt that the university's "focus on research may distract from the teaching mission." Some participants felt that many in higher administrative positions were not in favor of innovative teaching strategies, such as collaborative teaching, that took away time away from research programs.

Several participants claimed that university administrative leaders did not have the appropriate amount of teaching experience and pedagogical knowledge to make sound decisions in how the university acted out its teaching mission, and that instead, many decisions were made from a fiscal perspective. Lack of necessary resources allocated to departments to support innovative teaching methods, including collaborative teaching, was noted as evidence. The focus, instead, is placed on developing standardized teaching practices to be resource efficient: "We talk about how great it is that we're a research-active university and our professors are in the classroom, but we're moving to 'instructorizing' just about everything to save money and time."

Participants felt that participating in interdisciplinary collaborative teaching could hinder them acquiring tenure because of the perception that such courses were resource intensive and therefore inefficient. The emphasis on giving their home department enough credit for the interdisciplinary collaborative teaching experience was perhaps the most widely discussed risk. Some participants felt that "collaborative teaching in [their] department does not count for teaching credit." And if they "taught a course outside of [their] department, collaborative or uncollaborative, that was simply not going to count toward their teaching load." Others felt that they were expected to participate in the modular model of collaborative teaching. It was expressed by several faculty that if they declined to do so this would also prevent them from obtaining tenure. It was felt by the participants that collaborative teaching experiences were not always considered helpful when tenure was being determined.

Discussion

Our exploration of interdisciplinary and collaborative teaching within the literature and in the context of a research university yielded key insights into the potential contributions these approaches stand to make to higher education pedagogy. In the following sections, we discuss our findings from three perspectives: 1) all who work in higher education, 2) educators who work in the classroom, and 3) the administrators who support them. Each discussion includes suggestions for best practices as well as a call to arms for those in higher education to consider the relevance of these approaches in the context of their own colleges, universities, or classrooms.

Call to all: Recognizing variation in purpose for collaborative teaching

Not all collaborative teaching experienced at this research institution was defined in the same way. Leader-based, modular, and the traditional form of collaborative teaching were all experienced by faculty. Perceptions of these forms of collaborative teaching were also different. From our experience in this inquiry, the modular form was the most used. The modular model of collaborative teaching was also associated with the most negativity expressed by participants. In contrast, the traditional form was described as most challenging yet positive for the faculty. Traditional collaborative teaching teams were successful when transparency, open communication, and effective interpersonal relationships existed. Leader-based was more often used in a mentoring capacity linking senior faculty with less experienced junior faculty or teaching assistants. This approach was also utilized when teaching teams were large for the purpose of course cohesion. In exploring how interdisciplinary and collaborative teaching existed within the literature and on-campus, we found that the necessary intentional activities identified in the literature (*taking responsibility for integration* and *commitment to collaboration*) did not apply to all the models that existed at our institution. Although instructor responsibility for integration was necessary in the traditional model, it did not apply to all instances of leader-based or modular collaborative teaching. This was especially true in cases where integration was not one of the goals of the course, or where only one disciplinary perspective was presented. The different models also required differing levels of commitment to collaboration. Where traditional and leader-based experiences required high to moderate

levels of commitment, modular experiences required little instructor interaction. By integrating our findings from the literature and our qualitative inquiry, it became clear that different models served different purposes, and that the different models evoked strong affective reactions from instructors. Instead of assigning one model the title of "best practice", it is useful, instead to examine using these models in their appropriate contexts.

The leader-based model serves as a useful way to introduce less experienced instructors to teaching at the higher education level. It can also provide the cost-saving benefits of the modular model while still helping students integrate the various perspectives and concepts in the course. Faculty generally viewed the leader-based model as a positive experience that forged a compromise between necessary resource reduction and providing beneficial experiences for students and instructors alike. Participants' views of the leader-based model reflected the suggestion in the literature that interdisciplinary and collaborative teaching can provide valuable professional development experiences (Lester & Evans, 2009; Neumann et al., 2006).

The modular model proves to be more controversial, relating back to Neumann et al.'s (2006) warning to avoid treating interdisciplinary and collaborative teaching as a simple division of labor. Although useful in saving time and resources, the over-use of the modular model can be demoralizing for instructors and students alike. The modular model can save departments functioning with a reduced faculty, but perhaps should be viewed as a temporary solution.

The traditional model, often seen by participants as the ideal, involved great challenge and risk, yet great reward. However, through exploration of the literature and participants' responses, it is clear that the traditional model may not be appropriate for every instructor in every course. Strong interpersonal dynamics, students who are capable of dealing with ambiguity, and course content that lends itself well to an integrative, democratic approach can result in a transformative teaching and learning environment (Bacharach et al., 2008; Lester & Evans, 2009; Neumann et al., 2006; Robinson & Schaible, 1995). Applying the traditional approach where it is not warranted, however, can result in confusion and frustration on the part of students and instructors.

Keeping these insights in mind, we assert that each model holds value in its own right. This value, however, is only accessed when these models are used appropriately by administration, department heads, and instructors. Thus, additional support for understanding and implementing collaborative teaching models in various contexts is essential.

Call to educators: Collaborative and interdisciplinary teaching and learning

Higher education is beginning to recognize a necessary shift in the way educators structure and deliver instruction in colleges and universities. Collaborative teaching is emerging in many departments from a range of disciplinary and interdisciplinary perspectives as one method for addressing this shift. Above we discussed the categorizations of the various models uncovered in the literature and on-campus, and the benefits and caveats attached to each model. Keeping contextual factors in mind, it is clear that both students

and instructors stand to benefit from the thoughtful implementation of interdisciplinary and collaborative teaching. Collaborative teaching offers opportunities to grow as an educator and to model effective collaboration for students. New forms of pedagogical knowledge, for example, were reported. Also, collaborative teaching allows for professionals to learn new concepts, theories, and measures that are directly and sometimes indirectly connected to course content.

We also suggest that the relationship between collaborative teaching and interdisciplinary learning and teaching aims needs to be explored further. Our research provides some framing to the larger relationship between the two areas of inquiry, but clearly more needs to be done. The epistemological implications of faculty and student's cognition enhancement warrants further investigation, as well. While some faculty did not teach collaboratively from an interdisciplinary perspective, those that did highlighted several key points. First, interdisciplinary collaborative teaching provides multiple perspectives for educators and best help their students learn course content. Second, it allows for professional knowledge gains for enhanced understanding of concepts of complex systems and problems. Third, it enhances teaching abilities by engaging in dialogue with other colleagues.

Thoughtful and successful implementation of interdisciplinary and collaborative teaching, however, will require further experimentation on the part of college and university instructors, as our higher education institutions are not currently designed to accommodate such approaches (Oitzinger & Kallgren, 2004). In order to change the landscape of higher education pedagogy, instructors must take on the task of classroom-based trial and error within the contexts of their own programs in order to stimulate progress toward a more integrative, democratic approach to teaching and learning. It is instructors who then reveal the feasible, effective interdisciplinary and collaborative approaches to their department and university administration.

Call to administrators: Moving forward with higher education innovation

Collaborative teaching, like any other form of teaching, needs to be done well to work. To improve the implementation of collaborative teaching, resources and programmatic focus from administration are required. A disconnect exists between what administrators say and do, between the mission statement and the reality. Participants shared that new grant initiatives that emphasize teaching and learning innovation often lack sustainable administrative resources beyond a grant cycle. Some faculty express that administrators reduce teaching to a numbers game rather than one that reflects quality teaching scholarship, which was illustrated well by the participants' perceptions of the use of the modular model, wherein large, unintegrated teaching teams were a barrier to ensuring student learning. Other faculty expressed willingness to engage in teaching collaboratively, yet it is discouraged by department administrators who perceive a loss of department credit value and resources. Still others voiced frustration that many administrative leaders make fiscal decisions about teaching resources with inadequate teaching experience or pedagogy knowledge.

A shift in the administrative 'fiscal' climate to support teaching innovations like collaborative teaching will prove challenging. Tensions between the two central academic missions (research and teaching) prevail in the 21st century. How best to reconcile or better balance them within a scholarship paradigm at a research intensive university warrants further investigation within the context of collaborative teaching. Overall, there is consensus that collaborative teaching is a worthy endeavor. It also comes with structural realities that need addressing. Wieman et al. (2010) stated that the department is the "necessary unit of change", and this was reflected in the participants' statements, as well. Many felt that change at a research university, and similar large institutions, would have to originate from the bottom-up, as opposed to top-down approaches. Department heads must serve as the advocates of their faculty to ensure they have the space and resources necessary for innovation. In the context of large research institutions, the responsibility will fall to them to direct their university's climate back towards a focus on teaching and learning.

University administration can play a role in the current climate-shift by providing recognition and incentive to develop and implement interdisciplinary and collaborative courses and programs. Many participants noted that top-down approaches to such change often resulted in a lack of buy-in and simply going through the motions for many educators "on the ground." Department heads must lead the charge within the context of their own programs; however, university administration must create the space and support for them to do so.

Conclusion

Instructors, department heads, and university administration have unique and necessary roles to play in integrating interdisciplinary and collaborative teaching into higher education. Interdisciplinary and collaborative teaching endeavors have a high tendency to fail, whether it is from a lack of faculty or student buy-in, a lack of sustained support from administration, or from department cultures that actively discourage such practices (Burkhardt, 2006; Wieman et al., 2010). In order to successfully integrate these beneficial approaches, a high degree of commitment is required from all three parties. To further validate the effectiveness of interdisciplinary and collaborative teaching, it falls to educational researchers to conduct a simultaneous effort to measure its impact on student learning.

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