

Comprehensiveness and Interdisciplinarity

Submitted by

NC State Task Force on Comprehensiveness and Interdisciplinarity

A brief history of comprehensiveness and interdisciplinarity

In *Interdisciplinarity: History, Theory, and Practice*, Julie Thompson Klein addresses the origins of academic interest in interdisciplinarity, finding support for the concept in the writings of Plato and the structure of medieval cathedral schools. The earliest efforts to define what kinds of knowledge were characteristic of an educated person were underpinned by the belief that students should specialize in their academic studies, but that the specializations could also reside within a community of general knowledge.

Realizing interdisciplinary goals, however, was difficult. By the late Middle Ages, there was general acceptance of disciplines (in particular, law, medicine, and the arts) and, by the eighteenth century, the growing polarization of knowledge was evident in both the structure of university curricula and definitions of research by academic research societies. In the nineteenth century, the need for a stronger sense of disciplinarity was reinforced by the evolution of modern natural sciences, the general "scientification" of knowledge, the industrial revolution and technological advancement, and agrarian agitation (Klein 1990, p. 21). This separation of fields of knowledge was supported by the modern demand for specialists in industry and the academic recruitment of students to their ranks by faculty in colleges and universities (Klein 1990, p. 21).

The modern period was also characterized by important disciplinary trends (Voskamp):

- institutional establishment of disciplines as discrete components that collectively attempted to define a larger, more comprehensive, system of knowledge;
- differentiation of academic institutions for the sake of progress in individual disciplines; and
- cooperation between individual disciplines, especially of the kind that focuses on solving problems within the larger system.

Many liberal arts colleges sought an antidote to this disciplinary specialization by adopting the goal of educating the "whole person." Ernest Boyer of the Carnegie Foundation for the Advancement of Teaching described this movement as a response to the misplaced vocational emphasis of institutions in the 1920s and the need for a national sense of unity in the beginning and middle of the twentieth century. Harvard, Columbia, and the University of Chicago set the pace for other schools by instituting a general education core curriculum composed of courses

in Western civilization; literature; scientific principles; English composition; and a sampling of the humanities, social sciences, and natural sciences. This revolt against the fragmentation of education by specializations dealt with contemporary problems through more than one discipline and shared values, but it was confined largely to the undergraduate curriculum (Klein, p. 28).

Area studies appeared as a strategy in American universities in the late 1930s and was predicated on a belief in comprehensive, integrated knowledge. A "doctrine of concentration" professed that "the mind advances when wholly immersed in one interest but connections should be made with related subjects" (Klein 1990, p. 27). It sought a restructuring of fields through theoretical perspectives regarding what disciplines had in common (for example, behavioral sciences or cultural geography). This approach altered the methods of social inquiry, but never impacted the cumulative science.

World War II was the impetus for applied interdisciplinary work in research, and by the middle of the twentieth century the "hyphenated sciences" (biophysics, biochemistry, etc.) were well established. Unlike earlier work, this research was mission driven. The Manhattan Project was a prime example of specialists needing to work together to accomplish a specific goal that could not be addressed by a single discipline (Klein 1990, p. 32-34). Established in 1969, the National Science Foundation further reinforced this new definition of interdisciplinary research through its funding practices.

Despite debate over definitions, a fundamental call for integration had emerged. Several terms entered the education and research lexicons through a 1970 conference of the British Group for Research and Innovation in Higher Education:

- "Bridge building" was seen as collaboration between two disciplines, which remained complete and distinct in their disciplinary definitions. This approach was easier to implement because it preserved the character of the traditional disciplines and focused on application.
- "Restructuring" implied changing the parts of several disciplines or developing new organizing principles, concepts, or methods.
- "Transdisciplinarity" addressed overarching concepts that linked disciplines.

At about the same time, the Organization for Economic Co-operation and Development initiated a survey to study what kinds of interdisciplinary activities were being conducted in universities around the world. It found the undergraduate general education model was the most common around the globe and also of work in the United States. In Canada, interdisciplinary activity focused primarily on science and applied research, as did interdisciplinary work in Japan. In France, the social sciences were at the forefront of interdisciplinarity and in the United Kingdom the emphasis was on professional training, usually in the sciences.

In her second book, *Creating Interdisciplinary Campus Cultures*, Klein attributes universities' heightened interest in interdisciplinarity in the twenty-first century to a number of factors:

- the association with bold advances in knowledge, solutions to large societal problems, technological innovation, and a more integrative educational experience;
- the need for organizational flexibility, response to new needs, new educational offerings, and competitive faculty recruitment;
- the desire to establish distinct identities between peer institutions and to secure external funding;
- the economic efficiency gained in the collaborative use of facilities;
- interest in new partnerships with government, industry, and community; and
- increased student interest in solving real-world problems, making connections among fields of study, and developing higher-order critical thinking and collaborative skills (Klein 2010, p. 2).

There is, however, evidence of a gap between the "rhetoric of endorsement and the realities of campus life" (Klein 2010, p. 3). Interdisciplinary initiatives often exist as showpieces within a university, rather than representing the overall culture. They frequently have limited staying power and lack "deep roots within the functions of hard money budgets" (Klein 2010, p. 3).

A 2004 study by the National Academy of Sciences (NAS) identified administrative, funding, and cultural barriers between research and teaching (Klein 2010, citing Collins in *Facilitating Interdisciplinary Research*, 2004, p. 171). The study charged most university administrators with not implementing "systemic reforms for lowering institutional barriers."

The NAS also offered a number of recommendations for fostering a culture of interdisciplinary teaching, learning, and research (executive summary of *Facilitating Interdisciplinary Research*, 2004, pp. 4-6):

For students

- Undergraduate students should seek out interdisciplinary experiences, such as courses at the interfaces of traditional disciplines that address basic research problems, interdisciplinary courses that address societal problems, and research experiences that span more than one traditional discipline.
- Graduate students should explore ways to broaden their experience by gaining "requisite" knowledge in one or more fields in addition to their primary field.

For postdoctoral scholars

- Postdoctoral scholars should actively exploit formal and informal means of gaining interdisciplinary experiences during their post-doctoral appointments through such mechanisms as networking events and internships in industrial and nonacademic settings.
- Postdoctoral scholars interested in interdisciplinary work should seek to identify institutions and mentors favorable to interdisciplinary research.

For researchers and faculty members

- Researchers and faculty members desiring to work on interdisciplinary research, education, and training projects should immerse themselves in the languages, cultures, and knowledge of their collaborators.
- Researchers and faculty members who hire postdoctoral scholars from other fields should assume the responsibility for educating them in the new specialties and become acquainted with the postdoctoral scholars' knowledge and techniques.

For educators

- Educators should facilitate interdisciplinary research by providing educational and training opportunities for undergraduates, graduate students, and postdoctoral scholars, such as relating foundation courses, data gathering and analysis, and research activities to other fields of study and to society at large.

For academic institutions' policies

- Academic institutions should strengthen existing policies and practices and develop new ones that lower or remove barriers to interdisciplinary research and scholarship, including developing joint programs with industry and government and non-government organizations.
- Institutions should experiment with more innovative policies and structures to facilitate interdisciplinary research, making appropriate use of lessons learned from the performance of such research in industrial and national laboratories.
- Institutions should support interdisciplinary education and training for students, postdoctoral scholars, researchers, and faculty by providing such mechanisms as undergraduate research opportunities, faculty team-teaching credit, and interdisciplinary research management training.
- Institutions should develop equitable and flexible budgetary and cost-sharing policies that support interdisciplinary research.

For evaluation of interdisciplinary research

- Interdisciplinary research programs and projects should be evaluated in such a way such that there is an appropriate balance between criteria characteristic of interdisciplinary research (such as contributions to creation of an emerging field and whether they lead to practical answers to societal questions) and traditional disciplinary criteria (such as research excellence).
- Interdisciplinary education and training programs should be evaluated according to criteria specifically relevant to interdisciplinary activities (such as number and mix of general student population participation and knowledge acquisition), in addition to the usual requirements of excellence in content and presentation.
- Funding organizations should enhance their proposal-review mechanisms so as to ensure appropriate breadth and depth of expertise in the review of proposals for interdisciplinary research, education, and training activities.

- Comparative evaluations of research institutions, such as the National Academies' assessment of doctoral programs and activities that rank university departments, should include the contributions of interdisciplinary activities that involve more than one department, as well as single-department contributions, even if this results in double counting.

Today, these efforts to break down disciplinary barriers seem even more pressing than they did in the past. Work by the Knowledgeworks Foundation and Institute for the Future defines the future of learning for the year 2020, describing several trends in the first decade of the century that are likely to shape education (Knowledgeworks Foundation, *2020 Forecast: Creating the Future of Learning*):

- Amplified organization: This trend calls for remaking organizational models through technologies of cooperation that support highly social, collective, and improvisational strategies. It suggests that students will be required to read and write across multiple platforms, collaborate through networked technology, and innovate in non-traditional ways.
- Platforms for resilience: This trend calls for flexibility and distributed collaboration as means for confronting the inevitable failure of traditional systems. "Brittle hierarchies will continue to act in ways that seem institutionally rational but which further destabilize weak, inflexible systems." Institutions must be prepared to adapt and to innovate in response to constantly changing conditions.
- New civic discourse: This trend calls for articulating the importance of community and a new commons in global society. It predicts a new class of "educitizens" who want greater control over their education and who make use of collective learning resources.
- The maker economy: This trend observes increasing tendencies of people to innovate, customize, and create solutions outside the traditional top-down organizational structures. Traditional fields that once provided solutions will now focus on developing tools and systems through which others create their own solutions.
- Pattern recognition: This trend addresses information proliferation and the burden for new "sense making" in an environment of too much information and too little understanding. Visual literacy is now an essential skill and decision makers will need to become more adept at pattern recognition in order to create effective and differentiated responses to the information environment.
- Altered bodies: This trend concerns the intersections between environment and human performance. It argues that schools must instill a sense of stewardship in students and become a nexus for health, environment, community, and learning.

What these trends indicate is that educational institutions must adapt to a new reality in which students and industry demand a broader, more integrated education and workforce.

Technologies will reconfigure the traditional delivery systems for information, requiring not only new skills on the part of all learners, but also access to information and instruction that is not bounded by institutional hierarchies. Traditional computational and linguistic modes of communication will not be sufficient in an increasingly visual world of data. And the

connections between the learning environment and the world outside of school will be more complex and more demanding of integration.

The institutional context for comprehensiveness and interdisciplinarity

It is within this context that NC State University addresses the issues of comprehensiveness and interdisciplinarity in its strategic planning. The C&I task force noted a number of issues that are particular to the university.

The aspirations of a land-grant university

A land-grant institution of higher learning is perfectly positioned to provide leadership in this shifting environment, but it will be necessary to create new collaborative structures both inside and outside the university to meet the demands of the times. It is the feeling of the C&I task force that the longstanding "silo structure" of colleges and departments at NC State University presents formidable barriers to interdisciplinary activity for all but the most tenacious faculty and students. While there are bright examples of interdisciplinary activity, such efforts typically rely on the initiative of individual developers and lack infrastructure for their continuing leadership and development. This is consistent with the history of efforts in other institutions, signaling that bold structural moves will be necessary to overcome the obstacles to development of interdisciplinary programs and research.

The location of the arts within the academic structure of the university

With regard to the issue of comprehensiveness, it was noted in the last Emerging Issues Forum that 42 percent of all new jobs in the United States between 2006 and 2016 are expected to be in creative industries, reflecting that the nation is undergoing a shift from purely analytical work to employment that requires social intelligence and innovation skills. Retaining the current administrative location of fine arts programs in Student Affairs communicates to students that these disciplines are extracurricular and not essential to the comprehensive education of North Carolina citizens. This position is inconsistent with current and historical notions of general education, likely influences the university's ability to attract well-rounded students who also focus on the sciences and technology, and limits the scope of opportunities for interdisciplinary research among the faculty.

Doctoral studies in the humanities and social sciences

The growth of doctoral study in the humanities and social sciences is also essential to the development of a comprehensive university. However, success in gaining approval for new programs is likely to depend on the lack of redundancy with existing programs in other UNC institutions and congruency with the overall mission of the university. Development of these programs, therefore, must arise from the interests and expertise of the faculty; be informed by engagement with other doctoral programs and colleges (inside and outside the university); and anticipate relevant or emerging areas of interdisciplinary activity in the culture at large. This argues against stand-alone disciplinary doctoral programs in the humanities and greater emphasis on programs that span departmental and college boundaries.

The role of basic and applied sciences

Some of the basic sciences, most notably biology, struggle in their identity within the university as they are dispersed and located within colleges that emphasize application. Thus, it is difficult to coordinate course offerings and develop new programs, advise students whose registration might span colleges, and conduct collaborative research under different management frameworks. On paper, these locations appear to make sense. But practically, they frequently represent hurdles for faculty and students to overcome and inhibit the development of nationally competitive graduate programs and basic research in areas that require their participation.

Undergraduate success and ability to change majors

Undergraduate students are currently admitted to colleges based on disciplinary affiliations declared at the time of application to the university. For some students, this is appropriate because pre-college experiences and admissions criteria confirm both interest and aptitude in a professional discipline. For others, poor first-year performance in the chosen discipline and/or indecision about future directions result in lost time in their progress toward degrees or the termination of studies. The penalty for students who change curricular paths is steep because there are few common requirements that make it easy to switch majors to colleges other than those they entered. Furthermore, advising practices are frequently ineffectual or inconsistent among colleges, so many of these students are lost to the university majors in which they might be successful.

Sustaining interdisciplinary faculty research

Interdisciplinary research and educational efforts already exist at NC State University, but they are mostly ad hoc, depend on the entrepreneurship of individual faculty, and are not publicized or recognized. There is no established mechanism for the routine development and ongoing support of interdisciplinary programs. Neither are there any criteria or procedures for discontinuing interdisciplinary efforts that are no longer successful.

Most interdisciplinary efforts take time to develop and show results. At the same time, university procedures, such as those for the review of undergraduate courses, often show bias toward discipline-based offerings and are unable to respond quickly to emerging areas of interest and opportunities for instruction that cross department and college domains. This discourages faculty from innovating in emerging areas outside their traditional training, often resulting in coursework that is artificially narrow or that duplicates offerings in areas of common interest to many disciplines.

Determining peer institutions when setting goals for interdisciplinary work and comprehensiveness

In looking for models in the contemporary educational environment, the task force had two options: to look at peers whose missions and organizational structures match the current profile of NC State University or to identify aspirational peers whose histories distinguish them as responsive to the changing landscape for education and research. For example, should we

look to a Mississippi State University or Clemson for ideas or is our goal to develop the national and global influence of an institution like Georgia Tech?

Ultimately, the task force decided that if the university is to move up in its rankings, it must aspire to be more like many of the institutions in the membership of the Association of American Universities (AAU). At the same time, the task force recognizes that leadership will also require charting new directions and experimenting with organizational strategies that remove barriers and support what energized faculty already do well.

Goals and strategies for establishing a more comprehensive and interdisciplinary campus

Julie Thompson Klein suggests that a key to success in bringing about interdisciplinary change is developing a portfolio of strategies, rather than a single approach or model (Klein 2010, p. 67). She also recommends combining transformative and incremental approaches, as well as top-down and middle-level strategies.

Toombs and Tierney (1991) identified three major approaches to curriculum reform:

- Modification adds new knowledge and practices to existing fields, but change is typically reflected in special programs and compartmentalization is preserved.
- Integration builds connections across disciplines, but typically efforts are simply tolerated and the impact is partial.
- Transformation acknowledges the need to address new issues, pose new questions, and make new demands on the institution. It is a paradigm shift that usually requires a new infrastructure (Klein 2010, p. 68).

Task force member Laura Severin studied the interdisciplinary practices at Duke University and UNC-Chapel Hill. As two of 10 institutions belonging to the Consortium on Furthering Interdisciplinary Inquiry (formed by the University of Minnesota) and the only members in the Southeast, the schools have some standing in the effort to establish a culture of interdisciplinarity.

UNC-Chapel Hill has taken an incremental approach to change but has relatively little centralized oversight for the advancement of interdisciplinary teaching and research. The university has made progress in instituting joint appointments of faculty as the norm rather than the exception. Sometimes these appointments happen upon hiring; at other times they occur later in the faculty member's career. According to Executive Associate Provost Ron Strauss, the university is still having problems formalizing this practice and a review is under way on rules and procedures.

There are eighty-three centers and institutes at UNC-Chapel Hill, most with an interdisciplinary mission and without dedicated space. All are research centers with very little teaching required. Strauss describes some friction between "interdisciplinary faculty" and others over

departmental workload. This is also a problem at Duke (see later discussion). As a way around this, UNC has required all faculty to teach, even those with large grants.

Interdisciplinary teaching at UNC-Chapel Hill happens through "service centers." The university is about to launch an initiative on theme-based or topical courses, with one third to one half of the seats reserved for first-year students. They also do a great deal of cross-listing of courses among departments and FTEs follow the student, rather than the teacher. This competitive model encourages departments to become more involved in interdisciplinary teaching.

Duke University has adopted a more transformative approach. By establishing a vice provost for interdisciplinary studies (Dr. Susan Roth) who works with faculty and administrators from Duke's nine schools, Duke instigates and facilitates interdisciplinary research, collaboration, and instruction. The [Office of Interdisciplinary Program Management](#) is responsible for:

- sponsoring the annual Common Fund competition for interdisciplinary research;
- collaborating with deans and department chairs to overcome obstacles to interdisciplinary teaching and scholarship;
- helping to create structural changes in support of interdisciplinary activities, including new appointments, promotion, and tenure guidelines and hiring procedures;
- working with the university development office to create strategies for interdisciplinary program fundraising;
- establishing school compliance with institute and center oversight procedures; and
- providing information about interdisciplinary programs to the Duke community and external organizations.

Seven Duke University institutes and their affiliated centers contribute problem-focused, interdisciplinary research and teaching, and generate knowledge in the service of society through initiation and facilitation of novel collaborations and programming. An institute might contain an academic undergraduate major, a graduate program, a certificate program, and/or a research center. The university institutes and centers (UICs) also have the opportunity to hire faculty through two different procedures, non-tenure track hires and partnerships with schools in jointly appointing tenured or tenure-track faculty. All of the institutes have space, meeting rooms, and a permanent budget allocation that flows from the provost. This model appears to be sustainable and integrates disciplinary and interdisciplinary discussions.

To encourage collaboration between Duke's schools and departments on the one hand and UICs on the other, the provost designated strategic funds for the joint hiring of tenured or tenure-track faculty through the provost's Common Fund. The program makes available a portion of salary for five years for faculty hired through the partnerships. The funding of the faculty appointments flows down to the schools within which the tenure home sits, normally at a rate of 20 percent per year. For the provost's joint hiring program, all UIC directors are eligible to submit proposals in partnership with a school dean. The partnerships are intended to be equal partnerships, with the faculty member splitting time equally between a UIC and a school. The fund currently provides seven awards of \$20,000-\$50,000 annually for the development of

interdisciplinary projects. Projects must include plans for a deliverable product, which could include a course, grant proposal, program, or some combination of elements. In addition, each institute has a fellowship teaching program, which provides money to teams of faculty for interdisciplinary course development. Duke is also moving toward providing "research professionals" to teams of faculty to work on interdisciplinary grants; these professionals organize grants work for faculty by calling meetings, setting deadlines, and filing proposals.

Duke's transformative approach takes significant financial resources, but the obstacles to establishing a culture of interdisciplinary are not only monetary. Klein has compiled a composite list of barriers and disincentives that appear in the literature on establishing interdisciplinary activities in universities (Klein 2010, pp. 72-73). Collectively, she calls them the "accumulation of disadvantage" to describe their effect on marginalizing units that do not have disciplinary status.

- Organizational structure and administration:
 - Rigid, one-size-fits-all organizational model
 - Discipline- and department-based silos of budget and administration
 - Ambiguous status for interdisciplinary programs
 - Lack of experienced leaders
 - Resistance to innovation and risk
 - Dispersed infrastructure
 - No clear reporting lines for interdisciplinary units
- Procedures and policies:
 - Inflexible guidelines that inhibit approval of new programs and courses
 - Rigid and exclusionary degree requirements
 - Inadequate guidelines for grants management and research collaboration
 - Unfavorable policies for allocation of workload in interdisciplinary teaching
 - Unfavorable research policies for sharing indirect cost recovery from external grants and allocating intellectual property
- Resources and infrastructure
 - Inadequate funding and ongoing support for interdisciplinary units
 - Inadequate faculty lines for interdisciplinary studies and research
 - Competition for funds and faculty between departments and interdisciplinary units
 - Inadequate or no interdisciplinary fellowships and assistantships
 - Inadequate space and equipment and inflexible allotments of use
 - Weak faculty development system
 - Ignorance of interdisciplinary literature and resources
 - Insufficient time for planning and implementing program and project infrastructure
 - Insufficient time to learn the language and culture of another discipline
 - Insufficient time to develop collaborative relationships in team teaching and research
- Recognition, reward, and incentives

- Invisibility and marginality of interdisciplinary research, teaching, service, advising, and mentoring
- Reliance on volunteerism and overload
- Weak networking channels and communication forums
- Ineligibility of interdisciplinary work for awards, honors, incentives, and faculty development programs
- Lack of support at department, college, or university levels
- Negative bias against interdisciplinary work

Discussions within the C&I task force indicate that most or all of these conditions exist at NC State. It is the opinion of the group that unless these are addressed, efforts to foster interdisciplinary work will be unsuccessful.

Klein goes on to identify facilitating strategies and mechanisms with which to counter the impact of these conditions (Klein 2010, pp. 73-74). Among her recommendations are:

- Organizational structure, administration, and policies:
 - Alternative administrative structures
 - Reporting lines with designated responsibilities
 - Procedures for course and program approval, research management
 - Timely interface between new research developments and the entire curriculum
 - Policies for hiring and tenure/promotion [that acknowledge interdisciplinary activity]
 - Policies for research and teaching evaluation, program review, learning assessment
 - Tolerance for risk and innovation
 - Alignment of interdisciplinarity with strategic planning themes
- Leadership, advocacy, and stewardship:
 - Top administrative support at the level of president, provost, and deans
 - General oversight body for interdisciplinary research and education
 - Annual forum for directors of programs, centers, and institutes
 - Strong and experienced leaders
 - Unit-level advisory boards
- Funding:
 - Baseline funding for interdisciplinary programs
 - Dedicated tenure-track faculty lines in programs
 - Cross-departmental budgeting mechanisms
 - Flexible resources at the department level
 - Seed funding
 - Systematic identification of external sources
 - Equitable credit allocations for team teaching and indirect cost recovery
- Infrastructure support:
 - Dedicate space for interdisciplinary activity
 - Pooling of space, facilities, and equipment
 - Interdisciplinary design principles for new buildings

- Communication systems that support collaboration and information flow
- Release time for program and project development
- Faculty development programming (including for graduate students)
- Resource banking of interdisciplinary resources and literature
- Recognition:
 - Visibility in the public face of the campus
 - Counting service for committee work, mentoring, and thesis and dissertation advising
 - Awards and honors in the existing system of recognition and new interdisciplinary competitions
 - Inclusion of interdisciplinary efforts in all annual reports and unit reports

Goals and guiding principles for developing comprehensiveness and interdisciplinarity at NC State University

In light of this overview of strategies, the C&I task force arrived at a series of goals or guiding principles for recommendations:

- Use a comprehensive approach to undergraduate education and consistent advising practices to improve retention rates for students who enter the university not prepared to commit to a specific career path.
- Foster greater collaboration among the sciences and humanities, with particular concern for strategically focusing new doctoral programs in the humanities around distinguishing relationships with the other disciplines and the historic mission of the university.
- Develop greater unity among the basic sciences, particularly the life sciences, which are currently dispersed among colleges that differ in their emphases on fundamental and applied research.
- Reflect the role of the arts in achieving comprehensiveness by relocating it from Student Affairs and to an academic unit.
- Consolidate common arts-related activities and reduce duplication of effort under one academic administration to maximize the use of space and resources.
- Provide a mechanism to incubate and support the development of interdisciplinary faculty and graduate student research, academic program development, and graduate and undergraduate course development.
- Establish a minimal administrative structure that could expand as needed to support specific interdisciplinary initiatives.
- Provide a "safe zone" for faculty development of interdisciplinary activities by reducing procedural redundancies, offering administrative support, offsetting negative consequences for departments when faculty work across disciplines; and guaranteeing appropriate faculty recognition in meeting university, college, and department performance criteria.
- Attract/retain the most gifted faculty who seek to work across disciplines and in emerging areas of interdisciplinary research.

- Encourage understanding of interdisciplinarity for students, faculty and administration through proactive dissemination efforts.
- Promote standards for the acceptance, continuation, and evaluation of interdisciplinary activities/programs through a rigorous peer review process.
- Launch annual, campus-wide courses/seminars, appropriate for a wide range of undergraduate and graduate programs and that reflect emerging, cutting edge interdisciplinary areas, such as sustainability, information visualization, epigenomics, and innovation to inform students of career opportunities. These could be tied to topics chosen for the Emerging Issues Forum.
- Make strategic use of Centennial Campus (possibly Hunt Library) as a hub for interdisciplinary efforts.

Specific recommendations

To achieve these goals, the C&I task force recommends the following specific strategies, which are consistent with "best practices" identified in the literature on interdisciplinarity:

- Explore alternative university structures that would reorganize the current affiliation of faculty with colleges and/or departments.
 - Include University Planning and Analysis in determining the implications for how students enter the university; advising and retention responsibilities; and faculty distribution under alternate structures.
- Establish joint appointments that affiliate faculty with programs outside their disciplinary departments and remove barriers that inhibit their ability to teach and conduct research across disciplines, including
 - Procedures for the development of the Statement of Mutual Expectations that shift faculty responsibilities to cross-disciplinary activities
 - Criteria for calculating faculty workload when team teaching or teaching outside a department;
 - Expansion of the disciplinary scope of participants in the content review of faculty for reappointment, promotion, and tenure when the candidate is working collaboratively or in an interdisciplinary area; and
 - Coordination of cross-disciplinary advising of students.
- Support the strategic development of doctoral programs in the College of Humanities and Social Sciences.
- Shift the reporting lines for visual and performing arts faculty to a college and support the academic development of degree programs in the arts.
- Create a university incubator for interdisciplinary innovations (referred to here as I3) that would achieve the desired outcomes listed above. Logistics would include the following:
 - Establishing a faculty/administrator committee to review current/past interdisciplinary efforts at NC State, including their genesis and historical development, and to also gather information on interdisciplinary efforts at other institutions in the US and elsewhere;

- Establishing a formal mechanism to propose, review, enact interdisciplinary ideas for research, academic programs, graduate/undergraduate courses, as well as to transition successful efforts to the mainstream academic structure, and retire ineffective or no longer needed efforts;
- Communicating decisions to fund/support interdisciplinary proposals from the provost's office and/or the Office of the Vice Chancellor for Research and Graduate Studies in a timely way; and
- Guaranteeing that I3 is flexible and involves significant faculty input through a faculty/administrator advisory committee;
- Providing an annual workshop to highlight interdisciplinary efforts and to propose/review new efforts;
- For successful launches of interdisciplinary efforts, giving faculty appropriate accommodations from their normal duties to lead the new initiative;
- Considering existing NC State units as home(s) or supportive frameworks for I3, including the Graduate School, the Kenan Institute, and the Emerging Issues Forum;
- Setting aside \$250,000 to \$500,000 per year (e.g., from IDC, ETF, Provost's Fund) for I3 proposals/staffing; and
- Drawing on senior faculty expertise in obtaining interdisciplinary extramural funding and curriculum initiatives.

Metrics for evaluating interdisciplinary efforts

- Achievement of the qualifications for AAU membership
- Extent to which NC State investment in ID been leveraged
- Interdisciplinary research proposals submitted/funded
- Interdisciplinary courses developed and resulting enrollment figures/student evaluations
- National and international impact of NC State
- Faculty/Administrator hiring/retention successes, recognition of interdisciplinary efforts in promotion and tenure review
- Undergraduate, graduate, and postdoctoral student recruiting/retention
- Translation of ID efforts into the core academic mission of the university

Examples of efforts by other universities

There are numerous examples of efforts by other universities to address the agenda of comprehensiveness and interdisciplinarity. They range from new approaches to the general education of undergraduates, to the expanded opportunities for interdisciplinary graduate programs, to collaborative research by faculty from across fields. The task force has provided a few examples at various scales (incremental and transformative) for this report. As we go forward, we recommend a comprehensive review of other models that could inspire the ultimate plan and program at NC State.

Arizona State University's new general education model

http://asunews.asu.edu/20101206_newcollegecoursework

Arizona State University has adopted a thematic approach to the general education curriculum. The redefinition of general education is under the leadership of New College Associate Dean Tom Keil, who has worked with faculty from the college's three divisions—humanities, arts and cultural studies; social and behavioral sciences; and mathematical and natural sciences—to create a curriculum that will focus on student learning outcomes, rather than how many credits they compile. By linking together writing, critical thinking, information, and qualitative literacy in interdisciplinary, problem-based courses, faculty have developed a new general education program that will allow New College students to integrate knowledge within and across disciplinary boundaries and discover how forms of knowledge interrelate to produce meaningful solutions to today's challenges.

This year's New College thematic focus is on the subject of food. Discussions, readings, performances, lessons, the introduction of a community-supported agriculture program and even culinary demonstrations have been a part of the experience. Beginning with the spring roll out of the New College general education coursework, students enrolled in Lincoln professor of ethics and religion Martin Matustik's humanities-based course focusing on religion, literature, and philosophy will explore the importance of nourishing both body and spirit. At the same time, they will be able to link their insights in that course to one focusing on the economics and politics of food. In associated classes focusing on composition and quantitative reasoning, students will learn how to apply effective communication and analytic tools to articulate compelling solutions to the challenge of ensuring that the world's population has access to the food they need to end hunger.

University of Arizona Interdisciplinary College

<http://www.arizona.edu/colleges/clas>

The University of Arizona created an entire college devoted to interdisciplinary study. This is in addition to more discipline-specific colleges that maintain traditional specializations in some of in the same fields.

The UA Colleges of Letters, Arts, and Science offers a signature university experience: opportunities for students to explore areas of study that cannot be contained within a single department or college. Consisting of the colleges of Fine Arts, Humanities, Science, and Social and Behavioral Sciences, this new collaborative college will advance innovative programs that cross the boundaries of humanities, arts, and the sciences. It will foster interdisciplinary research and offer undergraduate and graduate students unparalleled opportunities to learn from and contribute to a diverse intellectual community.

Penn State University Social Science Research Institute

<http://www.ssri.psu.edu/general/mission.htm>

Penn State University consolidates social science research under the umbrella of an interdisciplinary research center, offering services to researchers who want to collaborate with others outside their fields.

The mission of the Social Science Research Institute (SSRI) at The Pennsylvania State University is to promote research encompassing the wide range of skills and perspectives that are needed to solve complex social problems. SSRI fosters communication and collaboration across the full range of social science disciplines and provides a shared infrastructure for social science research that enables faculty to conduct high-quality studies. Created by the Colleges of Agricultural Sciences, Education, Health and Human Development, and The Liberal Arts, SSRI is open to all social scientists at Penn State. Uniting outstanding social science faculty across the university, SSRI encourages and supports:

- Research of individual investigators from diverse fields
- Research collaborations across disciplinary lines, across colleges and research centers, and across universities
- Programs to support multidisciplinary graduate training
- Multidisciplinary centers of activity within SSRI that focus on different areas of social concern

In addition to the overall institute, SSRI includes a number of research centers focusing on specific issues in the social sciences. The Population Research Institute (PRI) is one of the foremost research and training programs in the population sciences in the United States. The Children, Youth, and Families Consortium was created to encourage and develop faculty expertise and to promote the kind of interdisciplinary collaboration that could place Penn State in a position of national and international leadership, demonstrating the role a land-grant university could and should play in addressing critical social issues and serving community needs. SSRI also houses the Survey Research Center (SRC), which advances research and training in survey methods and meets the need for state-of-the-art and comprehensive survey services to support social science research.

SSRI offers a range of high quality services to all Penn State social scientists regardless of college or research unit. These include:

- Computing
- Data management and statistical programming
- Survey design and data collection through the SRC
- Geographic Information Systems approaches to social science research questions
- Methodological consulting

Texas Tech University graduate interdisciplinary studies programs

Interdisciplinary studies at Texas Tech University allow graduate students the freedom to design a degree comprising courses from any of 108 graduate programs. Interdisciplinary studies are divided into two categories: pre-designed master's degrees that have already incorporated several disciplines to develop a commonly sought degree, and a self-designed

master's degree comprised of courses that are unique to whatever the student's particular interest may be. Texas Tech offers interdisciplinary master's programs in two formats: pre-designed and self-designed.

The pre-designed programs (housed in single departments) are usually quite tightly structured, requiring that many courses be taken in the department of specialization. Some allow an optional minor (six to nine hours) and may permit it to be in another department. Many programs have required "core" or foundation courses and additional requirements called "tool" courses (languages, computer courses, etc.). Students who do not have an undergraduate major in the field in question may also be required to do "leveling work," to place them on a level of preparation comparable to that of other graduate students in the department. The pre-designed programs include:

- **Applied Linguistics:** A master of arts degree in applied linguistics is offered through the Department of Classical and Modern Languages and Literature. Students may select a 36-hour non-thesis or a 30-hour plus thesis option in either general applied linguistics or in teaching English as a second or foreign language.
- **Heritage Management:** Heritage management emphasizes extensive investigation in the field of heritage management. Graduates from the program are prepared to enhance local, regional, and national sociological and scientific values. The program is configured to allow individual students to emphasize areas of special interests such as heritage administration, conservation, interpretation, education, and use (ecotourism). The program offers both theoretical and practical course work designed to prepare graduates to be leaders in the heritage management field.
- **Museum Science:** This master of science program emphasizes museum theory and practice. Graduates from the program have a comprehensive background in museum studies, preparing them as generalists. In addition, they may elect to become specialists in a number of sub-disciplines, including collection management and care; exhibitions and interpretation; museology; museum management; and curatorship in anthropology, art, ethnology, history, and the natural sciences.
- **Public Administration:** The program for the master of public administration degree is designed to prepare students to assume administrative positions in government and nonprofit agencies with particular emphasis on municipal government and specialty tracks associated with it. Specialty tracks include city management, fiscal administration, public policy analysis, border municipalities administration, and public health administration.
- **Sports Health:** This interdisciplinary program leads to the master of science degree with a major in sports health. The program, which involves sports medicine and exercise science, is designed to provide an academic foundation for the coach, athletic trainer, physical therapist, physician, exercise physiologist, nutritionist, cardiac and pulmonary

rehabilitation specialist, and others associated with conducting sport, exercise, or rehabilitation programs.

- **Wind Science Engineering:** The educational objective of this unique multidisciplinary Ph.D. in wind science and engineering of the program is to provide students with the broad education necessary to pursue research and solve problems related to detrimental effects of windstorms (e.g., hurricanes, tornadoes, and thunderstorms) and to learn to take advantage of the beneficial effects of wind (e.g., wind energy).

The self-defined interdisciplinary programs require students to define their goals in graduate study, drawing up a brief statement of purpose that will be useful in counseling and enrollment. New students are encouraged to peruse the catalog and create a list of courses that appear suitable for their goals (because not all courses will be available at any given time). The program has been developed to allow students to self-design a program of study specifically tailored to their own needs, individual interests, or career goals. There are no required courses, no core or tool requirements, and no majors or minors; although the guiding assumption is that there will be some coherent common principle that structures the program. Students can select from the entire graduate catalog as well as the Law School and Health Sciences Center, with very few restrictions (usually excluding the required "core" courses of a small number of existing majors in "traditional" departmental programs). The master of arts or master of science degree program in interdisciplinary studies gives students the freedom to design a degree that will meet their individual needs in conjunction with an advisor in the graduate school.

Georgetown University Social Sciences Interdisciplinary Research Guide

Georgetown University facilitates interdisciplinary study by offering its law students a Web-based guide to non-legal research materials and how to use them. This research guide is designed to help students, faculty, and other members of the Law Center community in research beyond traditional legal research. In many instances, scholarly and practical legal research calls upon a researcher to broaden their scope into looking beyond traditional legal research tools. This guide is designed to help users find those resources. The Web sites and resources listed in this guide are available to all GULC students, faculty and staff.

Many of the non-legal databases included in this guide contain abstracts of articles, not the full text. The library has a growing collection of non-legal books and some non-legal journals indexed in these databases; however, many articles or reports are not available at the law library, and must be obtained through the main campus library or interlibrary loan.

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