

Building Interdisciplinary Research Models: A Didactic Course to Prepare Interdisciplinary Scholars and Faculty

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Abstract

Many academicians assume that anyone can engage in interdisciplinary research, but it is clear that successful interdisciplinary efforts require mastery of specific competencies that can be learned and improved. This paper describes the development and implementation of a course designed for Master's, pre- and postdoctoral students and research faculty on models of interdisciplinary research skills, based on a set of core competencies. Major challenges included working through institutional structures that made it difficult to offer cross-school courses, and interpersonal challenges among a diverse group of students from a number of disciplines. Although universities may be poised for interdisciplinary research, strategies for faculty preparation and support are lacking. Institutions embracing the concept of team and interdisciplinary science must focus not only on the structural barriers and facilitators, but also on direct support to faculty. The didactic course described in this paper is one approach to enhance interdisciplinary research skills of scholars-in-training and faculty, and we recommend that similar efforts be widely implemented. *Clin Trans Sci* 2011; Volume 4: 38–41

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Introduction

Interdisciplinary research is an approach to advancing scientific knowledge, in which researchers from different disciplines work at the borders of those disciplines in order to address complex questions and problems. The assumption is sometimes made that anyone can engage in interdisciplinary research should they choose to do so, but it is clear from a considerable body of literature that successful interdisciplinary efforts require mastery of specific competencies.^{1–3} It follows, then, that if such competencies are explicated, it might be possible to enhance researchers' abilities to participate in and conduct interdisciplinary scholarship. A number of interdisciplinary programs have emerged in higher education, primarily focused on undergraduates.^{4,5} Those targeted to graduate students are often designed to enhance participants' appreciation for cross-disciplinary thinking and models, but not to specifically focus on education to develop interdisciplinary research skills.^{6–8} The purpose of this paper is to describe the development and implementation of a course designed for pre- and postdoctoral students and research faculty on models of interdisciplinary research skills.

Methods

In 2004, an interdisciplinary planning center grant (P20 RR020616) was funded as part of the National Institutes of Health (NIH) Roadmap Initiative (which has now evolved into The NIH Common Fund, <http://nihroadmap.nih.gov/>). The grant funded a portion of the salary for a number of faculty members from more than 10 departments and disciplines across a single University, but it became clear over the 2-year planning process that interest in and skills needed to conduct interdisciplinary research differed widely across individuals. There was considerable variation in opinions and beliefs about issues as basic as defining interdisciplinarity and understanding competencies needed for interdisciplinary success. As a result, work groups were formed to add clarity and develop a set of shared definitions, values, and language about interdisciplinary research. The resultant work of the group to define interdisciplinary research is published in *Health Services Research*.²

One particular ongoing debate among center participants was whether or not interdisciplinary skills could actually be taught and learned, or whether the abilities and interest in such work were intrinsic to one's personality and value system. Some team members expressed the opinion that interdisciplinary skills could not be formally taught, but rather had to be experienced and learned "on the job." To enhance our understanding of this issue, we conducted a Delphi survey of national experts in interdisciplinary research to determine whether they could identify core competencies necessary for interdisciplinary research. After several rounds in this survey, experts agreed upon 17 competencies that were essential for interdisciplinary research.³ We concluded from this survey that these competencies could in fact be taught, at least in part, as part of a formal curriculum. Based on this evidence, we developed a didactic graduate course, "Building Interdisciplinary Research Models," designed to address the core competencies articulated in the Delphi study. This course has been offered twice thus far; once by a lone instructor from the Nursing faculty, and once (and most recently) by a pair of instructors/collaborators from the Schools of Nursing and Public Health. The description and observations below characterize the experience of the instructional team, who will again offer the course in coming years.

Results

Development and components of the course

The course content is based on the 17 core competencies identified in the Delphi survey, which were categorized into three major components—conducting research (six competencies), communication (seven competencies), and interaction with others (four competencies)—as summarized in *Table 1*. The four objectives for course participants are to:

- (1) Demonstrate a working knowledge and beginning mastery of research competencies shown to be important for successful interdisciplinary collaborations.

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Major Area	Competencies
Conducting research	• Use theories and methods of multiple disciplines in developing integrated theoretical and research frameworks.
	• Integrate concepts and methods from multiple disciplines in designing interdisciplinary research protocols.
	• Investigate hypotheses through interdisciplinary research.
	• Draft funding proposals for interdisciplinary research programs in partnership with scholars from other disciplines.
	• Disseminate interdisciplinary research results both within and outside his or her discipline.
Communication	• Author publications with scholars from other disciplines.
	• Advocate interdisciplinary research in developing initiatives within a substantive area of study.
	• Express respect for the perspectives of other disciplines.
	• Read journals outside of his or her discipline.
	• Communicate regularly with scholars from multiple disciplines.
Interacting with others	• Share research from his or her discipline in language meaningful to an interdisciplinary team.
	• Modify his or her own work or research agenda as a result of interactions with colleagues from fields other than his or her own.
	• Present interdisciplinary research at venues representing more than one discipline.
	• Engage colleagues from other disciplines to gain their perspectives on research problems.
	• Interact in training exercises with scholars from other disciplines.
	• Attend scholarly presentations by members of other disciplines.
	• Collaborate respectfully and equitably with scholars from other disciplines to develop interdisciplinary research frameworks.

Table 1. Core competencies for interdisciplinary research identified in Delphi survey.³

of their choice. It also requires them to apply their interdisciplinary skills by working with other class members from different disciplines than their own. The requirements for this project are depicted in *Table 2*.

The seminar-style course is open to graduate students and faculty members in any discipline across campus. It is currently required for all PhD students in the School of Nursing and strongly suggested for trainees in several funded pre- and postdoctoral research training programs. As noted previously, the course is currently cotaught by faculty members from the School of Nursing and the School of Public Health, both of whom are also active in the University's Irving Institute for Clinical and Translational Research, funded in part by a Clinical and Translational Science Award (CTSA) from the NIH. It will be offered for the third time this year, with enrollees who are students and faculty members from nursing, public health, medicine, psychiatry, pediatrics, and biomedical engineering. The syllabus is available upon request from the authors.

- (2) Apply theories and methods of multiple disciplines in developing integrated theoretical and research frameworks.
- (3) Give and receive constructive feedback that will foster efficient and effective information exchange, strong working relationships, and internal commitment among team members.
- (4) Modify your own work and/or research agenda as a result of interactions with colleagues from other fields.

The course content includes a combination of lectures, readings, and case studies designed to assist learners to understand why and how different professional disciplines must work together to generate and disseminate knowledge. Speakers present on the following topics: different conceptualizations of interdisciplinarity; barriers to and facilitators of interdisciplinary research; approaches, benefits, and limitations of collaboration and team science; methods for measuring interdisciplinary collaboration; the intersection of translational and interdisciplinary scientific strategies; and individual researchers' experiences with and evaluations of their own interdisciplinary scientific projects.

There are two primary requirements/work products for the course. The first is an analysis of one of five specific case studies of interdisciplinary research available in the text by Kessel, Rosenfield, and Anderson.⁹ Students are asked to analyze the case study, identify gaps and unanswered questions, and discuss what, if anything, an interdisciplinary approach adds to understanding of the domain. The second requirement is a capstone project at the end of the course that requires students to apply the core competencies to a question

Challenges in implementation of the course

We encountered several institutional challenges when implementing the course during the most recent semester it was offered. Like most universities, our academic offerings and courses are primarily school-specific. For interdisciplinary courses, there must be processes in place to cross-list and cross-register between departments and schools. Several months were required to work out the details, but the course is currently listed in three schools (public health, nursing, and the graduate school of arts and sciences), allowing students to register and receive academic credit for the course from any of these entities. Similarly, the course-syllabus formats of schools vary, so, while the course content is the same, the syllabus takes several forms.

Another institutional challenge was that the course required separate approval by the curriculum committees or other appropriate administrative groups in each school. It is possible that different committees could require different course objectives or modified course content or requirements. Fortunately, that situation did not occur, because the result would create a dilemma for the course instructors, that is, how to incorporate various objectives or requirements for different students taking the same course. Nevertheless, this highlights the concern that there are currently no mechanisms for cross-school curriculum development.

In addition to these institutional factors, finding the right balance in the course has presented an even greater challenge. Despite careful planning, it is still difficult for both the speakers and the students to move outside their disciplinary boundaries.

Sections of Paper

- (1) Describe an important health or health care problem, including, for example, its prevalence, severity, costs, impact on society, etc. (Examples: pediatric obesity, health disparities, hypertension, antibiotic resistance, behavior change in patients or health care providers, long-term care, tobacco cessation)
- (2) Identify gaps in our current understanding of this problem, that is, what is not known that would help to address or add important information needed to resolve the problem.
- (3) Each member of the group will, from his/her specific discipline, develop at least one research aim or question to address this problem. Describe the theoretical underpinnings associated with this aim (i.e., what is your disciplinary perspective).
- (4) Develop one single integrative research aim or question that might emanate from an interdisciplinary perspective.
- (5) Describe the research team that you would ultimately assemble, your rationale for these selections, and what role each member would play.
- (6) Finally, describe potential challenges that might emerge during your project, and the steps that you would take to maximize the potential for a successful interdisciplinary project.

Table 2. Capstone project designed to apply of core competencies for interdisciplinary research. You will work in interdisciplinary groups of two to four people to identify an important health or health care problem that warrants research, assess gaps in what is currently known, and articulate how a research study might be designed to address the problem, first from individual disciplinary points of view and then with an interdisciplinary approach. Each group will also present its findings in class.

The course is designed for a wide range of participants, but the diverse student composition, while on the one hand essential to the purpose of the course, also poses the greatest challenge. During one semester, for example, one class member tended to dominate discussion and other members of the class who were less senior were often passive and silent. Indeed, course evaluations reflected dissatisfaction with the way two course members would “dominate the discussion.” Hence, while the content and exercises in the course are designed to foster and model interdisciplinarity, differences in seniority, personality, and willingness to listen rendered the establishment of trust more difficult.

Such interactions raise questions about the ideal timing of interdisciplinary training in the course of one’s career development, and the composition of the classes. It may be too difficult for junior academics-in-training to interact as class peers with senior professors. While the structure and content of the course is carefully planned to address essential core competencies, the process and student composition of the course also has an important impact on its success.

Feedback from an anonymous course evaluation from the first cohort team-taught by the instructors from Nursing and Public Health revealed that students were reasonably satisfied with the course content as “interesting and intellectually stimulating” (with an average score of 3.13 out of 5), but were less satisfied with their understanding of the “application of the content” (2.87 out of 5). In written comments, students recommended the following changes to the instructional approach:

- (1) More time allocated to the interdisciplinary group assignment.
- (2) Better explanation of the logistics of embarking on and sustaining an interdisciplinary project.
- (3) Additional case studies that focus on successful interdisciplinary initiatives, and less attention paid to “barriers.”

It was because of these comments that the case-study analysis was incorporated as one of the key work products of the course, to enable students to assess the workings of successful interdisciplinary teams. In addition, the course will incorporate readings from a draft manuscript recently posted on the web, entitled “Collaboration & Team Science: A Field Guide.”¹⁰ By their own account, the authors set the goal of “understanding what makes collaborative research teams succeed.” The result

is a practical, well-written manual that provides guidance to investigators who plan to engage in team science projects. Topics addressed in the document include building the research team, fostering trust, developing a shared vision, communication, sharing recognition and credit, and strengthening team dynamics, among others. These useful, concrete strategies may address the concerns of previous students who felt that while interdisciplinary research was a stimulating topic, they still needed more support for how to initiate their own interdisciplinary efforts.

Discussion

While much has been written about facilitators and barriers of interdisciplinary research, the need for didactic training of faculty is rarely mentioned. In the National Academy of Science report, “Facilitating Interdisciplinary Research,” for example, the chapter devoted to the academic researcher describes immersion courses and interdisciplinary curricula for undergraduate and graduate students, but does not explicitly recommend what content would be important to develop interdisciplinary expertise.¹ The chapter cites a survey in which 190 educators responded to the question regarding what could be done to best facilitate interdisciplinary research. Their recommendations included developing curricula incorporating interdisciplinary concepts, participating in faculty-development courses on interdisciplinary topics, and providing student experiences in interdisciplinary research. The recommendations for postdoctoral scholars focused on obtaining skills in new fields of inquiry and seeking mentors in other fields rather than acquiring the types of essential competencies suggested by experts in our Delphi survey.¹

Factors that facilitate interdisciplinary research discussed in a recent Association for the Study of Higher Education (ASHE) Report¹¹ included defining the scope of research projects, fostering personal connections, establishing structural and cultural priorities related to interdisciplinary research, recruiting interdisciplinary faculty, and providing financial support. While there is some evidence from research-intensive universities that culture change conducive to interdisciplinarity may be commencing,¹² preparation of faculty for such changes seems to be assumed. Harris¹³ analyzed documents from 21 research-intensive universities to assess interdisciplinary research and teaching. He summarized evidence of institutional strategies for

interdisciplinarity from institutions' missions and strategic plans and structural strategies such as building facilities, but did not discuss what efforts were underway to prepare and support faculty readiness for change.

Unfortunately, despite the fact that interdisciplinary teams are increasingly evident in science,¹⁴ many institutions seem to have adopted the mantra of interdisciplinary research when, in fact, “many initiatives deemed interdisciplinary are, in fact, merely reconfigurations of old studies—traditional modes of work patched together under a new label.”¹⁵ Kessel and Rosenfield point out that despite the rhetoric and apparent enthusiasm for crossing disciplines “remains relatively difficult to initiate, fund, publish, and sustain.”¹⁶

One recommendation from a 2008 report from the National Science Foundation was to identify specific outcome goals for professional skills development and assure that the training of academicians actually match these goals.¹⁷ The Integrative Graduate Education and Research Traineeship (IGERT) program is the funding program for the U.S. National Science Foundation that has provided funding for interdisciplinary education since 1998. Borrego and Newswander in a content analysis of 129 successful IGERT awards identified five categories of learning outcomes for interdisciplinary graduate education: (1) disciplinary grounding; (2) integration; (3) teamwork; (4) communication; and (5) critical awareness¹⁸ which were quite consistent with the competencies identified in our curriculum. Hall and colleagues have suggested that to move team science forward, it is vital to develop more effective ways to train scientists.¹⁹

Conclusion

Although universities may be poised for interdisciplinary research, strategies for faculty preparation and support are sorely needed. Reducing institutional structural and cultural barriers is necessary but not sufficient to move collaborative research forward. What is needed now are specific tactics and action plans to prepare faculty for what is, for some of them at least, a new way of working and thinking. We urge that institutions that are embracing the concept of team and interdisciplinary science focus not only on the structural barriers and facilitators, but also on specific actions to support the faculty. In an effort to contribute to the advancement of interdisciplinary scholarship, we developed the didactic course described in this paper designed to build on core competencies preparatory for building and sustaining interdisciplinary research models. The didactic course described in this paper is one approach to enhance interdisciplinary research skills of scholars-in-training and faculty, and we recommend that similar efforts be widely implemented.

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