

Interdisciplinary Graduate Education at UNH

Advantages, Opportunities, and Obstacles

William H. McDowell
Professor of Water Resources Management
Faculty Fellow, Graduate School

Executive Summary

Interdisciplinary graduate education uses tools and intellectual approaches from multiple disciplines for two purposes—to address a problem that is intractable when approached from any single discipline and to enrich the programmatic curriculum by drawing on diverse theoretical and methodological frameworks. Over the past several decades, there have been numerous calls at the national level for a restructuring of graduate education that facilitates and encourages interdisciplinary education. UNH is already a leader in several interdisciplinary fields of research, and has the opportunity to become a leader in interdisciplinary graduate education as well. Current interdisciplinary programs are prospering, and the judicious introduction of several additional programs might give the University a portfolio of interdisciplinary programs that highlights our strengths and furthers our emerging institutional identity as outlined in the UNH Strategic Plan. Several concrete actions can be taken to enhance graduate interdisciplinary graduate programs; a general commitment to facilitating interdisciplinary education is likely to be very successful in terms of increased funding and enrollment for graduate programs.

Definitions and Context

Interdisciplinary graduate education involves preparing students in the techniques and approaches of multiple disciplines such that these techniques can be brought to bear on a single problem that is otherwise intractable and/or to bring new and creative perspectives to complex, multifaceted intellectual challenges. Exactly when a field becomes interdisciplinary, and what makes an interdisciplinary graduate program, is open to debate. It is probably best to consider the intellectual landscape as a continuum, with interdisciplinary education and research ranging from the application of a single discipline to a new field (e.g. biophysics, which includes study of topics such as the physics of movement of organisms) to a full-blown integration of related fields. At its fullest, interdisciplinary research and education involves a melding of traditional disciplines into a new field; the emerging fields of neuroscience environmental science, cultural psychology, justice studies, and regional studies are examples of fully interdisciplinary fields.

Can there be credible interdisciplinary degree programs without separate and distinct disciplinary components? I believe that the answer is yes, so long as faculty with the appropriate expertise in individual disciplines are part of the program. In some cases, in fact, the presence of discrete, traditional disciplinary programs may effectively inhibit the development of interdisciplinary programs, and reduce the potential effectiveness and attractiveness of the graduate program. This concern may be especially true at a University with the enrollment and resources of UNH, where limitations to the size of graduate programs can be severe. In some cases, for example, there may not be the critical mass of faculty needed to offer a specific disciplinary graduate program, yet by combining to offer an interdisciplinary degree a very competitive program results.

Current interdisciplinary programs at UNH include the Ph.D. program in Natural Resources, the M.A. in Environmental Education, the M.S. and Ph.D. in Genetics, the M.S. in Materials Sciences, the M.S. in Resource Administration and Management (RAM), the M.S. and Ph.D. in Ocean Engineering, the M.S. options in Ocean Mapping, the Ph.D. in Literacy and Schooling, the health administration option in the M.B.A., the Ph.D. option in Systems Design in Engineering, and the M.A. in Liberal Studies. Of these programs, both Natural Resources and Environmental Education are formal cross-college programs, and report directly to the Graduate School.

The Ph.D. in Natural Resources was established in 1990, with the first students admitted in Semester I, 1990-1991. The program encompasses the natural science, social science, and ethical and philosophical issues associated with environmental science and environmental issues. It has grown to be one of the largest Ph.D. programs on campus, with an approximate enrollment of 40 students. Most students are affiliated with advisors housed in EOS or the Department of Natural Resources; others are affiliated with advisors from a variety of disciplines across the UNH campus. Historically, the program has had very little direct financial support; it is slated to receive a small budget from the Graduate School starting in 2001-2002.

Individual faculty members with sponsored research projects have obtained funding for student assistantships, and the costs of student thesis research, from sponsored research projects. http://www.gradschool.unh.edu/grad_html/catalog/dNRP.htm

The M.A. in Environmental Education was established in 2000. The first 10 students were enrolled in the Summer Institute, a critical component of the degree, during 2001. Student response to the Institute has been enthusiastic, and as the first cohort of students begins to move through the program this fall, the University will be able to begin to judge the program's success. Environmental Education is a collaboration between the Education Department (College of Liberal Arts) and the Department of Natural Resources (College of Life Sciences and Agriculture).

<http://www.learn.unh.edu/MAEnviron/>

Interdisciplinary programs under consideration include a Masters of Science in the Management of Technology (based around the new Hamel Center for Management of Technology and Innovation); a MS in the History of Marine Animal Populations; and degrees that might emerge from the proposed formation of a Center for Social, Behavioral, and Health Sciences.

Value of Interdisciplinary Graduate Education

The value of interdisciplinary education has become increasingly apparent in the past decade. For many fields, the ability to collaborate with those in other disciplines, to integrate information from multiple disciplines, and to apply the most appropriate tools from a range of disciplines is essential to professional success (Golde and Gallagher 1999; COSEPUP 1995). This need for interdisciplinary education results from the need for sophisticated approaches to difficult research questions, as well as the accelerating pace of change in both society and scholarship. In their report, the National Academy argues that this is "the central feature of contemporary life: continuous change" (COSEPUP 1995, p. 83), and that graduate education must reflect this reality by providing students with the tools to reach across disciplines and adapt to change. There have been calls for increasing emphasis on interdisciplinary education for the past 30 years, but progress has been relatively slow at most universities (e.g. Panel on Alternate Approaches to Graduate Education, 1973; Boyer 1990; Miller and McCartan 1990).

Governance and Management of Interdisciplinary Graduate Education at UNH

Governance Interdisciplinary programs housed within a college report to the Dean of that college through their program director. Interdisciplinary programs that are inter-college are formally housed in the Graduate School; the program directors report to the dean of the Graduate School. As with a traditional department-based graduate program, faculty oversight is essential to establishing and maintaining a high-quality educational experience for graduate students. External review and regular, internal self-assessments should also be part of the oversight process. Accreditation and

evaluation of the program by accrediting bodies can also be an important yardstick for measuring program quality in some fields. Interdisciplinary degree programs are led by a program director, who is typically elected by the program's faculty. He or she serves a role analogous to the graduate program coordinator or director of a departmental degree program. Depending on the size of the program, an Executive Committee may also be established to assist in decision-making.

The governance structure for interdisciplinary programs at UNH is typical for other universities with an administratively distinct graduate school. Penn State, for example, has twelve interdisciplinary, inter-college graduate programs that report to the graduate school, in addition to traditional, departmentally-based programs that report to their respective colleges. At Rutgers, many graduate programs are interdepartmental or intercollege. They have various governance arrangements depending on the units involved, with a large number reporting to the graduate school. Universities without a distinct graduate school, where each program reports to the dean of a college, can have considerable administrative difficulties with multi-college interdisciplinary programs.

Penn State: [http://www.psu.edu/bulletins/whitebook/\\$igmenu.htm](http://www.psu.edu/bulletins/whitebook/$igmenu.htm)

Rutgers: <http://gsnb.rutgers.edu/programs.php3>

Budget Under RCM, net tuition dollars generated by graduate students are returned to the student's major, i.e. to the RCM unit in which the major is housed (this is in contrast to the undergraduate model, in which the tuition dollars are returned to the point of instruction). In the case of interdisciplinary programs housed within a college, there is no direct tuition return to the program; tuition revenue is returned to the Dean, who then allocates funds as s/he chooses. For cross-college interdisciplinary graduate programs, the Graduate School is the home of the major, and thus net tuition revenue is returned there. Current policy is that most of the tuition dollars returned to the Graduate School are allocated to the point of instruction; approximately 10% of the net tuition revenue is returned to the major, the interdisciplinary graduate program. These funds are then available to the program to support administration, financial aid, or other items that the program deems appropriate.

Admissions The faculty of an interdisciplinary program operate in a manner analogous to that of a departmentally based graduate program, and directly control the admission process. Typically, student applications are reviewed by individual faculty members, recommendations for acceptance or rejection are made by them, and an Executive Committee elected by the program's faculty makes the final recommendation to the Graduate School regarding admission.

Competitors, Comparators, and Aspirants

To place the current situation and future opportunities at UNH into context, it is useful to examine the interdisciplinary offerings at comparable institutions and those

with which we compete for students. Overall, it appears that UNH is in an excellent position to become a regional leader in interdisciplinary graduate education. The regional land-grant colleges have few opportunities for interdisciplinary graduate education. Most universities in New England have little emphasis on interdisciplinary education, with degree boundaries sharply drawn along traditional departmental divisions. The number of interdisciplinary offerings at UNH is average to above average, but they do not have particularly high visibility.

In the New England region, the state universities have made varying commitments to interdisciplinary graduate education. At the University of Maine, a truly interdisciplinary program in Ecology and Environmental Science (M.S. and Ph.D.) created in the last several years draws upon faculty from 15 departments and fields ranging from philosophy to biogeochemistry. An interdisciplinary M.S. in Quaternary and Climate Studies is also offered, with faculty from four departments. At the University of Massachusetts, interdisciplinary programs are clearly highlighted on the web but are limited to programs in the biological sciences (degree programs in Plant Biology, Molecular and Cellular Biology, and Organismic and Evolutionary Biology) and tend to be more interdepartmental than broadly interdisciplinary. At the University of Vermont, there appear to be few interdisciplinary programs and they are difficult to find. The M.S. and Ph.D. are offered in Material Science within the College of Engineering. The School of the Environment at UVM offers a Ph.D. in Natural Resources that is broadly interdisciplinary (science, policy, ethics). At the University of Connecticut, no interdisciplinary programs are clearly identified, and I could not find any examples. At the University of Rhode Island, there are also few interdisciplinary programs. A degree in Marine Affairs is offered by a Department of the same name, and a degree in Environmental Science is offered by the Department of Natural Resources Science.

Maine: (Env. Science) <http://www.umesci.maine.edu/biology/ees/>
(Quaternary studies) <http://www.ume.maine.edu/iceage/gradprog.html>
Vermont: <http://www.grad.uconn.edu/departments.html>
Massachusetts: <http://www.umass.edu/umhome/academics/gradprog.html>
Vermont: <http://www.uvm.edu/~gradcoll/?Page=programs1.htm>
Connecticut: <http://www.grad.uconn.edu/departments.html>
Rhode Island: http://www.uri.edu/gsadmis/gs_progs.html

A survey of some of the other colleges and universities that serve as comparators to UNH shows that the range of interdisciplinary graduate education is typically fairly limited. Boston College has no interdisciplinary graduate programs. Clemson University has several interdisciplinary programs, including a program in bioengineering that is almost 40 years old. Students in the program take courses such as cell biology, engineering, and orthopedics; both M.S. and Ph.D. are offered. Other interdisciplinary programs at Clemson include Fine Arts in Computing, Environmental Engineering and Science, and Materials Science. Ohio University offers a M.S. in Environmental Studies with biological sciences, physical sciences, and policy. It also offers an individualized M.S. and Ph.D. titled the Individual

Interdisciplinary Program. Oregon State University offers a similar M.A. in Interdisciplinary Studies, as well as broad interdisciplinary degrees in Marine Resource Management, Materials Science, and Environmental Sciences. University of Maryland Baltimore County offers a M.F.A. in Imaging and Digital arts, combining graphic design with computer imaging. The University of Colorado has newly organized interdisciplinary M.S. and Ph.D. programs in Environmental Studies, and a series of interdisciplinary graduate certificates. These interdisciplinary certificates are designed to be an addition to a student's traditional departmental degree program, and range from Biotechnology to Ethnographic and Transcultural Filmmaking. The University of California system has several campuses with particularly innovative programs. Santa Cruz has an interdisciplinary program in History of Consciousness, as well as programs in Environmental Studies and Science Writing and Illustration. Santa Barbara has strong interdisciplinary programs in the new Bren School of the Environment, with a Masters in Environmental Science and Management, M.B.A. in Environmental Management, and a Ph.D. that integrates environmental science and management. From this survey, as well as a review of other universities not specifically highlighted above, it appears that 1) programs in Materials Science and Environmental Science/Studies are two of the most common interdisciplinary graduate programs; 2) that most Universities have several interdisciplinary programs; and 3) that only a few maximize their visibility.

Boston College:

http://www.bc.edu/bc_org/avp/gsas/GSAS/departments.html

Clemson University:

<http://www.grad.clemson.edu/catalog/index.htm>

<http://www.ces.clemson.edu/bio/index2.html>

<http://www.grad.clemson.edu/catalog/index.htm>

Ohio University:

<http://www.ohiou.edu/graduate/iip.htm>

<http://www.ilgard.ohiou.edu/mse/nature.html>

Oregon State:

http://oregonstate.edu/dept/grad_school/GraduateMajors_Minors/graduate_mm.html

<http://www.orst.edu/dept/gradcat/coldep/interdis/intstu.html>

<http://www.oce.orst.edu/mrm/introduction.html>

<http://osu.orst.edu/dept/envsci/>

University of Maryland Baltimore County

<http://www.umbc.edu/academics/degrees.html>

<http://imda.umbc.edu/IMDAinfo/Program.html>

University of Colorado:

<http://www.colorado.edu/GraduateSchool/degrees.html>

http://paos.colorado.edu/faculty/curry_home/ENVSGRAD/index.html

<http://www.colorado.edu/GraduateSchool/certificates.html>

Univ. California Santa Cruz

<http://gradstudies.ucsc.edu/>

<http://humwww.ucsc.edu/histcon/HisCon.html>

<http://zzyx.ucsc.edu/ES/es.html>

Univ. California Santa Barbara

<http://www.graddiv.ucsb.edu/degrees.cfm#23>

<http://www.bren.ucsb.edu/programs/default.htm>

Opportunities and Obstacles at UNH

Numerous opportunities exist to aggressively pursue the creation, improvement, or maintenance of interdisciplinary graduate programs. These include a re-focusing of current programs, allocation of existing University resources to support new initiatives, and obtaining new funding specifically in support of interdisciplinary education. Opportunities for obtaining new funding are particularly important, as they have the highest potential to transform graduate education at UNH. Both public and private funds are available to support interdisciplinary graduate education. The National Science Foundation, for example, has funded the Integrative Graduate Education and Research Traineeship (IGERT) program since 1997. The program was developed “to meet the challenges of educating Ph.D. scientists and engineers with the multidisciplinary backgrounds and the technical, professional, and personal skills needed for the career demands of the future. The program is intended to catalyze a cultural change in graduate education, for students, faculty, and universities, by establishing new, innovative models for graduate education and training in a fertile environment for collaborative research that transcends traditional disciplinary boundaries” (NSF Program Solicitation 00-78). IGERT funds projects in all areas normally funded by NSF, and includes all the individual Directorates.

Private foundations and earmarked donations are also likely sources of support for interdisciplinary education. Two recently funded projects clearly make this point. The Hamel Center for the Management of Technology and Innovation was established in 2000 by a \$7 million endowment to the University. The purpose of the Center is to establish UNH as a leader in providing integrated interdisciplinary management and technology programs for students and professionals, and to educate leaders who will understand both management and technology. The Center will be pursuing development of an interdisciplinary M.S. in Management and Technology. A second project of note is HMAP, the History of Marine Animal Populations. It provides the historical component to the international project “Census of Marine Life,” and involves marine biologists, policy scientists, and historians at three institutions, including UNH. Initial funding of over \$1 million was obtained from the Sloan Foundation. One anticipated outcome of the project is an assessment of the feasibility of developing an interdisciplinary M.S. or Ph.D.

program that focuses on the historical dimensions of marine ecology and population biology. <http://www.cmrh.dk/hmapindx.html>

In my discussions with faculty at UNH and elsewhere, several obstacles have been identified that impede development of truly interdisciplinary programs. At UNH, several administrative obstacles hinder the development of strong interdisciplinary programs. For the initial establishment of a cross-college interdisciplinary program, the necessity of obtaining approval from multiple colleges is a difficult and time-consuming task. The burden could be eased somewhat if there were clear, University-wide guidelines regarding the procedures to be followed, the organizational structure of the written request for a new program, and the timetable that should be followed. Although the graduate school has outlined University-wide criteria and guidelines, it appears that there is still considerable variation in how these criteria are applied at the college level, necessitating the preparation of several versions of the same proposal. Once a program is in place, the University needs to recognize that interdisciplinary courses that are team-taught are different from traditional team-taught courses that do not include multiple disciplines. The first several times that an interdisciplinary course is taught, the faculty will be learning from each other, and should participate in all classes. Thus, there must be flexibility in how credit hours are assigned for teaching.

Interdisciplinary programs may pose special challenges for the promotion and tenure process. With a successful interdisciplinary graduate program, faculty advisors will come from multiple departments or colleges. For an individual faculty member, students in the program may represent a large fraction of their total commitment to graduate education. If the faculty member's home department is not supportive of the sort of scholarship undertaken in the interdisciplinary program, then he or she may have difficulty obtaining tenure. The situation will be exacerbated when a department sees the interdisciplinary program as a threat to the viability of the disciplinary program. These are significant issues with no clear administrative solution. Exposure of departmental faculty to the work undertaken in an interdisciplinary graduate program, and their active involvement and consultation in the initial establishment of the program, are probably the best ways to avoid this problem.

Split appointments to a traditional department and the interdisciplinary program also pose potential problems in the promotion and tenure process. Clear standards will need to be established regarding how the review process will occur, how external reviewers will be chosen, and what criteria will be used to judge the faculty member's scholarship and service.

A final administrative obstacle to interdisciplinary programs is potential competition between traditional disciplinary departments and interdisciplinary degree programs. The source of this competition is largely financial, rather than intellectual. If allocation of resources for graduate education is seen as a zero sum game, then a successful interdisciplinary program, by definition, succeeds at the cost of the disciplinary program. Viewing graduate education as a zero-sum game is remarkably shortsighted, however. A strong interdisciplinary program is likely to shore up traditional programs, given the

greater overall visibility, credibility, and funding for the institution that are likely to accompany the successful interdisciplinary program. At the level of individual faculty members, the conflict between disciplinary and interdisciplinary education is less an issue. Most faculty will judge the success of their graduate program by the quality of students which it enrolls, not whether these students work within or outside a disciplinary department.

Some might argue that interdisciplinary research can flourish without a formal interdisciplinary program. At many universities, interdisciplinary graduate degrees are *ad hoc*, and designed by the student. Without the framework of a formal interdisciplinary graduate program, several significant challenges are likely to be faced by students attempting to undertake an interdisciplinary research program (Golde and Gallagher 1999). They include finding an appropriate advisor, reconciling conflicting methodologies among disciplines, finding appropriate professional outlets for their research work, and developing an intellectual community. All of these barriers to successful interdisciplinary research are largely overcome by a strong interdisciplinary degree program with dedicated and knowledgeable faculty. Perhaps the most intractable of these problems is the need to develop an intellectual community. The surest way to develop such a community is with both formal and informal interactions among faculty and students in the program. Seminars, colloquia, and other formal settings are invaluable. But equally invaluable is the interaction that comes with chance encounters in hallways, labs, lounges, etc. A physical home that fosters these casual interactions is one of the best ways to promote the growth of an intellectual community.

Recommendations

UNH has the opportunity to become a regional leader in interdisciplinary graduate education. This opportunity will only be realized, however, through a concerted effort at all levels of the University. As priorities are developed for faculty hires, building renovations, curriculum changes, and allocation of funding, the question must continually be asked, “will this help foster interdisciplinary graduate programs?” The current Academic Strategic Plan recognizes the importance of enhancing interdisciplinary education at UNH, as do most of our stakeholders. Now we must act in a way consistent with that strategic vision.

The following specific recommendations are made:

- 1) make interdisciplinary graduate education more visible on campus through organization of the web page and graduate catalog, and short vision statements that express our philosophy toward interdisciplinary education
- 2) provide consistent institutional support for existing programs through stable base funding, campaigns to fund endowed chairs, and inclusion of interdisciplinary programs in all phases of campus planning (SARRC, campus master plan, etc.)
- 3) carefully assess the value and likely success of various additional interdisciplinary programs, identifying those which have broad faculty support, a compelling

- intellectual foundation, a strong market for graduates, and which build upon existing teaching and research strengths
- 4) attempt to make guidelines for approval of new graduate programs more consistent among colleges, so that a single proposal can be used in support of a proposed interdisciplinary, multi-college program
 - 5) provide sufficient seed funding to foster the creation of new programs selected based on the likelihood of their success and their centrality to the UNH mission

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