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Finding Common Ground: Collaboration Across the Disciplines in the Scholarship of Teaching

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Many recent writings on the scholarship of teaching discuss the need to locate this scholarship within the disciplines. The authors argue that while scholarship within the disciplines is important, it should not come at the expense of work across *the disciplines. They demonstrate the usefulness of cross-disciplinary collaboration for the scholarship of teaching and learning through the specific example of how collaboration contributed to their understanding of the role of such scholarship in the teaching of mathematics and negotiations courses. The authors also outline some of the pitfalls of cross-disciplinary collaboration, and they offer suggestions for beginning collaborative initiatives.*

Many of the recent writings on the scholarship of teaching discuss the need to place such scholarship within the disciplines (Huber, 1999; Ronkowski, 1993; Shulman, 1999). The reasons offered range from improving the rewards for such scholarship to broadening its readership. While work within the disciplines is important, it should not come at the expense of work *across* the disciplines. Work across the disciplines is useful for at least two reasons: It creates new synergies by connecting ideas and concepts across disciplines, and it allows us to identify and fill knowledge gaps within our discipline. In this article, we describe and draw on our own cross-disciplinary collaboration to support our arguments.

The article consists of four main sections. The first section provides background information on the scholarship of teaching and learning vis-‡-vis the disciplines. In the second section, we give examples of our own work across disciplines, and describe how this collaboration has enriched our teaching and theoretical development. In the third section we consider the potential pitfalls in undertaking such work, and the concluding section discusses future directions for cross-disciplinary collaborations.

Background

In 1990, The Carnegie Foundation for the Advancement of Teaching released Ernest Boyer's landmark work, *Scholarship Reconsidered*. Boyer argued for a richer definition of scholarship that includes four different dimensions: "the scholarship of *discovery*, the scholarship of *integration*; the scholarship of *application*; and the scholarship of *teaching*" (p. 16). Since that time, in the midst of an expanding literature, different definitions of "the scholarship of teaching" have been used (Kreber, 2001). Richlin (2001) clarified the distinction between the *scholarship of teaching* and *scholarly teaching* by noting that the scholarship of teaching "builds on the end product of scholarly teaching" (p. 61) and results in formal, peer-reviewed publications. Citing the work of Elinor Ochs, Shulman (1999) argued that this process leads to enhanced analysis and synthesis: ". . . [R]eflecting on one's investigations in order to present them to others engages the scholar in deeper thinking about her findings, and hence a deeper understanding of her own work" (p. 99).

Faculty members' efforts to improve their teaching often begin within their own disciplines. Huber (1999) has described how disciplinary models support the scholarship of teaching: "Clearly, disciplinary styles empower the scholarship of teaching not only by giving scholars a ready-made way to imagine and present their work, but also by giving shape to the problems they choose and the methods they use." Shulman (1993) has also highlighted the importance of connecting the scholarship of teaching with the disciplines: "Like it or not, the forms of scholarship that are seen as intellectual work in the disciplines are going to be valued more than forms of scholarship that are seen as non-disciplinary" (p. 6). Our work is located within disciplinary communities, and those communities pass first judgment upon our work as scholars. As Bass (1999) noted, "what matters most is for teachers to investigate the problems that matter most to them." Scholars from the same field are most likely to seek the answers to similar questions. If one of the purposes of a scholarship of teaching is to allow our peers to build on our work, then

this scholarship must be readily accessible to peers within our discipline. Thus, the scholarship of teaching must be positioned within the disciplines.

We must note that none of these authors would argue that the scholarship of teaching should be housed solely within disciplinary silos. Their argument is that the scholarship of teaching needs to have a home in the disciplines, and it should not be treated as removed from a scholarly community. The question is, is this the only relevant community? We believe that the scholarship of teaching and learning can benefit from broader cross-disciplinary collaborations as well.

We make a distinction between cross-disciplinary and inter-disciplinary work (Blaisdell, 1993): Cross-disciplinary work focuses on studying contrasts and commonalities between and among disciplines, whereas interdisciplinary work is more concerned with studying the scholarship of teaching and learning in interdisciplinary courses. Table 1 shows how these types of scholarship differ at three different levels of analysis: the student, the course, and the program.

As Table 1 suggests, interdisciplinary work involves the familiar overlap or pairing that occurs between closely related disciplines or contexts (such as 18th-century literature and 18th-century history). In contrast, cross-disciplinary work requires reaching across a greater gap. The synergy cannot necessarily be based on shared content per se. Rather, the synergy exists at a meta-level, such as in the area of metacognitive strategies for teaching and learning. In the next section we describe our own collaboration for illustration, and then move to a discussion of the values and pitfalls of cross-disciplinary work in the scholarship of teaching and learning.

One Example of the Scholarship of Teaching as Collaboration Across Disciplines

Our collaboration began when we were introduced by a mutual acquaintance during Curt's year-long sabbatical at Elaine's school, and we began discussing the issues we faced in teaching our respective courses in mathematics and negotiations. Curt explained that in teaching a capstone class for prospective mathematics teachers over the past several years, he had noticed that mathematics students "do math" differently than mathematicians. This is a result of how they are taught. That is, American middle school mathematics teaches facts and procedures, such as being able to apply rules and algorithms and reproduce proofs that others have already discovered, whereas Japanese middle school math-

Table 1
Contrasting Interdisciplinary and Cross-Disciplinary Work at Three Levels of Analysis

Unit of Analysis	*Interdisciplinary*	*Cross-Disciplinary*
Student	Same students or students from a common program (e.g., physics students taking both a calculus class and a physics class)	Unrelated students: students from two different programs, with no expected overlap.
Course	Interdisciplinary course, or courses on closely related material taken by same students (*e.g.*, a seminar course on math and economics, or paired courses like 18th century literature and 18th century history)	Unrelated courses, or courses from different areas with different students (*e.g.*, a math course and a sociology course where material might be related, but connecting them is left to students)
Program	Single interdisciplinary program or connected programs	Unrelated programs

ematics, for example, teaches conceptual understanding (Stigler & Hiebert, 1999). Thus, US students, who have experienced procedural mathematics for 12 years, will naturally see this as the point of mathematics education. To get students to "think like mathematicians," as opposed to thinking like traditional math students (De Corte, Verschaffel, & Op 't Eynde, 2000), Curt began to require a semester-long research project rather than the usual weekly problem sets. For example, a weekly problem set might include a question such as, "Prove that the fraction a/b (in lowest terms) has terminating decimal if and only if the only prime factors of b are 2 and 5." A related research project, on the other hand, might be for students to discover how to create good rational approximations of the square root of 2. Curt assessed the effectiveness of

this semester-long assignment, as well as other features of this course, through a variety of instruments, including student surveys, taped student interactions, an instructor diary, and project reports. His analysis of these assessments showed that students began to see mathematics as something they could discover and understand on their own (see Bennett, 2003).

In listening to Curt describe his mathematics course, Elaine saw a number of connections with her negotiations course for prospective practitioners in human resources and labor relations. Just as Curt's course seeks to teach students to think like mathematicians, one objective of Elaine's negotiations course is to teach students how to "think like skilled negotiators." However, she encountered a number of student assumptions that acted as barriers to their understanding of this concept. One of these assumptions was that simply reading about a theoretical concept made them immediately able to apply it correctly to their daily negotiations. Thus, Elaine needed to have students confront this erroneous belief, among others. By having students complete a large number of short writing-to-learn assignments that focused on practicing the applying of theoretical concepts to their real-life negotiations, she found that they began to understand that developing negotiating expertise required more than simply reading about a new technique; the technique also had to be practiced in a real-world context (see Yakura, 2004). Comparisons of student assessments before, during, and after the course indicated that they found this and other similar mechanisms effective in helping them to "think like skilled negotiators."

Although we teach different subject matter in unrelated courses, our core pedagogical challenges were quite similar. Teaching students to move from "thinking like a student" to "thinking like a mathematician" or "thinking like a skilled negotiator" is difficult because it conflicts with common student expectations or beliefs about what it means to learn (Schommer, 1994). Students often believe that problems must be solved either right away, or not at all (Svinicki, 1999). They have also been "taught" that there is "one right answer" (Svinicki, 1991). Our discussions have led us to compare notes on a "metacognitive" level, as described in the next section.

Synergies and Connections to Larger Theoretical/Pedagogical Issues

Our experience highlights the importance of larger issues of teaching and learning that traverse the disciplines (Hutchings & Shulman, 1999;

Table 2
Comparison of Course Elements for the Authors' Two Courses

	A Capstone Course for Future Teachers of Mathematics	*A Course in Negotiations for Prospective Practitioners in Human Resources and Labor Relations*
Course Objectives	To think (and act) like a mathematician by applying concepts and techniques to mathematical problems	To think (and act) like a skilled negotiator by applying theoretical concepts to real-life situations
Course Assignment (examples)	Semester-long projects (vs. weekly problem sets)	Short written assignments focusing on application
Assessment of Course (examples)	Student surveys, taped student interactions, an instructor diary, and project reports	Weekly student feedback, videotaped student interactions, student assessments, and peer review

Ronkowski, 1993). Halpern (1998, 1999), for example, has argued that metacognitive thinking can be used to transfer critical thinking skills across domains; we have found that the issues of how to teach these skills also cross disciplinary boundaries. In particular, students cannot learn to transfer their critical-thinking skills until they recognize what skills are required for particular disciplines and, subsequently, how they might transfer them effectively. Creating this recognition in students is a common problem among teachers in all disciplines.

We both felt that in our courses we were fighting the learned behaviors and epistemological beliefs of our students (see Paulsen and Feldman, 1999, for examples). Creating "cognitive dissonance" is one way to attempt to change student attitudes (Hansen, 1998; Lee, 1998). Through our discussions, we came to realize that having students experience the *task* of practicing and working in the discipline—in our cases, as a mathematician or as a skilled negotiator—was a powerful way to break through their restrictive beliefs. How the specific features of each oth-

er's assignments functioned, however, was unclear to us. For example, in the context of the mathematics course, how important did we feel the length of the assignment is versus the opportunity for students to explore multiple solutions? In the case of the negotiations course, did we consider the process of written reflection or the frequency of giving and receiving feedback the more critical factor? It was the need to provide each other with detailed explanations about the inner workings of our assignments that caused us to confront these issues. Because such detailed explanations had never been necessary when discussing and working with our disciplinary colleagues, our understanding of these issues was deepened only because we had moved outside our disciplines.

One benefit of our cross-disciplinary work, then, was discovering common features of successful tasks across our disciplines in order to create better and more effective tasks. We recognized the importance of the tasks themselves—these tasks demonstrated for students the skills and processes required for each discipline. But successful tasks also appeared to involve directly confronting students' incorrect epistemological beliefs, such as "one right answer." In addition, the tasks forced students to apply the syntactic knowledge, or rules of evidence, knowledge, and proof, of the discipline, requiring that they think and work on multiple levels.

Our experience suggests that cross-disciplinary collaboration can be especially useful in advancing this work. We are complete novices in each other's subject matter. In this respect, we are like each other's students. And, as it turned out, we shared a similar set of pedagogical problems. Thus, unlike working with colleagues within our respective disciplines, we were able to offer each other a fresh perspective on the subject matter, while maintaining an experienced perspective on the pedagogical issues. This unique position is possible only through cross-disciplinary collaboration.

"Filling in" Our Knowledge Gaps

One of the most useful and most important reasons for entering into cross-disciplinary discussions in the scholarship of teaching and learning is to fill the gaps in one's knowledge of existing research and methodologies (Huber, 1999). This has certainly been the case in our own work. For example, many questions that arise in the scholarship of teaching and learning appear to demand qualitative analysis. To gain an understanding of changes in student attitudes requires analyzing more than a simple quantitative survey (Cross & Steadman, 1996). Curt had

collected data from his students that included free-form responses to open-ended questionnaire items. Analyzing qualitative data of this sort is an iterative process (Spradley, 1979; Strauss, 1987) that can often be anxiety provoking for those unfamiliar with it (Creswell, 1994; Marshall & Rossman, 1995), including mathematicians like Curt. Yet this was a familiar method for Elaine. Thus, Curt, like many of the mathematicians, scientists, and humanities scholars we have encountered, found it helpful to seek outside advice from someone with experience in qualitative analysis. On the other hand, scholars from fields primarily using qualitative methods find it helpful to collaborate with colleagues who have quantitative experience, particularly when using attitudinal surveys to measure the effect of teaching on the affective domain.

The examples above are among the most extreme gaps in mutual knowledge that scholars doing cross-disciplinary work may encounter. Seemingly minor knowledge gaps also can be bridged through collaborative discussions. What is more important is that this knowledge could well prevent frustration or, worse, needlessly repeating the work of others. For example, scholars of composition teaching have examined how to construct effective writing prompts and assessed their value in teaching writing (Brand, 1992; Pelkowski, 2000). Similar discussions about what types of mathematics questions prove most valuable in teaching writing have been under discussion in mathematics education (Lampert, 1990). In mathematics, the trend has been to ask more open-ended questions that require students to investigate rather than calculate or prove a stated result. While these discussions are well known to researchers in the fields of mathematics education and composition, the ideas are not well known outside of these fields. Ideally, the work being done in each field should be informing the other, but such is unlikely to occur without cross-disciplinary collaboration. Moreover, the nuances of meaning inherent in such research may well be lost on a scholar coming from a different research perspective. We suggest that in addition to bridging the major knowledge gaps in terms of research styles, cross-disciplinary collaboration, as seen in the previous section, can lead collaborating colleagues to discover the knowledge coming out of their parallel sets of work.

Difficulties of Cross-Disciplinary Work

While we have been extolling the virtues of cross-disciplinary collaboration, we are aware of the difficulties in working cross-disciplinarily. The first major difficulty has to do with the differences between the dis-

ciplines. Teaching and learning in the respective disciplines tends to involve entirely different theoretical concepts. Thus, what one discipline considers an "interesting" problem may not be considered at all relevant in another discipline (Huber, 1999; Kuhn, 1970). Further, there are important distinctions in the way terms are defined. For example, the term *triangulation* implies a much more precise measurement tool to a mathematician than it does to a social scientist.

As noted above, nuances in meaning can be lost across the disciplines; furthermore, collaborators may assign different meanings to a particular term, often causing inadvertent misunderstandings. For example, while Curt's discipline is mathematics, designating Elaine's discipline is more difficult. Her Ph.D. is in management, which is considered an "applied" or "professional" field that has evolved in response to real-world problems in for-profit organizations, and which encompasses a variety of different perspectives or disciplines. She also has practiced law, and this work has shaped much of her research as well as her teaching. Most recently, she has taught management courses, such as Negotiations or Organizational Behavior, to graduate students in a school within a social science college. While the differences between "labor and industrial relations" and "management" departments are understood clearly by their members, these differences are not always readily apparent to outsiders. For example, Curt still has difficulty correctly designating Elaine's departmental home. Faculty typically behave as though one's academic discipline is a simple designation, but, like designations of ethnicity, this is not necessarily the case. As seen earlier, however, these difficulties, once recognized, can be of benefit. For example, clarifying disciplinary jargon for students can lead to a better understanding of how they interpret our teaching and of how colleagues outside the discipline will respond to our work. However, overcoming these barriers requires a concerted effort.

This leads us to our second major difficulty with collaboration: time. It takes time to discuss and discover the commonalities and contrasts across disciplines, let alone discuss the nuances of disciplinary designations. Not only does someone have to become familiar with teaching/learning theory and concepts in his or her own discipline, but also he or she must become familiarized with the conversations in research and teaching in a different discipline. There is also the problem of identifying potential collaborators in different disciplines.

Recently, several institutions have attempted to facilitate matching potential colleagues from different disciplines by encouraging conversations about teaching and learning across campus communities and in

national discussions. Examples of these endeavors on particular campuses are found not only on campus Web sites, but also on national Web sites, such as the Web site for the American Association of Higher Education (http://www.aahe.org) and the Carnegie Academy of the Scholarship of Teaching and Learning (http://www.carnegiefoundation.org). These forums for discussion can lead to cross-disciplinary connections and opportunities for collaboration.

Future Directions for Cross-Disciplinary Collaboration

While any work having to do with the scholarship of teaching must take place within the disciplinary communities, we also encourage cross-disciplinary work. Cross-disciplinary learning is inherent in the curricular structure our students must grapple with daily. Thus, integrating cross-disciplinary collaboration into the scholarship of teaching promotes effective teaching and learning. While cross-disciplinary integration has occurred occasionally on a large scale—the Curriculum Foundations Project of the Mathematical Association of America (Barker, 2003), for example, and, at the campus level, the Lilly Fellow programs (Austin, 1992)—we argue that scholars can begin profitably with smaller scale collaborations and conversations.

Through collaboration, for example, both of us were able to recognize key metacognitive elements that the tasks we assigned to students required. This allowed us to create new tasks that we hope will be even more effective. Specifically, Curt will be able to perform a better analysis of his data about students, Elaine will be able to design more focused writing assignments, and both of us will see our teaching in a new light. Although creating such one-on-one collaborations is challenging and, by its very nature, cannot be imposed externally, our experience has shown that such a partnership can yield rich rewards.

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