Innovations in Undergraduate Research and Honors Education
Proceedings of the Second Schreyer National Conference

The Pennsylvania State University
University Park, Pennsylvania
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Josephine M. Cambia, Schreyer Honors College
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The Schreyer National Conference Proceedings:
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Preface

I recall the excitement of my undergraduate experiences with research even though it was twenty years ago and the advances that have been made since then dwarf the contributions I stated in my now yellowed thesis. At that time in my life, research was the way to apply the engineering and science topics I was studying in my courses, to do something purposeful and of interest to others, and to be part of a team-responsible for my research while recognizing its place in the bigger picture. The research connected me to my profession in a way that courses did not. Now as I lead my own research projects, I try to engage as many undergraduates as I can. I know the value of framing a hypothesis, creating an approach to test it, discovering its validity and limitations, and reporting the results in appropriate forums. I want more students to experience what I experienced, to be thrilled by their discoveries, to be challenged by the complexities and intricacies of the research topic, to be buoyed up by the steps forward, and to be able to pose the next questions after each stage so as to advance the research.

When Cheryl Achterberg, Dean of the Schreyer Honors College at Penn State, and I began planning the conference that led to this collection of papers, we found that our interests and motives were quite similar around the topic of undergraduate research; thus, we chose it as the conference theme. The conference included keynote papers, short presentations, and thematic roundtable discussions. This compilation of papers reflects all of these forms of presentation and discourse. In the chapters that follow, you will see that they are organized by topic. The first section "Making the Case for Undergraduate Research" includes three papers that set the stage for the remaining sections. The papers provide examples of undergraduate research experiences and justification for embracing research as an extremely valuable active learning experience for undergraduate students.

The next four chapters deal with specific topic areas: Curriculum Models that Include Undergraduate Research, Course Models that Include Undergraduate Research, Undergraduate Research via Service Learning and Outreach, and Learning Strategies that Support Undergraduate Research. The papers in these chapters vary in length-some are full-length papers, while others are 'reaction papers' that resulted from the roundtable discussions that took place at the conference. Overall, this collection is rich with ideas and models that I hope will be helpful to you as you explore ways to include or expand the undergraduate research opportunities at your university or college. The proceedings close with the section "The Next Challenges," which includes two papers that place challenges before us to consider as we create programs and opportunities to engage undergraduate students in research.

Renata S. Engel
Director, Schreyer Institute for
Innovation in Learning

I.   Making the Case for Undergraduate Research

In this section Josephine Carubia and Renata Engel introduce the topic of undergraduate research by focusing on the current definitions of scholarship. They place those definitions in the context of specific disciplines and research opportunities. Next, two distinguished educators engage scholarship and also reflect upon the reasoning and purposes that support the practice of undergraduate research. Alan Jenkins probes data on the impacts of undergraduate research in an attempt to answer the most preliminary and crucial questions of whether educators should support this experience, and if so, why and how. He starts out a skeptic and slowly persuades himself, along with his readers, of the value of undergraduate research. Rodney Erickson, by contrast, begins on a positive note and builds evidence thoughtfully on the beneficial outcomes of undergraduate research on students, faculty, and the university. Erickson draws upon many years of experience to offer evidence of how undergraduate research motivates students, guides them in finding relevance, and helps them develop strategies and relationships that lead to deeper and deeper understandings. Together, these three papers establish a frame and a context for the more specific studies, case histories, and narratives that follow.

INTRODUCTION:
UNPACKING THE RESEARCH ENCYCLOPEDIA

JOSEPHINE M. CARUBIA, RENATA S. ENGEL
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SCHOLARSHIP - THE FOUNDATION OF HIGHER EDUCATION

Ernest Boyer's work is the touchstone for most contemporary discussions about research and scholarship and is as pertinent to undergraduate research as to the professional research of faculty. This introduction will begin with Boyer so that his definitions and philosophies may inform additional discussions concerning the epistemologies, methodologies, and hierarchies embedded within the creative human pursuits we call research and scholarship. Boyer's work may be valued as much for the vocabulary it endows upon this conversation as for its impact on the values and purposes of higher education. His articulation of terminology for a range of creative pursuits under the umbrella of scholarship was brilliant in its timing and effects. In 1990, a decade of discontent and reflection culminated in the publication of Boyer's *Scholarship Reconsidered: Priorities of the Professoriate* by The Carnegie Foundation for the Advancement of Teaching. In this short volume, Boyer addressed his conviction that "scholarship is at the core of academic life" (Boyer, 1990, p. 1) and that the vitality of the academic professions required an expanded notion of this crucial element. Reflecting on the history of educational commitments as well as years of observation, data from faculty, and conversation with other educational leaders, he formulated a definition that encompasses four functions of scholarship and that is responsive to both academic and community purposes.

Boyer reminds educators that *research,* the function of scholarship he designates *scholarship of discovery,* is a relatively new and comparatively narrow aspect of the range of activities of those we call *scholars.* For several generations it has been the most highly valued work of the university. Conceived primarily as an individual activity where breakthroughs are achieved or innovative models are developed, the scholarship of discovery advances new knowledge that transforms disciplines and, quite often, even our lives.

By naming three additional functions of scholarship, *Scholarship Reconsidered* expands the legitimacy of faculty work, and thus of academic experience, to three additional areas. The *scholarship of integration* is work valued for its ability to "give meaning to isolated facts, putting them in perspective ... making connections across the disciplines, placing the specialties in larger context, illuminating data in a revealing way, . . .[through] critical analysis, interpretation," and so on (Boyer, 1990, pp. 18, 19). The work of integration often stretches inquiry across disciplinary boundaries in search of explanatory models, and can lead, according to Boyer, "from information to knowledge and even, perhaps, to wisdom" (Boyer, 1990, p. 20). If laboratory science is the paradigmatic case of discovery, scholarship in literature or philosophy might provide the paradigm for integration. These distinctions may be vital in understanding why scholars in the humanities and arts respond less frequently to a call for proposals on "Undergraduate Research" than their colleagues in the sciences.

The third function of scholarship is *application.* This function is most often observed in scholarly work where knowledge is created through solving actual problems experienced in communities. The scholarship of application may not look familiar because it transcends the

walls of the classroom and even of the university. It may be accomplished by individual scholars or by teams, and the reciprocal relationships of community engagement will lead some to confuse this function of scholarship with community service. The paradigm of bioengineering (or medicine in general) might be a helpful model. It is only through a reciprocal relationship with actual persons needing artificial joints that scholars may learn enough to develop a useful apparatus. Physician and writer Atul Gawande writes eloquently about "The Learning Curve" of physicians, especially surgeons, where the application of scholarship is necessary to the process of gaining expertise and then further advancing knowledge of how to help people live longer, healthier lives. Gawande's contributions to the scholarship of the health professions are similar to the humanities in that they integrate and interpret practices in the field with their effects on the profession and on the community in a reflective narrative mode including personal experience and case histories.

In designating *teaching* as the fourth function of scholarship, Ernest Boyer draws upon the history of educational institutions in this country. Until well into the nineteenth century, teaching was of paramount importance and was accorded the highest respect. The focus was on students and their "intellectual, moral, and spiritual development" (Boyer, 1990, p. 4). The shift from teaching to research came as the nation struggled to develop industrial and economic mastery in the world of the nineteenth century. The scholarship of teaching, which includes "transforming and extending knowledge," is the only guarantee of the "continuity of knowledge" (Boyer, 1990, p. 24). Our focus at the Schreyer National Conference and in this publication upon pedagogy and strategies for enhanced student learning through research is a contemporary commitment to this same principle. Scholars in this volume ask questions about how undergraduate research and scholarship enhance the learning of students and enhance education as a cultural resource, and ultimately, about how these commitments contribute to communities.

In addition to articulating the categories of scholarship that have had such a profound impact on education in the ensuing decade, Boyer infused education with two additional values: a recommitment to engaged education and the motivation to create strategies to document and evaluate scholarship as he defined it.

Ernest Boyer died in December of 1995. His final work of scholarship was published in the first issue of the *Journal of Public Service & Outreach* in 1996. In "The Scholarship of Engagement," Boyer reiterated the value of all four functions of scholarship, especially in view of the tendency for funding and other resources to be allocated disproportionately to the scholarship of discovery. He urged universities and colleges to "become more vigorous partner[s] in the search for answers to our most pressing social, civic, economic, and moral problems" (Boyer, 1996, p. 11) and to recognize the need "not just [for] more programs, but a larger purpose, a larger sense of mission, a larger clarity of direction . . . [and for] creating a special climate in which the academic and civic cultures communicate more continuously and more creatively with each other" (Boyer, 1996, p. 20).

RESEARCH ON UNDERGRADUATE RESEARCH

A commission named for Ernest Boyer and headed by Shirley Strum Kenney issued a series of recommendations in 1998 *(Reinventing Undergraduate Education: A Blueprint for America's Research Universities),* one of which emphasized the value of engaging undergraduate students in research as a strategy for learning. Now, three years later, many universities are taking these recommendations seriously as reported in a follow-up study noted in

The Chronicle of Higher Education in March 2002. All of the universities that were surveyed reported having opportunities for undergraduates to engage in research, especially in "laboratory-science research, including in biochemistry and psychology, and in engineering" (Wilson, 2002, p. A12). The Boyer Commission Report also served as a catalyst to create a national organization, The Reinvention Center at Stony Brook, which focuses exclusively on the undergraduate experience at research universities. This group recently focused its attention on one of the elements in the Boyer Commission Report-integration of research into undergraduate education. In her opening remarks to the Reinvention Center's "Spotlight on Undergraduate Research," Nancy Weiss Malkeil states, "No matter how the opportunity is packaged - the senior thesis at Princeton, undergraduate research opportunities at MIT or Stanford, or any of the many modes at other colleges and universities - the research experience challenges and stretches students in ways that cannot be replicated even in the most rigorous and demanding course work."

Many scholars have taken up the challenges Ernest Boyer brought to public attention. For example, Kerry J. St'rand discusses "Community-Based Research as Pedagogy" in the Fall 2000 issue of the *Michigan Journal of Community Service Learning.* Responding to Boyer's call for scholarship that responds to community needs, Strand defines community-based research as "collaboration between trained researchers and community members in the design and implementation of research projects aimed at meeting community-identified needs" (Strand, p. 85). If community leaders can present scholarship that systematically documents a lack of, for example, retail stores selling nutritious foods at reasonable prices compared with suburban neighborhoods, then perhaps agencies can be persuaded to offer incentives to attract a more adequate grocery store to the neighborhood. The same holds for community-based research on transportation, housing, education, childcare, and additional contributing factors to the conglomerate of conditions called urban poverty. Strand, like Boyer, suggests that engaged scholarship is a fruitful learning laboratory for students. Strand is explicit about the added possibilities for student learning in the two fundamental areas of methodology and epistemology.

Ernest Boyer's work has been extended into the critical areas of documentation and evaluation by his colleagues at the Carnegie Foundation. Charles Glassick, Mary Taylor Huber, and Gene I. Maeroff published *Scholarship Assessed: Evaluation of the Professoriate* in 1997 to assist universities in efforts to incorporate Boyer's earlier work on the legitimate functions of scholarship beyond discovery. Glassick has argued more recently that "It's one thing to give scholarship a larger meaning, but the real issue revolves around assessment" (Glassick, 2001, p. 24). Glassick, Huber, and Maeroff tapped into discussions on faculty performance and evaluation as well as on the alignment of the process of faculty review with institutional goals. They sought to extract a consistent set of qualities or criteria that would apply to scholarship of all forms and functions and help institutions articulate standards and maintain rigor. They discovered six features that could be applied across all disciplines and endeavors: clear goals, adequate preparation, appropriate methods, significant results, effective presentation, and reflective critique. The set is flexible enough to admit discipline-specific criteria in each category and simple enough for even novice scholars to apply and gradually learn to use with greater sophistication. *Scholarship Assessed* provides sub-questions in each category to guide an initial attempt to use this standard for evaluation, and Glassick comments that documentation should follow the six criteria to record evidence of achievement in each category.

UNDERGRADUATE RESEARCH - DOES ONE SIZE FIT ALL?

Alan Jenkins of Oxford Brookes University in the United Kingdom takes up another issue raised by Ernest Boyer and thinks it through to his own conclusions in this volume. Boyer suggested that all teachers should be engaged in scholarly work, and Jenkins refines the question to ask whether there is a direct benefit to student learning when their teachers are also engaged in the scholarship of discovery, more commonly called *research.* Jenkins begins by answering his own question in the negative because research is often limited to a select elite faculty within particular types of universities and because mentoring student research is a very time-intensive endeavor, further limiting the numbers of participants who might benefit. Through the course of his article in this volume, however, Jenkins reasons to a nuanced conclusion that under certain conditions, students can, indeed, benefit from carefully constructed programs where research-based learning is successful. He issues many cautions, and ends with an exhortation to consider how "these programs can become what <u>all</u> students ... experience" (Jenkins, p. 21). Jenkins concurs with Strand and others in urging faculty to use research to enhance student learning about methodology and epistemology in the process.

Strand, Jenkins, and many others, including Barry Checkoway at the University of Michigan, have raised issues of methodology and epistemology in any number of contexts related to the academic "pursuit" of knowledge. These issues cannot be separated from issues of ethics. From the perspective of a faculty member teaching social science methodology, Strand questions the model of the "expert" as one who always has the exact right answers, solutions, and strategies. She encourages students to approach community-based research with openness to learning from relatively unstructured methods such as focus groups and to collaborate with community members on the design of research, on what kinds of knowing will be surveyed, and on the forms and means of disseminating the knowledge gained. She wants her students to understand standard and alternative methodologies and to appreciate "social research not just as a collection of methods and strategies, but also as the way that knowledge about the social world is produced" (Strand, 2000, p. 87).

Through her course, Strand also invites students to examine critically the epistemological assumptions that underlie scholarship. She challenges the notion that knowledge is "value free" and engages students in contemplating questions such as these: "For what purpose do we produce social scientific knowledge? Who controls the production of knowledge and who owns-or ought to own-the knowledge that is produced? What are some consequences of that control?" (Strand, 2000, p. 90) Implicit in Boyer's appeal for more engaged scholarship like that of Strand's students is a call for scholars to raise more ethical issues around research. We are being asked not merely to question a hierarchy of knowledge that favors the function of discovery scholarship over other functions, but also to ask that the values and assumptions behind a broader range of activities generally called "research" be explored. Strand culls five features that seem to be common to an enhanced ethical approach: "Value of research rests on potential for positive social change; Research methods are sensitive to particular people and situations; Experiential knowledge is given legitimacy; Power and control over research process is shared; Knowledge is collectively owned by participants and researcher" (Strand, 2000, p. 92).

Even though Strand's model is based on social science research, some of the same principles and certainly the intent can be carried across disciplinary boundaries. Geographers Jones, et aI., articulate a similar commitment in a discussion of feminist methodology in geography: "knowledge born of the research process is a joint, yet always unequal, creation of

both the researcher and the research subjects ... [and] investigators [must be] sensitive to the ways that the unequal power relations between researcher and researched can influence knowledge creation" (Jones, 1997, p.122). Barry Checkoway discusses strategies for faculty, students, and universities to "challenge the prevailing positivist paradigm" of research by "reconceptualizing research in [a] way [that] raises methodological and epistemological issues" (Checkoway, 2002, p. 13).

In a recent issue of *The Chronicle of Higher Education,* faculty members in medicine and law also raised similar issues in a *Point of View* article on "Doing Research Well by Doing Right." Jeffrey Kahn and Anna Mastroianni comment that research ethics demand far more than just meeting the standards of regulatory compliance in effect at most universities. They cite the "significant differences in power, understanding, and potential profit" between the researchers and subjects as compelling reasons why researchers must take responsibility for protecting subjects over and above compliance standards. These researchers claim that "ethical commitments [are] at the core of research" (B24).

Thus far, we have observed that ethics and common criteria for evaluation may transcend the disciplines and functions of scholarship. Scholars in all disciplines can also draw attention, as Checkoway, Strand, and others do, to the methodologies and epistemological assumptions that are often taken for granted in their disciplines. Those are substantial and profound similarities across functions and disciplines, but somehow the *differences* in scholarship from discipline to discipline are most often what we hear about. Ernest Boyer endeavored to describe a model of scholarship that would encompass all disciplines in its breadth. It should be possible for each discipline to include all four functions, but Boyer recognized that the hierarchy of value surrounding the functions has a historical correlation to the disciplinary structures of knowledge within the academy.

One way to track the value associated with areas of scholarship might be to look at research funds from government and business awarded to scholars in different disciplines. It is possible, but very difficult to map the functions of scholarship onto the departments and colleges of a university structure because specific departments may have "pure science" specialties within a college that focuses on the application of discovery knowledge, and vice versa. However, we might make a few general correlations and thus see how research dollars may indicate the value that certain sectors of society place on each type of scholarship. The figures used here are for The Pennsylvania State University in the year 2001 *(Annual Report of Research Activity 2001).*

College of Science (Discovery)	$65.3 Million
College of Engineering (Application)	71.5 Million
College of the Liberal Arts (Integration)	17.7 Million
College of Education (Teaching)	7.8 Million

Any mapping is likely to be misleading because many funding agencies, particularly the National Science Foundation, have expectations of discovery, application, and education interwoven in the funding of a single proposal. Consider the highly successful Research Experiences for Undergraduates Program at NSF in which students engage in a variety of research experiences that are integrated with seminars, instruction in research methods, laboratory and communication skill development, as well as exposure to applications. Nevertheless, certain disciplines lend themselves to certain scholarship paths. It is the integration

and extension of findings into the areas of scholarship that allow the advances to have an even greater impact.

The drastic difference in levels of funding corresponds to a broad context within which knowledge is generated and disseminated, including political and economic agendas, attitudes, and policies concerning research and scholarship. Additionally, the expense associated with laboratory-intensive activities and constant reinvestment in updating technology can be overwhelming to those doing interpretation and analysis activities which require less space, fewer utilities, and less complex (costly) equipment. Applied scholarship is closest to the opportunity for a return on investment through commodification. Still, the paradigm of discovery research is the standard recognized and publicized most broadly. Social science research might be the second most recognized model, while students in the humanities are often quite puzzled by the challenge of doing "research" in their own fields given these two prevalent models. Part of the problem may be that faculty sometimes speak of "research" without qualifying what the term means within their own discipline, assuming that students will have absorbed this knowledge through their coursework. Boyer's articulations of the functions of scholarship have not fully infiltrated the professional literature in the disciplines, so the term "research" is often used for all types of scholarly work, with the possible exceptions of creative work in the arts and of some innovative forms of technological production. One practical strategy might be for all disciplines to offer methodology courses for both graduate students and undergraduate students and to begin with a broad overview of paradigms of scholarship including Boyer's.

Many scholars of the culture of Higher Education have considered these issues. In conjunction with the National Humanities Alliance and the Association of Research Libraries, the Knight Higher Education Collaborative sponsored a Roundtable on Scholarly Communication in the Humanities and Social Sciences in March of 2001. The assembled scholars reflected on the issues and problems generated by the "tendency throughout the latter half of the twentieth century . . . to value the practical advances in science, medicine, and technology over scholarship in literature, languages, history, philosophy, politics, and art" (NHA, p. 3). The work of scholarship in the humanities is often reflective and interpretive work conducted by individual scholars who "develop, extend, or refine the state of thinking in a particular subject" (NHA, p. 3). A key problem is that this work may seem "insular," especially if scholars do not make determined efforts to reach broad audiences outside specific disciplinary societies.

CLOSING COMMENTS

The recent attention given to undergraduate research by the sample of scholars cited in this paper is indicative of the increased value placed on life-long learning and inquiry. In the preface of a recent publication *(At the Interface of Scholarship and Teaching: How to Administer Institutional Undergraduate Research Programs),* Larry Wilson states, "When this objective [independent learning] is coupled with the goal of providing students the ability to make original contributions to the knowledge of their fields, the stage is set for an active learning environment that is at the core of the undergraduate research and investigative studies movement (Hakim, 2000)."

Beyond the personal advances in understanding and the dissemination opportunities for students, the real benefit is realized because of the integrative nature of research. Yes, research is focused and involves deeper insights, deeper learning, and understanding of more complex relationships, but done well, it also requires the researcher to consider the bigger picture, how the

new understanding will advance policy, or what the implications of a new material may be on the environment. Furthermore, the bigger picture aspects cut across disciplinary boundaries. In an essay on "Globalizing Literary Study" in a recent edition of *PMLA (Publications of the Modern Language Association of America)* Edward Said, past president of MLA and noted scholar and public intellectual, comments on the challenge facing the humanities and social sciences to create new means of scholarly work that more immediately addresses a world of vast wealth and starvation where sanctioned or ignored mass killings are commonplace. Said notes the "fragmentation and self-cancellation of the humanities as incapable, unwilling, to offer . . . resistance" to these circumstances despite many books debating the discourse in which they may be discussed (Said, pp. 64-68). Said traces a key component of the problem to the view in western culture that science (the pursuit of truth) and the humanities (in pursuit of beauty or the "good") are separate and unequal. "This split ... produced the images of the value-free researcher in one area and ... the detached humanist in the other" (Said, p. 67). Said clearly finds both approaches to be lacking in local grounded engagement with the circumstances of persons struggling through specific upheavals. He asks for a renewed commitment by intellectuals to be aware, not only of their area of expertise, but also of how it connects to the big picture "of collective human history [and] global patterns of dependence and interdependence" (Said, p. 68).

Edward Said calls for scholars in the humanities to integrate their work with the actions and contexts of real people inhabiting the earth. This resonates with Boyer's call for a renewed civic purpose in all of the functions of scholarship. It is scarcely possible to read any general discussions about education, research, or scholarship without encountering these calls to engagement and a renewed civic mission. Environmental concerns, starvation, poverty, disease, genocide, war, and even something so trivial by comparison as increasing levels of stress all point to the need for a concerted effort on the part of all scholars to articulate purposes in terms that can be easily understood by undergraduates and the general population. The research mission of our great universities must be accessible to all as a sustainable public resource.

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10

HOW (OR WHETHER?) TO INTEGRATE RESEARCH INTO CLASSROOM TEACHING FOR ALL STUDENTS AND ALL HIGHER EDUCATION INSTITUTIONS

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ABSTRACT

The chapter starts by posing a range of questions re teaching/research relations and, in particular, asks whether such is only for selected students in elite/wealthy institutions. The issues are complex and before considering the evidence some of this complexity is discussed-for our answers to the chapter's central questions depend in part on how we 'define' 'undergraduate research' or 'linking teaching and research.' The arguments, including research evidence that undergraduate research should be for selected students, are then presented, including a major review of the research which concludes that the 'common belief that teaching and research are inextricably intertwined is an enduring myth.' Then such questioning views are countered by arguments and evidence from recent research that suggests more positive relations between teaching and research. Other factors are considered including the view that universities should develop all students' understanding of the 'supercomplexity' of the world being continually reshaped by research. In conclusion I present my current attempts to answer the questions posed in the introduction--in particular, outlining ways and the extent to which research-based learning can be extended to all students (and staff) in higher education.

> *Schreyer National Conference; Innovations in Undergraduate Research and Honors Education: Join the national dialogue on honors education and learn about-integrating Teaching and Research (and) Models of Undergraduate Research.*
> *(Brochure announcing the 2001 Schreyer Conference).*

> *We must conclude that the common belief that research and teaching are inextricably intertwined is an enduring myth. At best, research and teaching are very loosely coupled.. The strongest policy claim that derives from this meta-analysis is that universities need to set as a mission goal the improvement of the nexus between research and teaching... <u>The aim is to increase the circumstances in which teaching and research have occasion to meet, and to provide rewards not only for better teaching or for better research but for demonstrations of the integration of teaching and research.</u>* Hattie, J. and Marsh, H. W. (1996, pp 529-533) *(emphasis added).*

INTRODUCTION AND CENTRAL QUESTIONS

Is student research and research-based student learning for *all* students at *all* higher education institutions or are such just for elite students (and elite staff) in selected institutions? This is the central question or rather questions addressed in this paper. For are student research and research-based learning one and the same thing, and can one have research-based learning

when most/many of the staff are not actively or centrally involved in research? The following quotations seemingly demonstrate 'two' contrasting positions on these issues.

The American scholar, Burton Clark (1997, 242), has argued that "research activity can and does serve as an important mode of teaching and a valuable means of learning." He further argues that *"Student involvement in research is an efficacious way to educate throughout the education system the great mass of students, as well as the elite performers,* for the inquiring society into which we are rapidly moving" (emphasis added).

Yet, here are extracts from selected anonymous web sites for US Honors Programs, which clearly see student research as a distinctive and selective characteristic of Honors programs:

- "Learning community composed of talented and highly motivated students;"
- "Honors contract, independent study, thesis;"
- "40,000 dollar annual research grants to undergraduates;"
- "You will be admitted if you have a 3.5 G.P.A. of twelve or more academic units...You have to maintain a 3.5 G.P.A. to stay in the College;"
- "Increased faculty to student interaction through research opportunities."

Clearly, these institutions see such research-based activities as being for highly selected students--and these institutions are all Carnegie 1 research universities and/or rich private institutions. Implicitly, such modes of learning and such programs are not, thus, for the broad mass of students on most or all US campuses.

AN INTERNATIONAL PERSPECTIVE

Clearly, these issues are central to many of the discussions on US higher education. But these are not just 'parochial' US concerns. In many state systems--particularly in the 'first world' economies of the European Union and Australasia--one can see individual academics and institutional and national policy makers seeking to grasp their complexity. They are certainly central to current discussions in my institution (in US terms, effectively a 'comprehensive' university) as we seek to formulate 'deliverable' and 'relevant courses.' Our stated institutional commitment is as follows:

> The University is committed to enhancing the links between research activity and teaching in order to ensure that students and staff benefit from learning and teaching in a research environment. (Oxford Brookes University [UK] Learning and Teaching Strategy (January 2000) http://www.brookes.ac.uklbrookes/LTS.html.)

That description suggests such 'research- based' education is for all students (and all staff?). But, at present we are still grappling with how to deliver such a brave commitment. Anyway, perhaps statements such as this are just 'mission speak,' dreamed up by the University marketing department and certainly not deliverable. Would such a strategy be deliverable for all students and all staff in all institutions in your state?

UNPACKING SOME OF THE COMPLEXITY

The questions raised above are immensely important, for they raise central issues as to what are, and what should be, the educative roles of universities. They also ask hard questions as

to what can be effectively delivered in our respective institutions, given current levels of funding and how universities and national systems organize research and teaching. Related to this, as we investigate what others have written and researched, we will find many studies and much complexity (Hattie and Marsh, 1996 and Jenkins, 2000). As has been implicitly indicated above, some of the complexity can be better seen if we distinguish, somewhat crudely, between certain types of programs/forms of student learning that promote *integrating teaching and research (and) models of undergraduate research.'* Such might include (undergraduate) students,

- Learning how knowledge (in their discipline) is constructed and reconstructed through research, and is often tentative and contested;
- Being taught and assessed in ways that support them in understanding the nature of knowledge and research questions in their discipline or inter-disciplines;
- Being taught-including in year one-by staff who are currently carrying out high-level research;
- Being taught-including in year one-by staff who are currently aware of (and contributing to?) the scholarship on their discipline and/or on the pedagogy of their disciplines;
    - o Where the form of learning parallels the research process in that discipline;
    - o Where the curriculum equips students with the techniques to carry out research;
    - o Where students are supported through the formal and informal college curriculum to transfer the research knowledges and skills they have gained to the worlds of life and employment beyond college.
    - o Where (significant) elements of the curriculum involve (selected) students carrying out research projects-supported by (selected) staff;
    - o Where the institutional and/or department culture is one that integrates inquiry by staff and students.

We also need to consider at what 'level' the integration between (staff) research and student learning is achieved. Such issues of level include:

- Whether we are considering undergraduate or postgraduate courses (and, at postgraduate level, we need to distinguish between taught Masters … to Post-Doctorates). In this chapter, my main focus is at the undergraduate level, as that is the area where the issues are most complex and under debate;
- At undergraduate level, are we mainly focusing on advanced level courses or is our focus inclusive to all 'levels?'
- Does the integration occur at the level of the individual academic, each of whom is active in both research and integrating that into their teaching? Or, does the focus of integration occur from the staff perspective in the course team or department (or even at the international level of the disciplinary community)? From the student perspective, does integration occur in each module or program or is the integration over the whole degree?

THE ARGUMENTS FOR SELECTIVITY

There are strong reasons why such student research/research-based learning is for the few. Such reasons include: a) the evidence from research that students don't seem to benefit from staff research; b) the evidence that, in most political systems, money for research in universities is highly concentrated; and c) the rise of mass higher education systems.

The Evidence from Research

While many academics profess the value to student learning from staff (involvement in) research, the evidence from research is more questioning. Thus, many studies have analyzed the relation/the correlations between staff research productivity and student ratings of individual staff as instructors. Terenzini and Pascarella (1994, p. 30) concluded from these studies: "That good teachers are good researchers is a myth and that, at best, the association between ratings of undergraduate instruction and scholarly productivity is a small and positive one, with correlations in the .10 to .16 range." In a meta-analysis of these studies of university academics, Hattie and Marsh (1996, p. 529) considered 58 research articles contributing 498 correlations and found that the overall correlation was 0.06. "Based on this review we concluded that the common belief that teaching and research were inextricably intertwined is an enduring myth. At best teaching and research are very loosely coupled" (Hattie and Marsh, 1996, p. 529) (emphasis added).

Astin (1993) and Astin and Chang (1995), in a study of 200 US four-year undergraduate colleges, using sophisticated measures of student development, concluded that "a college whose faculty is research-orientated increases student dissatisfaction and impacts negatively on most measures of cognitive and affective development." Astin (1993, p. 363). The few institutions in this study that scored high on both "teaching" and "research" were a few rich, private colleges.

It was on the basis of these and related studies that one policy-orientated review of research concluded that "there is little functional interaction between undergraduate teaching and discovery research." (Ontario Council on University Affairs, 1994, p. 18). In the UK, where current national policies on research and teaching are being reviewed, Bahram Beckhradnia, Director of Policy for the Higher Education Funding Council for England (1998), has argued that "I have not seen any convincing evidence for a causal relationship between teaching and research." Such research and such policy analyses of the research evidence on teaching/research relationships seem to justify national and institutional policies for de-coupling of teaching and (staff) research.

The Pressures for Research Selectivity

In many, perhaps all, political systems, practice and policy are for research being concentrated in selected staff, in selected departments, in selected institutions. In the USA, post-WW2 saw the growth of research concentration, perhaps, paradoxically, just as the HE system was being expanded to accommodate more students (Boyer, 1990). Such research expansion and concentration was fuelled by federal and state governments, who saw research as central to national security and prestige, and to economic growth in the new 'knowledge economy.' While much of this research is now outside universities, governments intervene directly and indirectly to focus research in those HE institutions, departments, and research areas which are likely to produce 'higher returns.' Thus, a recent Australian review of government funding of research argues for high selectivity and competition to better ensure world-class research and researchers. Any discussion of how to ensure links to undergraduate teaching and learning is conspicuous by its absence (Commonwealth of Australia, 1999). Likewise, in the UK, a recent major review of university research has concluded that "Despite the evidence of a synergistic relationship between teaching and research, we make no recommendation about this: it would be wrong to allow teaching issues to influence the allocation of funds for research." HEFCE, (2000, para 175, p. 26). Such selectivity is clearly the result of government and corporate policies. But, certainly

in the UK and, no doubt, elsewhere, many academics, too, see research, particularly in the sciences, as needing to be concentrated. The few voices who argue for research allocations' being equitably allocated to all academics and/or in part, shaped by the needs of supporting undergraduate courses, are few and not very powerful. Thus, if we look at how research support and funding is allocated in our institutions, I doubt that the support of undergraduate student learning is central to the decisions and allocations of research policy or practice. It is, of course, this pressure for research selectivity and the high rewards for institutions and individuals for 'performance' in research that has fuelled the primacy for research in the faculty reward system and for its frequent, effective, de-coupling from undergraduate student learning. In the USA, this has been brought to national attention by such studies as the Boyer Commission (1998, p. 1), with its trenchant opening statement that as "The research universities have often failed, and continue to fail, their undergraduate populations, thousands of students graduate without seeing the world-famous professors or tasting genuine research."

The Rise of Mass Higher Education Systems

The rise of mass higher education systems has called into question those cultural perceptions of higher education as characterized by a close interdependence of staff research and undergraduate student learning. Thus, in the UK in 1963, a major review of higher education argued that university staff should both teach and carry out research on the grounds that "the element of partnership between teacher and taught in a common pursuit of knowledge and understanding, present to some extent in all education, should become the dominant element as the pupil matures. It is of the utmost importance that the ablest, who are capable of going forward to original work, should be infected at their first entry to higher education with a sense of the potential of their studies." (Committee on Higher Education Higher Education, 1963, para 555).

But, at that time, only a small elite went into UK higher education-some 3% of c. 18-year-olds, and most of these would enter HE with a strong academic high school background. They would also benefit from small university classes. That same 1963 'Robbins' Report stated that lecture classes averaged twenty-seven students, seminars, four, and laboratory/practical classes, eight. American readers, whose perceptions of UK higher education are shaped by watching reruns of Inspector Morse and its selective scenes of Oxford University, need to realize that such are nostalgic, perhaps reactionary, fictions. The reality is that UK higher education is now characterized by attempting to educate some 40% of any age cohort in higher education. And, this is occurring as governments are reluctant to increase taxes to pay for such public services. The consequences include large class sizes and overworked staff with available money for research and scholarship being selectively concentrated. In that context (as in the USA with its honors programs in wealthier institutions), undergraduate students' being 'infected' by (staff) research is selectively rationed. Students receiving such research-based learning and/or contact with staff who are active in research will be concentrated in those departments which are successful in obtaining that research funding (though, as in the USA, such staff may have little time or inclination for undergraduate teaching). Research-based learning will be also concentrated in the final year of undergraduate courses. Here, the cultural emphasis on research-based learning, classically argued in the 1963 Robbins Report, still persists. Thus, most UK institutions, including my own, have graduation requirements involving students' completing an independent thesis. This 'dissertation' requirement is similar to the US honors thesis but clearly aimed at the majority of students in all or most institutions. However, some, perhaps many, staff

question whether such a requirement is practical, given student numbers and varied abilities. In my institution and elsewhere, staff comment that advising students doing such independent/research-based inquiries takes much time. In reality, many students don't get that time, which is probably, in practice, mainly for the able students, as staff consider time with them well spent. This issue is made more critical in the sciences, where students need access to scarce research equipment. Some staff ask whether such research-based learning is appropriate for all students. Studies by colleagues at Brookes have indicated that some students are much more motivated than others in doing research and knowing about staff involvement in research. (Breen and Lindsay, 1999). Clearly, these are the sorts of students to whom the US honors programs cater.

Some staff at Brookes (including, at times, myself), ask whether most students in entry-level courses wouldn't gain more from course requirements introducing them to the nature of research in their discipline and for graduating synoptic capstone requirements similar to those on some US campuses. Such capstone requirements could better ensure all students graduate with an understanding of research, without being necessarily able to do it. Should such be restricted to the able motivated few?

The Development of Professional Disciplines

Universities have long trained people for jobs/roles outside academia. Universities such as Oxford and Harvard trained people for the clergy, government, and law. But now, professional courses for the law, health care, business, and information technology are dominant on many campuses. Knowing about professional practice and having some ability to do such practice may be far more appropriate to (highly able) students (and for staff) in such disciplines than research-based inquiries.

You may now want to go back and re-read the early section 'unpacking the complexity' and further consider which connections between (staff) research and student learning are appropriate to which contexts and then read on!

THE ARGUMENTS FOR INCLUSIVITY

There are contrary pressures and arguments of inclusivity-for research-based learning (or, perhaps, certain aspects of 'it') for all/most students in all higher education institutions. Such arguments include a) recent research evidence on teaching /research relations; b) the research evidence as to the effectiveness of active 'constructivist' learning; c) the needs of the new 'knowledge' economy and life-long learning; d) political/cultural arguments as to the nature and role of universities.

Recent Research Evidence on Teaching/Research Relations

As outlined above, previous, largely quantitative/correlative, research has demonstrated that "at best, teaching and research are very loosely coupled" (Hattie and Marsh, 1996, p. 529). More recent research has moved away from correlative studies and, using more qualitative methodologies, have pointed to potentially closer, more positive connections between (staff) research and student learning.

Brew and Boud (1995, 272) called for "more fine-grained studies," focused on how academics experience teaching and research. They hypothesised that *"if there is a link between the two it operates through that which teaching and research have in common; both are*

concerned with the act of learning" (p. 261). They suggest, *"teaching and research are correlated when they are co-related"* (ibid.) and in conclusion suggest that one way to achieve this is to *"exploit further the link between teaching and research in the design of courses."* (p. 272). (Emphasis added.)

Neumann (1994) in a large Australian research-oriented institution, interviewed some 28 students in a range of disciplines and from first-year undergraduate to doctoral students, on their experiences of teaching and learning. Her conclusions were that there were tangible benefits to students of staff research, mainly through students' perceiving that their courses were up-to-date and that staff demonstrated interest in what they were studying. Also, staff research interests gave students "the opportunity to see their teachers as real people and to be able to glimpse what they do, how and why" (Neumann, 1994, p. 335). In a related study at Oxford Brookes, we used focus groups across a range of undergraduate courses to examine student perceptions of research and staff research and its impact on their learning (Jenkins et al. 1998). Our findings were that students considered the principal role of the university and academics was to teach them and teach them effectively. That was a bottom line requirement and it clearly reinforces the views of Neumann's respondents. Yet, students did perceive clear benefits to them of staff involvement in research. These were what many of us would hope for in particular up-to-date knowledge, enthusiasm, and academic credibility of the lecturer, the department, and their degree. We have now extended this study to taught postgraduate courses, where the students' perceptions of (staff) research are even more positive (Lindsay, Breen and Jenkins, in submission). In related research, Brew has considered how staff perceptions of research may shape the possible connections. Brew (1999, p. 299), argues that "the relationships between teaching and research are dynamic and context driven." The contexts include whether university researchers see research as an objective product or as a process of inquiry and whether teaching is seen as transmission of what is known or an exploration of what is not known by students. "If researchers recognize the ways in which their activities parallel those of students and take steps to involve students in research-like activities, research can inform practice in facilitating learning." (ibid., p. 298).

So the research evidence is now pointing again to the complexity of teaching/research relations, but also clearly indicating the potential benefits in a range of institutional types of students learning about research and through research-based processes. Research by Colbeck in the USA has shown that the extent to which staff can link teaching and research is shaped by "university, departmental and disciplinary contexts" (1998, p. 649). Thus, she shows how staff in a low-prestige institution were, in certain respects, better able to link teaching and research than in a Carnegie 1 institution. For at 'Cosmopolitan University' (a fictional name! -but a real institution), faculty evaluation for 'research' included the writing of textbooks and creative works in popular media. In the Carnegie 1 institution, such work would not 'count'. So, perhaps in some respects, it may be easier to link teaching and research outside the 'research elite'? Certainly, the research evidence is now clearly pointing to the (potential) value of (staff) research to student learning.

The Research and Policy Evidence on the Importance of Constructivist/Active Learning

Much current research on student learning clearly points to the importance of courses that actively engage students through processes of inquiry, to 'construct' knowledge in relation to the knowledge developed through research. Paradoxically, while Boyer's (1990) work is rightly seen as a criticism of universities' emphasis on discovery research, his work can also be seen as a

strong argument for encouraging, even requiring, a close linkage between (staff) research and undergraduate student learning. In College (Boyer, 1987), Boyer criticized the dominant passive lecture-based student experience, the separation of undergraduate education from inquiry or research process-based teaching, and the lack of connections between research-orientated staff and (undergraduate) student learning. Indeed, much of the thrust of the powerful reform movement that stems from Boyer's and his colleagues' work is to bring a 'research as student' inquiry guided by (research-based) staff into the US undergraduate curriculum (Carnegie Foundation, 1998). http://notes.cc.sunysb.edu/Pres/boyer.nsf/).

Elton (2001), as well, having reviewed the research evidence on teaching/research relations, has similarly argued that that there can be a "positive nexus between research and teaching ...under particular conditions." These he sees less in terms of the outcomes (e.g., published papers of staff) than of the extent to which students learn through some form of student-centered or enquiry-based approach, e.g., problem-based learning.

The Needs of the New 'Knowledge' Economy and Lifelong Learning and, relatedly, Political/Cultural Arguments on the Nature and Role of Universities

As discussed above, there are evident pressures from governments, from students and from parents for universities to focus on professional and business skills and downplay academic research. Yet, aspects of the new 'knowledge economy' are seen as requiring individuals with creativity and ability to create and find and synthesize new knowledge. However, in the view of a recent Demos report "our educational structures are lagging behind ... the dominant educational paradigm still focuses on *what* students know, rather than *how* they use that knowledge." (Seltzer and Bentley, 1999, p. 9). If this is accepted, then students' understanding of the research process and ability to do research may be a vital 'key skill' and thus should be central to the curriculum for all/most students.

There are also related and, at times, 'complementary' arguments by those who see Universities as needing to counter the 'new vocationalism' of higher education. Barnett (2000, 63) sees universities as needing to support students (and through them as graduates, society at large) to cope with the 'supercomplexity' of societies that are continually undergoing changes developed through the advance of knowledge. "In that context the issue is whether lecturers adopt teaching approaches that are likely to foster student experiences that mirror the lecturers' experiences as researchers." Again, this is pushing us to see such aspects of research as for all students and all (higher education) institutions.

TENTATIVE CONCLUSIONS AND WAYS FORWARD FOR INDIVIDUALS AND INSTITUTIONS

Such then, is the complexity that individuals and institutions have to confront in delivering on teaching/research relations. My own position on these issues is not fixed. Indeed, over the last five or so years, it has moved from a strong questioning of the value of (staff) research to undergraduates to advocacy of coupling teaching and research (Jenkins, 2000). The 2001 Schreyer Conference gave powerful testimonies of innovative programs that were achieving such connections and certainly shifted my thinking to further advocate their strengthening. So, in conclusion, here are my current answers to some of the questions I posed at the beginning of this chapter:

- We should start from the research evidence which cautions us as to the complexities and difficulties we face--and certainly shows us that if we want to connect student learning and (staff) research, then it has to be purposefully created and this requires actions by staff, institutions and national systems (Jenkins et al. in preparation).

- All higher education institutions and all degree programs should educate all students to understand how knowledge is constructed through research and to understand the research process. Knowledge should be presented as tentative, uncertain and of utter fascination.

- All higher education institutions and all degree programs should educate all students through processes of active 'constructivist' learning, which attempt to parallel the research processes in the disciplines students (and staff) are studying.

- All higher education institutions should support (and require) all academic staff to be scholars/aware of current research developments in their discipline and in the teaching of their discipline (Healey, 2000).

- The above 'requirements' re scholarly activity and support for all staff have major implications for institutions' research policies. These need to give far greater emphasis to supporting the scholarly activity of all staff--not just focusing on high-level research for the few. Such will require a broadening of what 'counts' as 'research' and/or a greater valuing of 'scholarship.' It also requires national systems to ensure that universities are funded for such broad-based but high-level scholarship.

- Such practices and policies can be (in part) achieved outside the research and wealthy elite. Indeed, to give a US example, an institution such as Alverno, Milwaukee may be far more able to support aspects of research-based learning than aspiring research-based institutions such as Oxford Brookes or research-elite institutions such as Penn State or Madison et al.! For Alverno's strong focus on undergraduate learning, an assessment focus on supporting learning, on staff scholarship and research being directed to develop student learning, offers a clear institutional commitment to students' understanding of scholarship (and research?) (Mentowski and Associates, 2000).

- However, singling out Alverno as an indication of what can be achieved outside the research and private elite does indicate that achieving inquiry-based learning requires long term and collective action across an institution. Sadly, such is unusual. It also requires higher education to stand up for the ethical values of the academy--for learning for its own sake-- and to question political and student pressures for learning subsumed to the needs of the corporate economy.

- While a focus on students constructing their learning, guided by scholarly staff, does achieve aspects of research-based learning, it falls short of what most of us would see as key aspects of research-based learning--students actually engaging in doing research and students learning directly about the research process. Yet, in the USA there are strong examples outside the research elite of institutions (such as those supported by the Council for Undergraduate Research http://www.cur.org./) that have developed programs for selected undergraduate students to do research with selected staff (Hakim, 2000). An Australian study of teaching/research relations in three institutions at very different levels of the academic hierarchy demonstrated "ways in which it is possible to work to strengthen the connections between teaching and research, and highlight that it is valid and important for universities to address the nexus through measures consistent with their mission, goals and objectives. Since universities differ, it is appropriate that the means also differ" (Zubrick et al. in press).

- Aspects of the globalization of higher education enable me to envIsage students (and teaching scholars) being able to engage with high-level scholarship and gaining some understanding of the research process through high-quality learning materials (quality textbooks and computer software etc.). They even could have selective mediated access to high-level researchers. But such would require universities and national founders of research to value such materials and pedagogic support. That is not the case in the UK (or elsewhere?) where research funding effectively only values high-level discovery research. Nor do I put trust in the corporate software, publishing/media sectors to produce such support.
- Yet can scholarly teachers who are not currently (or recently) involved to an extent in research effectively aid (or coach) students to understand or do research--even if they have access to such high-quality materials? On this, the research evidence is silent. On prima facie grounds and, from personal experience, I doubt it. Such is certainly the conventional wisdom of academics. (The best sports players don't necessarily make the best coaches: but effective sports/educational coaching surely can only be done by those with a first-hand and current involvement in the game/the research process.)
- Such research-based learning is certainly what the research-based universities claim they (can) achieve. However, when such institutions and their academics proclaim the value of research, they should start from the research evidence, which we have seen questions this positive relationship for students. Certainly, such research-intensive universities have to recognize the research and policy evidence of the potential negative consequences for students of staff involvement with research.
- Yet, the research universities/the comprehensive institutions with research active staff do potentially have something particular to offer students. Potentially they can organize staff/the overall curriculum so that all students can have some exposure to (if not direct contact with) research-active staff. Indeed, to be questioning of the focus of the Schreyer 2001 conference: perhaps even in the context of research universities, its focus was, *for me,* too concerned with the selective education of the few and not the broad education of the 'many' students at those elite institutions.
- Yet, that critical remark misses what for me was the learning from one of the most intellectually exciting and 'useful' conferences I have ever attended. As is clear from the case studies in this volume, research-intensive institutionslHonors programs offer academically gifted/motivated students particular--and deserved--opportunities for a close understanding of the research process and for carrying out such research. I think the challenge for such institutions is not only to ensure the quality of these programs (and in some cases, ensure they don't fade away when external funding ceases), but also to consider how aspects of these programs can become what *all* students on these campuses experience. The challenge for us outside the research elite is to see what we can take from these innovative programs and adapt to the realities of our funding and to the needs of our students. I am still pondering how to do this. But, I am now determined it should happen.

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WHY INVOLVE STUDENTS IN RESEARCH?

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ABSTRACT

This article addresses the benefits of undergraduate research to students, to faculty, and to universities. Research experiences are credited with increasing motivation for learning, helping undergraduate students decide on a career path, forming mentoring relationships between students and faculty, and improving student performance in writing, speaking, and working in teams. For many students, research experiences are their most memorable experiences as undergraduates. From the perspective of universities, students bring enthusiasm to research teams and often ask insightful questions-sometimes quite by accident-that can change the ways faculty approach research inquiries. Student researchers contribute to the world of knowledge. Research universities have distinct advantages in offering undergraduate research opportunities. For example, research and education strongly complement each other. Undergraduate students benefit from the libraries, laboratories, and computers that support faculty research and graduate education. Our experience at Penn State indicates that offering research opportunities to undergraduate students is an educational activity that doesn't cost large sums of money, although it does require substantial commitments of faculty time. Offering undergraduate research is a valuable recruiting tool, especially for academically gifted students. Several examples of undergraduate research at Penn State are included, for students in a variety of academic disciplines.

BENEFITS OF RESEARCH TO UNDERGRADUATE STUDENTS

I'm pleased to report on a significant component of undergraduate education at Penn State-the involvement of undergraduate students in research activities. Undergraduate research can be a transforming experience in shaping lives. Research introduces students to the joy of discovery and makes the process of learning an active rather than a passive one.

Most, if not all, of us here believe that participating in research helps students, but how does this happen? What are the benefits to students and what are the benefits to faculty and to universities? Let's begin with the benefits of research from the perspective of the undergraduate student.

"Research enables students to make better choices about graduate school. " RosalYn Millman, Penn State, 1983.

Research can help students decide on a career path. It helps them decide if graduate school is the right choice. RosalYn Millman was an undergraduate student who was an essential member of my research group for more than two years. Her experience helped to shape her interests in public policy. She went on to earn a graduate degree at Princeton University and a subsequent career in Washington DC. Ros served as the Deputy Director of the National Highway Traffic Safety Administration during the Clinton Administration, and was named a Penn State Alumni Fellow last fall.

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Generations of students have asked for relevance in their studies: "Why do I need to learn this? When will I use it?" Research offers students a concrete demonstration of the principles and concepts covered in textbooks and lab sections. The active learning element of research allows students to make connections to their own interests that may not ordinarily be made in passive learning environments.

Research experience has been credited with improving students' motivation for learning. Students can pursue their individual interests. Intellectual curiosity is sparked, and research provides undergraduates with an opportunity to take greater ownership of their own learning process.

Research projects often provide badly needed financial support for undergraduates and better prepare them for paid off-campus jobs or internship opportunities. It may, at the same time, yield academic credits toward their degrees. The students' work is excellent value for the faculty member, too. And undergraduates, as newcomers to the research process, rarely feel that any of the tasks related to the research are beneath their dignity.

Mentor relationships with faculty often evolve. Students develop a different type of relationship with faculty than is possible within the classroom. The interaction is usually more intense and takes place over a longer period of time. It often provides the basis for a lifetime of personal connections and career guidance. Faculty research mentors are a great source of references and advice when students apply for jobs or graduate school.

Research-as an active learning process-challenges students to frame questions, develop a strategy for testing their propositions, analyze information, and report the results. Students learn to support an argument, to tolerate ambiguity, and often to see the world as the more complex place that it usually is.

Students also learn to work as a member of a research team. Research often involves group work, more in-depth interactions with colleagues, and development of improved communication skills. Employers are increasingly concerned about these characteristics.

Writing and presentation skills improve as students present their work at conferences and poster sessions. Published research papers and research experiences strengthen students' résumés and graduate school applications. Research begins the habit of sharing research with other scholars, as well as appreciating and regularly reading published research.

For many students, research experiences are some of their most memorable ones as undergraduates. My only experience certainly reflects this proposition. My most memorable recollections of my undergraduate years at the University of Minnesota are those when I was part of a small group of students-including graduate students-who spent Saturday mornings with a young professor doing field research. I still remember the field sites, the propositions we were testing, our findings-and such things as the stop at the café for a late morning breakfast of bacon, eggs, coffee-and more conversation-on our way back to campus.

BENEFITS OF RESEARCH TO UNIVERSITIES

Besides the benefits to students, universities also benefit when undergraduates are involved in research. Students bring energy and enthusiasm to research teams. They're hungry to learn and they often keep asking for more to do.

Undergraduate students ask questions that can be very insightful-sometimes quite by accident-and can change the ways faculty approach research questions. They're not yet afraid to make mistakes. They force us to respond to questions in different ways and on different terms

than we often do with graduate students and other faculty members. Faculty learn from students, just as students learn from faculty.

Student researchers contribute significantly to the world of knowledge. One of the joys of my job is learning about the contributions of our faculty and students to scientific discovery and creative accomplishment. I'm thinking, for example, of Nicholas Bond, our undergraduate student in Astronomy and Astrophysics who recently discovered-in collaboration with other astronomers-giant "superbubbles" in a very distant galaxy. Superbubbles are huge spherical regions where thousands of exploding stars have blown holes in the gaseous medium between the stars. Nicholas has received substantial professional acclaim and major national media coverage.

Undergraduate research breaks down the divisions between undergraduates and grad students and between faculty and students. And, it's a great factor in building maturity among young people as they interact with more seasoned professionals.

Offering strong programs supporting undergraduate research strengthens our requests for research funds. There are an increasing number of federal research grants that now require evidence of undergraduate student involvement in research as a condition of the award of funding.

Offering undergraduate research is also a valuable recruiting tool, especially for academically gifted students. After all, the potential involvement of undergraduates in research is one of the most important assets that research universities such as Penn State have to offer prospective students.

ADVANTAGES OF RESEARCH UNIVERSITIES

The Committee on Institutional Cooperation (CrC) prepared a report some years ago called *Values Added* about the advantages of an undergraduate education at a major research university (Committee on Institutional Cooperation, 1989). Several of the advantages cited relate to research; for example,

1. Teaching and research support one another. Advancing the state of knowledge through research strengthens teaching. Teaching the material and discussing it with others may stimulate new lines of research or application of the findings.

2. The undergraduate experience benefits from the resources maintained to support faculty research and graduate education, for example, libraries, laboratories, computers, other facilities and equipment.

3. Personal interaction between undergraduate students and active scholars benefits both. Role model and mentor relationships motivate students. Faculty will be motivated by the increased success and drive of their students.

4. Research universities offer their undergraduates a vast range of options for specialized study. The many and diverse specialized research interests of our faculties create wide opportunities from which students can select.

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5.   Research activity brings to campus a constant flow of people from outside the university-leaders from business, industry, government, and other universities. These guests visit classrooms and public forums, contributing to an enriched educational experience.

COSTS/TRADEOFFS OF A RESEARCH-BASED APPROACH TO TEACHING

Applying a research-based model to teaching is easier to implement in small classes, rather than large classes, although Penn State is implementing this in some large classes. One example is the recent changes in Economics 002 and 004, in which students write joint research papers on economic topics, combining writing and active learning in a large class.

Research-based teaching may require slightly more time on the part of the faculty, at least initially. There is certainly truth to this statement, as there is always more time spent on laying the groundwork for effective research contributions with undergraduates.

Switching from lecture-based to research-based courses requires some real adjustments on the part of faculty and students. Some students object to taking more responsibility for their own learning, and prefer the more passive non-research-oriented environment of their previous experiences in both high school and college.

In some instances, universities may be trading some breadth of content coverage for greater depth. This has been one of the constant concerns in Problem-Based Learning. But we also know that material covered in a research-based course will be better understood, better retained, and more easily applied by students. Evidence that I have seen related to medical education, for example, indicates that students in PBL perform equally well on standardized tests covering a wide range of material. Of course, we need to remember that undergraduate research-or most other approaches to learning for that matter-isn't necessarily the best for all students or all knowledge acquisition.

ADMINISTRATIVE SUPPORT FOR UNDERGRADUATE RESEARCH

With the cooperation of the academic deans at Penn State, we have been able to increase the number of students who are engaged in undergraduate research opportunities. Our experience indicates that this is not a costly venture in monetary terms, although it does require substantial commitments of faculty time.

Let me give you an example. For nearly a decade, Penn State had a small fund administered from my office called the "President's Fund for Research." This fund was used to support faculty research. It was customary for faculty to write lengthy proposals to get a few hundred or, at best, a few thousand dollars for their projects.

Believing that faculty time could be put to better use, I changed the format for the President's Fund. We granted block funds to the colleges and told the deans to pass on the funds to faculty for the exclusive use of supporting undergraduates involved in research. We also required the colleges to match my funding at least one-for-one, and we specifically stipulated that faculty should not write more than a paragraph or two supporting their request. The results have been positive far beyond our hopes.

Information as to the exact number of students involved in these block grants is difficult to pin down. But our data from the 1999-2000 academic year-which is admittedly conservative-

show that total funding of $241,000 supported at least 295 projects involving 200 faculty and over 470 undergraduates.

In addition, a recent survey of Penn State's colleges reveals that over 5,200 undergraduates participated in some form of research this year. We know that about 500 undergraduate students complete a formal research thesis each year, working one-on-one with a faculty member. Our payroll data scans indicate that nearly 600 undergraduates each year are financially supported by faculty members' sponsored research projects. And many other students simply volunteer for a chance to participate on faculty research projects.

EXAMPLES OF UNDERGRADUATE RESEARCH PROGRAMS AT PENN STATE

Let me share just a few of the first-rate examples of undergraduate research at Penn State.

The Learning Factory Showcase displays the results of senior capstone design courses in engineering. Students work in teams on industrially sponsored engineering design projects. The projects include both written and oral presentations. Students, industry sponsors, faculty, and parents attend a Project Showcase, and a panel of industry judges give awards for Best Product Design and Best Process Design.

The Schreyer Honors College and the Office of Undergraduate Education host an Undergraduate Exhibition every March. This event provides an opportunity for **all** undergraduates at Penn State to share their research and creative accomplishments-from art and anthropology to astrophysics and engineering. The number of participating students is increasing each year.

WISER (or Women in Science and Engineering Research) is a program for first-year women students in science-related fields--science here broadly defined. Students are matched with a lab or faculty member and agree to work at least five hours a week. The purpose is to retain women students in science and engineering fields.

The Eberly College of Science offers a Summer Research Program, funded by the John and Elizabeth Holmes Teas Scholarship. Its goal is to support every interested chemistry major for one summer of research; 80-90 percent of undergraduates in chemistry will do research at some point in their undergraduate careers, and many graduate with one or more publications. Undergraduate chemistry major Morgan Mihock, for example, uses a laser to break apart molecules; Morgan and faculty member Tom Mallouk are trying to create a clean, renewable alternative to fossil fuels.

Research sometimes involves international study-often a first for our students. Students from Geosciences, Art History, Arts, and Landscape Architecture have participated in archeological fieldwork in southern Egypt under the direction of several Penn State faculty. Students studied groundwater levels and geologic strata and identified buried monuments and structures.

Closer to home, Dr. Lakshman Yapa, known as Lucky to his friends and students, leads a student service-learning project which researches urban poverty in West Philadelphia. Students undertake research-based thesis projects looking at different aspects of urban life, living for several weeks in a Quaker work camp located in the midst of the community.

Besides promoting undergraduate research, Lucky Yapa and his students are changing the way we look at poverty. For example, students examined the transportation system and learned how the emphasis on cars and the lack of public transportation, carpooling, or safe routes for

bicycles helps to create poverty. Other students studied the potential of urban gardens to increase food production and supply fresh produce to city restaurants, and investigated nutrition and food prices in the West Philadelphia neighborhood.

CONCLUSION

The offices of the Vice President for Research and the Vice Provost and Dean for Undergraduate Education in cooperation with the Schreyer Honors College are now regularly devoting an issue of *Research/Penn State* to undergraduate research. Students in each of Penn State's colleges have contributed lively accounts of their research, including their reactions to the experience and thoughts about its potential impact. Dana Bauer, editor of the September 1998 issue, said this of the experience:

> *Undergraduates are willing to try anything, a professor told me when I was working on my thesis, a magazine about undergraduate research. He was right. My staff of undergraduate writers and I the editor, interviewed researchers who traveled to Australia to study zoos, spent hours sitting in lab sifting through dirt to find bits of dinosaur teeth, and designed a project to help community leaders understand the ecological effects of over-development. The students that we wrote about were more interested in the process of exploration than the outcome and that's what undergraduate research should be about: learning to discover.*

Research universities are discovering (once again) that research and undergraduate education are not in conflict but complement each other. Through research, we are able to offer personal attention and hands-on experiences to our undergraduate students. We want to increase the number of research opportunities that we can offer to students and encourage more students to take advantage of these opportunities. Students tell us that these experiences are making a real difference in their lives.

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AUTHOR BIOGRAPHY

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II. Curriculum Models that Include Undergraduate Research

This chapter features different perspectives on integrating research into the curriculum. The series of papers describes programs, credit bearing as well as non-credit bearing, that include a significant research component.

The first four papers provide an excellent contrast of approaches to bringing research into the undergraduate curriculum. The Gemstone Program at the University of Maryland is a four-year honors program that includes research methods courses and a four-year-long, team-based research project. The students identify the topic, propose the research question and are mentored by a faculty member. The next model describes the efforts in Muhlenberg College's Biology Department to include research via semester-long projects in four intermediate biology courses. The MARE program at the University of South Carolina, described by members of the student research team, is a student-driven, faculty-mentored research activity that does not carry any formal credits or research designation. Over the course of their four years of involvement, the students investigate marine and aquatic environments and the impact of human activities on those environments. The MASS program at Penn State provides a one-semester research environment with time spent studying mathematics courses, attending research seminars, and conducting mathematics or computational research. Finally an 'Issue Reaction' paper describes the unique challenges of integrating 'research' projects in the creative and performing arts.

THE MARYLAND GEMSTONE PROGRAM

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ABSTRACT

The Maryland Gemstone Program is a unique four-year honors program in which undergraduates from all majors are teamed together in groups of 10-15 students and challenged to address some aspect of a major societal problem containing technological, social, ethical, and business elements. At the conclusion of the program, each team submits a team thesis, which is reviewed by academic, corporate, and governmental representatives. Upon successful completion of the program, Gemstone students receive their undergraduate degrees with a special Gemstone Citation. The process of curriculum development, research project management, and particular lessons learned from the first cohort to complete the program are summarized.

INTRODUCTION

The Maryland Gemstone Program was conceived with the goal of addressing two perceived shortcomings in current undergraduate programs. The first is the failure of undergraduate programs to provide any kind of meaningful intellectual thread linking the students' program from start to finish. In too many cases, an undergraduate degree program is perceived by those enrolled as a degree completion process in which they take so many courses from area A, so many from area B, and so forth. Course sequences, when they exist, rarely comprise more than two sequential offerings, and even in those cases many students are not entirely convinced that the second course is related to, and should therefore follow, the first. The second problem which the Gemstone Program is intended to address is the failure of our undergraduate programs to provide meaningful intellectual contacts between students in engineering and the sciences and those in the social sciences, the humanities, and business. Even traditional Science, Technology, and Society programs, as valuable as they are, are usually designed to expose students with strengths in the humanities and social sciences to technology issues and vice versa, rather than to engage students from the various majors together in an intellectual process in which each brings his or her own talents and interests to the task in a complementary manner.

A further motivation for the program arises from the author's belief that society has not been as effective as it might be in utilizing the assets available across a broad intellectual spectrum in addressing societal issues. The evolution (or devolution, perhaps) of nuclear power in the United States is a clear example of a situation in which the development of applicable technologies would have greatly benefited from the input of social scientists, including economists, sociologists, and psychologists.

The Maryland Gemstone Program is intended to address each of these concerns. In summary, it is a unique four-year honors program in which undergraduates from all majors are teamed together in groups of 10-15 students and challenged to address some aspect of a major societal problem containing technological, social, ethical, and business elements. At the

conclusion of the program, each team submits a team thesis, which is reviewed by academic, corporate, and governmental representatives.

The program was conceived in 1994, and funding was quickly garnered from the GE Fund and the A.T.&T. Foundation to support a four-year experiment in which a program was to be developed and a single cohort recruited and tracked through the program to determine if the concept was viable. In order to identify a cohort to start the program in the fall of 1995, a group of students already admitted to the University of Maryland Honors Program was selected and formally invited to participate in the program. Using the usual yield figures for honors admittees, the number of invitees was chosen with the goal of achieving a first cohort of 60 students. Surprisingly, 113 students accepted the invitation with an average SAT score of 1420, effectively doubling the yield rate of such academically gifted admittees to the University. As a result, the University, in something of a leap of faith since at that time Gemstone was more of a concept than a program, immediately embraced the concept and pledged institutional support for a continuing program so that students could be recruited during the next, and subsequent, academic years. Since the author was dean of engineering at the time, the Institute for Systems Research, a cross-disciplinary research and education institute within the Clark School of Engineering at Maryland, was chosen as the administrative home for the program, and a team of faculty from across the campus was recruited to begin putting the program together.

Although the program was not initially planned to be a living-learning program, first year admittees to the program were invited to live together in Ellicott Hall, and nearly 100% exercised this option. Ellicott is an older-style residence hall with double rooms, but first- and second-year students enjoy the easy social interaction and the ready access to team members for meetings, etc. In academic year 1998-99, the basement of Ellicott was renovated to provide a number of specially equipped team meeting rooms with installed computers and audio-visual equipment. Since that time, student enthusiasm over the benefits of living together has resulted in most Gemstone program participants opting to live together in Ellicott for their first two years at the University. The University is currently constructing an upper-class residence hall for Gemstone students with apartment-like amenities not available in Ellicott. It has been our experience that upperclassmen prefer such facilities, although the Gemstone junior and senior students still usually wish to live together with their team members or other Gemstone students.

In each subsequent year, the Gemstone Program has shown itself to be an extraordinarily attractive program to talented applicants to the University. At the present time about 700 students are enrolled in the program with an average SAT of about 1430, by a wide measure the most talented cohort ever attracted to a single educational program at the University of Maryland.

THE CURRICULUM

Although several of the Gemstone courses meet core curriculum requirements for an undergraduate degree at the University of Maryland, it is important to note that all Gemstone students complete all regular degree requirements for their major. This was an important factor in obtaining the support of all of the Deans of the various colleges for the program, since no curriculum compromises were required from any of their programs.

The initial curriculum for the program included a special version of Maryland's freshman engineering design course to introduce teaming concepts in the first semester, a 1- credit course in the second semester in which possible research projects were explored and teams were

formed, and three core academic 3-credit courses centered on technology from historical, social, and business perspectives. In addition, starting in the third semester, each team met weekly with a designated faculty mentor in a I-credit team project seminar. Progress reports were presented by each team at the end of each semester, including a final team thesis presentation at the end of the eighth semester to a review panel composed of academic, corporate, and government representatives.

During the third year of the program, input from the Gemstone Student Advisory Group, an elected group established to provide continuous student feedback on the program, resulted in significant curriculum changes. Students reported that they felt that the three core courses on historical, social, and business perspectives on technology were limiting their own core elective choices and taking student time away from the multi-year team research project, which was always intended to be the heart of the Gemstone Program. They also requested more attention to team dynamics and research methodology. As a result, the curriculum was changed in the fall of 1999 and the three core courses were replaced with a single core course, combining essential elements from the three previous offerings, to be taken in the second semester. In addition, the special version of the freshman engineering design course for Gemstone students was replaced with a course on team dynamics and research methodology offered in the third semester. In the first semester, students were required to enroll in a one-credit honors seminar on the responsibilities of a liberally educated person. This course is intended to provide an early introduction to ethical issues associated with scholarly research. An elective course on leadership issues was also introduced. The remainder of the program, including the I-credit team project seminars and the research project exploration seminar in the second semester, was retained.

FINDING TEAM MENTORS

In a program which, in steady state, involves 40-50 student teams, identifying appropriate faculty mentors is a significant challenge. This is a primary responsibility of the Gemstone Program Director, Prof. Christopher Davis, who is a highly respected senior faculty member who, among other significant campus duties, has been Chairman of the College Park Senate and therefore is well acquainted with the faculty across the intellectual spectrum. As an incentive to those faculty willing to serve as team mentors, Dr. Davis can offer either modest overload compensation during the academic year, partial summer salary support, or partial support for a graduate student working under the supervision of the faculty mentor. Nevertheless, faculty agreeing to serve as mentors to Gemstone teams are making a three-year commitment, which in many cases can be difficult in the face of sabbatical plans, etc.

Despite these obstacles, faculty who have signed on as team mentors have in most cases become enthusiastic promoters of the program and have found their interactions with these exceptional students to be as gratifying as any experiences they have had in academia.

STUDENT RETENTION

Student retention was a matter of considerable concern from the outset of the Gemstone Program. The challenge of keeping student teams at work on research projects for more than three years was seen as the biggest obstacle to the success of the program, and concerns were raised over such issues as how to maintain critical mass within a team if a number of team members dropped out, how to deal with the loss of particular expertise if critical individuals left

the team, etc. Initially, some ideas were proposed for allowing limited numbers of upperclassmen not originally admitted to the program to join teams to fill critical vacancies, but that has not proven necessary, as student retention has exceeded expectations

Gemstone Program Student Retention AY96-99

	1996	1997	1998	1999
Initially Enrolled	113	171	159	199
% Retained to date	69% (Graduated)	84%	86%	93%

As is evident from the retention data, Gemstone Program retention is apparently improving as the program matures, with the predicted retention rate of those in the 1997 class graduating in the spring of 2001 at greater than 80%. The actual graduation rate of students admitted to the Gemstone Program as freshmen is even greater, since most of those students who drop out of the program do so to concentrate on their major and end up graduating with their Gemstone classmates.

TEAM ACCOMPLISHMENTS

To date, Gemstone student teams have tackled a wide variety of societal issues and problems, including flexible manufacturing, the psychological impact of long-term computer use, personal genetic testing, nuclear and other waste disposal, desensitization to violence through youth education, antibiotics and resistant bacteria, improvement of the national K-12 curriculum, urban mass transit, privacy and security in the internet, information technology and medicine, biological computing, affordable public housing, prisons: rehab or storage, manned mission to Mars, reclamation of the Chesapeake Bay, managed health care, life at all costs, innovative power sources, and the nation's crumbling infrastructure. Many of these teams are still at work, but a number of them have already achieved notable results; for example:

1. The Urban Mass Transit team designed a GPS-based tracking system to allow bus travelers waiting at any stop to see the location of any bus on their route on a graphic display at the bus stop. This concept was developed to counter the frustration of mass transit users generated by their inability to know when, if ever, a bus will arrive to pick them up. This concept was tested on the University's extensive shuttle bus system.

2. The Nuclear Waste Disposal Team presented a paper detailing an integrated approach to nuclear waste disposal, including both technological and social factors analysis, at the 2000 annual meeting of the American Chemical Society and received the "Best Paper" award at the conference.

3. The <u>Mission</u> <u>to</u> <u>Mars</u> team was one of five teams nationally chosen by NASA to develop an exploration program for Mars, and presented their findings at NASA's Houston Space Flight Center.

4. The <u>Beacon</u> project team developed a GPS-based tracking system employing ankle bracelets to allow law enforcement agencies to track prisoners on work release or home-detention programs. This group is currently forming a startup company to exploit this technology commercially.

5. The <u>Flexible</u> <u>Manufacturing</u> team presented a paper at the 1998 Artificial Intelligence & Manufacturing conference in Albuquerque.

As expected, however, team accomplishments are uneven In quality and depth and remain crucially dependent on the quality of team mentorship provided. In general, students are told that reasonable team' outcomes should normally include empirical research with appropriate findings and conclusions, the production of a scholarly paper to be published or presented at an appropriate conference, prototype construction and testing where appropriate, and possibly the initiation of appropriate legislation at the local or national level.

CONCLUSIONS

The Gemstone Program is still too new to allow definitive conclusions to be drawn, but the initial results of this very ambitious educational experiment are encouraging. The Program has proven to be exceptionally attractive to talented students and has been instrumental in raising the profile of the University of Maryland's undergraduate student body. Student retention in the program has exceeded expectations, and only one team to date has failed to carry their project to completion.

Students involved in the program continue to be enthusiastic (and a bit elitist) about their involvement, and the successes of some of the graduating teams are proving to be a powerful motivating factor for the underclass teams. Campus support for the program continues to be strong, and current institutional support for the program is about $500,000 annually.

A more conclusive evaluation of the program should be possible in 2-3 years, when several Gemstone classes will have graduated and information on their subsequent employment and/or further education is available.

For more information on the Gemstone Program go to our web page at *www. isr. umd. edu/gemstone.*

CREATING AN UNDERGRADUATE CULTURE OF SCIENCE BY INTEGRATING INQUIRY, PROJECT-BASED LEARNING, AND RESEARCH INTO THE CURRICULUM

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ABSTRACT

Full engagement in science includes observation and asking questions, the development of a hypothesis, designing and conducting an appropriate experiment to test that hypothesis, data acquisition, appropriate analysis, revisiting initial questions, and dissemination of results. Here, I report on efforts to engage undergraduate students in all of these elements of science by integrating inquiry, investigation, and research in four intermediate biology courses for all majors. The project-based courses include Plant Ecology, Scanning Electron Microscopy, Molecular Genetics, and Physiological Ecology. Students conduct semester-long, experimental research projects and present their results at a public poster session on campus. Using computers, peripherals, and software funded by an award from the National Science Foundation, efforts were made to enhance the data acquisition, analysis, and presentation aspects of student research. The quality of the student research was improved, and student pride and ownership over the work increased. Students exhibited a greater understanding of science and quantitative analysis. One student project was published in a peer-reviewed journal, and many others were presented at regional and national meetings. The number of students taking elective courses in related areas, continuing research and senior honors projects, and applying and being accepted to related graduate programs significantly increased. Student poster sessions served to create a campus-wide culture of science.

INTRODUCTION

The national call for reform in science education in the late 1980's and early 1990's (National Commission on Excellence in Education, 1983; AAAS, 1990; Project Kaleidoscope, 1991) has most recently caused many at colleges and universities to rethink how science is taught at the undergraduate level (Gibbons, 1994; Good and Lane, 1994). As reform has begun to pervade undergraduate science programs, emphasis has shifted from the tradition of teaching science as a stagnant body of knowledge to a more dYnamic approach emphasizing critical thinking. Reform has resulted in a change from the dualistic approach to teaching and assessment in the sciences as either correct or incorrect retention of content to a pedagogy that emphasizes the process of science (Hartman and Dubowsky, 1995). New strategies have included open-ended, investigative laboratory experiences (Sundberg and Moncata, 1994; Grant and Vatnick, 1998); inquiry-based approaches to lecturing (Uno, 1990; Ebert-May, Brewer, and Allred, 1997), small group and collaborative learning opportunities (Eisen, 1998), and the development of meaningful undergraduate research opportunities (NSF, 1996).

All of these approaches view science as a way of knowing. They serve to teach science by offering students opportunities to do science, and they represent a shift from passive to active learning and expose students to the meaningful uncertainty of the scientific process. Outcomes

from this new pedagogy include increased ownership and empowerment (Grant and Vatnick, 1998), more positive attitudes towards and increased confidence with science, and more opportunities to use material in creative ways and to place it in a larger context (Sundberg, Dini, and Lee, 1994; Eisen, 1998). Ultimately, this pedagogy results in increased scientific literacy and is presumed to lead to greater retention of students in the sciences. Additionally, engaging students in science allows them to develop important skills that are typically valued across an undergraduate curriculum. These skills include effective group work, oral and written communication, library and reading skills, and critical thinking and analysis. Some have argued that all of this comes at the expense of exposure to course content, but evidence suggests that total retention of scientific information is greater with the new pedagogy even though slightly less content is delivered (Ebert-May, Brewer, and Allred, 1997).

Full engagement in science includes observation and asking questions, the development of a hypothesis, designing and conducting an appropriate experiment to test that hypothesis, data acquisition, appropriate analysis, revisiting initial questions, and dissemination of results. Despite efforts to engage students in the process of science, depending on the approach, some of these elements are often lacking or superficially introduced. For example, we found in our curriculum that students lacked opportunities to conduct quantitative analyses and to disseminate their results in the same way that professional scientists do. Here, I report on efforts to engage undergraduate students in all of these elements of science by integrating inquiry, investigation, and research in four intermediate biology courses for all majors, and I focus on efforts that were made to enhance the data acquisition, analysis, and presentation aspects of student research.

PROJECT-BASED LEARNING FOR ALL MAJORS

Similar to that at most institutions, the biology major at Muhlenberg College begins with an introductory core sequence that includes a laboratory experience. In this sequence students are exposed to the scientific process through inquiry and collaborative exercises in lecture and recitation, and laboratory exercises that offer students opportunities to learn important skills and experience open-ended investigation. These short-term experiences constitute introductions to the various components of the scientific method but do not allow students to be fully and meaningfully engaged in the entire process. Class size and student preparedness preclude this opportunity. However, as a department, we firmly felt that all majors should be engaged in longer-term research projects. We met this objective by establishing four intermediate to advanced project-based courses. These are Plant Ecology, Scanning Electron Microscopy, Physiological Ecology, and Advanced Molecular Genetics.

In these courses we have departed from the traditional undergraduate mode of lecture and laboratory to that of research and seminar. Each of these courses exposes students to research methods and to the primary literature relevant to that field and offers opportunities to be fully engaged in science. Semester-long research projects are presented in the form of a scientific paper and at public poster sessions that are similar to those held at professional meetings. The limitations that we were confronted with in these courses were technology based and primarily had to do with data analysis and presentation. Although we were satisfied with the quality of the research that our students conducted, we felt that what we could offer in terms of quantitative analysis and graphing and presentation were not as sophisticated as what typically occurs in most research laboratories. To remedy this lack we solicited funds from the National Science Foundation through the Department of Undergraduate Education's Instrumentation and

Laboratory Improvements Program (NSF-ILl). The objective of this project was to develop an undergraduate computing facility, including computers, software, and peripherals, in an effort to expand the use of data analysis and presentation in the four project-based courses. Below I focus on one course, plant ecology, to offer a more detailed description of a project-based course and to illustrate the impact of these technological improvements on our pedagogical objectives.

PROJECT-BASED LEARNING IN PLANT ECOLOGY

Course Activities

The course, taught at the College's arboretum, introduces students to scientific thinking through inquiry. With inquiry or discovery-based exercises students reach an understanding of concepts for themselves (Uno, 1990). For example, rather than being taught how a plant grows and develops, students can be led to discover this through direct observation of plants in the field. Next students are taught how to make observations and develop questions based on those observations. Students generate a list of observations and questions, and by interacting with their peers generate some very reasonable hypotheses. Students are also required to maintain a herbarium as means of developing a taxonomic vocabulary, which they most often will find essential as they become engaged in their research projects.

Next the students develop research projects. Project development occurs in conference with the faculty member and with feedback from the class, which has effectively become a research group. This is typically based on earlier observations and questions, and is often shaped by the specific interests of each student. For example, students with environmental interests often are most interested in applied questions dealing with environmental assessment or impact. Premedical students often explore medicinal aspects of plants. The diversity of backgrounds and interests that the students bring to the class is a plus and results in the development of many different kinds of research projects. Students who have trouble developing a project idea can be directed or prompted primarily through questioning by the professor.

The class is then run like a research laboratory. Weekly journal club activities offer students opportunities to develop library skills and to gain experience reading and discussing the primary literature. Class is often held like a lab meeting where students informally present some aspect of their research. The focus here is to discuss and view science as a work in progress. Students might present and get feedback on a statistical analysis or a way to graph their data. This course is also a part of a college-wide writing program. Throughout the semester students are learning how to put their questions, objectives, and hypotheses in writing as they would in a scientific paper. They are taught how to integrate quantitative results into text and how to discuss results appropriately and place them in the context of the existing literature. Ultimately, students write up their project in the form of a professional paper and present their work at a college-wide poster session much like those that occur at major scientific conferences.

The Role of the Technological Improvements

The addition of the new technology in our NSF-funded undergraduate computer facility greatly improved the quantitative aspects of the student work. The common statistical software and graphing packages allowed students to gain expertise within the context of their own research. The quality and sophistication of the student presentations and papers were greatly improved. Students exhibited greater ownership and pride with their own work. Students have been more motivated to continue their research after the course with the objective of submitting

their work to a professional journal. The use of the technology itself is an essential skill, and students had the opportunity to further develop their technical expertise.

Outcomes

The research-based approach in this course has resulted in significant increases in elective enrollment in botany, which is typically under enrolled in departments where the majority of students have interest in the health professions. Assessment of student learning primarily through the evaluation of their written work indicated a greater understanding of science and quantitative analysis. Students enrolled in this course were more likely to pursue research outside of class. This includes participation in a yearlong honors research program in their senior year. Students are publishing and presenting their work. One student project has been published in a peer-reviewed journal and another is currently being revised for submission. Three student projects have been presented at regional or national scientific meetings. Since the inception of this course, significantly more students have applied to and have been accepted to fully funded graduate programs in ecology and botany. One former student, as a graduating senior, received honorable mention for the National Science Foundation Graduate Fellowship.

Challenges

One obvious challenge with project-based instruction within the confines of a semester is project failure. This is inherent in the process of science and can be a valuable teaching tool. However, working closely with students and helping them to redirect if their project becomes unworkable can minimize negative impact on the student. Many students, at least initially, experience some discomfort from this non-traditional form of learning. Another challenge can be the limited and diverse background of the students. Many students in these courses have not had more than an introduction to the area in which they are now asked to read the primary literature and conduct research. However, I have found that with time and patience the lack of background can be dealt with and is often advantageous in that their naivete permits an unbiased approach to observation, problem solving, and discovery. Because students are not lectured to directly in this type of course, there is reasonable concern that this type of experience comes at the expense of important content. Lastly, this type of teaching is much more time consuming and places greater demands on the faculty member than more traditional modes.

SOMETIMES A DIFFERENT APPROACH IS REQUIRED

As mentioned previously, this same pedagogical approach is employed in our Advanced Molecular Genetics course. However, because of the inherent technical nature of molecular biology a slightly different approach has been taken. In this class one technique is central to every student project. All students are taught microarray technology in conjunction with yeast molecular genetics (Wallack, 2001), and students ask different questions that can be addressed using that specific experimental system. Another model is for all students to work on different aspects of the same question. This is particularly useful in broader, interdisciplinary fields. The outcomes and the challenges of these modified approaches appear to be very similar to those of the project-based model presented above.

THE CULTURE OF SCIENCE

One of the greater contributions of this kind of pedagogy is that it offers students and faculty opportunities to participate in the *Culture of Science.* Most limit their notion of culture to the humanities, and science faculty and students do not hesitate to attend a campus play, musical event, or art opening. However, science is a cultural activity involving process, creativity, and discourse. We use our public presentations and poster sessions to promote this notion. Students are asked to invite faculty and friends from non-science departments to attend their session. As a result there is a greater appreciation of science across the campus. Our diverse college community is learning that participation in and talking about science is stimulating. They learn that science is not just a complicated body of facts but offers a way to think, to interact, to create, and to discover. This wider appreciation of science perhaps has been the greatest success of our project-based curriculum.

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AUTHOR BIOGRAPHY

Richard Niesenbaum is an Associate Professor of Biology and Environmental Studies at Muhlenberg College in Allentown, PA. In 1999 he was named the Donald and Anne Shire Distinguished Teaching Professor. At Muhlenberg he teaches and conducts research in the areas of plant ecology and conservation biology, and has written a number of articles on interdisciplinary teaching strategies.

THE INSIDERS: UNDERGRADUATES CRITICALLY EXAMINE THE PROS AND CONS OF A TEAM-BASED MARINE RESEARCH PROGRAM

TRACI J. HEINCELMAN[1], EDWARD J. MAJZLIK, CHRISTIE A. ROBINSON, LINDSEY J. WISE
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ABSTRACT

The Marine and Aquatic Research Experience (MARE) is a student-generated, faculty-guided not mandated, model for hands-on, team-based, environmental science research for undergraduates, of any class rank and any academic major. MARE is unique in many ways compared to traditional undergraduate research models. MARE was envisioned and established in the fall of 1998 as part of two Research-Based Learning (RBL) Critical Connection Courses (CCC) entitled Design of Inquiry in Science and Implementation of Inquiry in Science. The initial goal was to study the dYnamic processes occurring in Winyah Bay, South Carolina. As we began to establish research directions, MARE members organized themselves into crews to allow collaboration between members with similar research interests. Currently, there are 28 members in MARE, composing five crews. As students involved in MARE since the beginning, we have witnessed the evolution of the team as a whole. We felt it was time for us to take a step back and critically examine ourselves. We have formulated a list of the benefits and challenges of working in a team doing scientific research as undergraduates. Following our presentation on student-driven team-based research, there was a roundtable discussion focusing on three main issues: how MARE is funded, what the personal benefits of team-based research are, and what are the roles of the individual members. Overall, we came to the conclusion that team-based research is possible and rewarding due to the unique research and learning opportunities it provides students.   The rewards of this experience directly reflect the ideals of Critical Connection Courses and Research-Based Learning, illustrating the possibilities of these educational innovations.

INTRODUCTION

The Marine and Aquatic Research Experience (MARE) is a student-generated, faculty-guided not mandated, model for hands-on, team-based, environmental science research for undergraduates. The program is open to students of any class rank and any academic major. Funding for MARE is provided by the South Carolina Honors College and the Belle W. Baruch institute at the University of South Carolina. The overall goal of MARE is to learn about a variety of marine and aquatic environments and to observe the impact of human activities on these environments. Through this experience, we are able to conceive, design, execute, and present original scientific research as well as improve leadership, organizational, teamwork, communication, and problem-solving skills.

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1 Researcher and author Traci 1. Heincelman suffered a tragic and untimely death in an automobile accident on March 10,2002. This research collaboration is published in her memory.

MARE is unique in a variety of ways compared to traditional undergraduate research models. MARE is neither part of a degree-granting program nor part of a professor's regular research program. MARE is not part of a dues-paying social club or scientific society. The program is maintained through time and effort volunteered by the student and faculty members. Students are responsible for recruiting faculty members as collaborators, not directors, to MARE research agendas. The student MARE members have ownership of their own data and assume genuine responsibility for their actions.

HISTORY AND EVOLUTION

MARE was envisioned and established in the fall of 1998 as part of two Research-Based Learning (RBL) courses called Critical Connection Courses (CCC) (Williams et aI., this volume). The CCC's were entitled Design of Inquiry in Science and Implementation of Inquiry in Science. The initial goal of the program was to conduct oceanographic research in Winyah Bay, South Carolina, in order to understand the dynamics of the estuarine system located there. Four expeditions to Winyah Bay were conducted in the winter and spring of 1998-1999. The primary purpose of these expeditions was to gather preliminary data to aid in the formulation of future research hypotheses for Winyah Bay. The initial data collected contained information regarding nutrient concentrations, salinity and temperature distribution, bottom sediment types, and GPS locations. During the fourth expedition, we observed salinity values that strongly deviated from those measured on previous expeditions, which sparked questions about the forces and physical parameters behind the estuarine system. Subsequently, we decided to conduct a 30-hour sampling expedition over two complete tidal cycles and to look at the impact of stream flow and tidal forcing on the estuary. Since that expedition, our cruises have become smaller, more goal-driven, and focused. In the winter of 2001, MARE expanded its domain to include environmentalist aspects, outreach to freshman marine science classes, and collegiate extension. After gathering and analyzing a presentable data set, MARE has given several presentations across the country, including the Southeastern Estuarine Research Society (SEERS) in Tampa, Florida, the American Geophysical Union (AGU) in both Washington, D.C. and San Francisco, and many others.

Currently, MARE has 28 members, 18 in-state students, 10 out-of-state students; 16 women and 12 men. MARE includes members from all four class ranks from freshmen to seniors and also involves some graduate school members acting as informal advisors. Most members of MARE are marine science majors, but we also have a full range of members from other majors, including other science majors and liberal arts majors.

As MARE began to establish research direction, the members decided to organize into crews in order to allow for greater collaboration among members with similar research interests. The biological oceanography crew is interested in studying species richness and diversity of both micro- and macro-organisms. This crew would also like to monitor the impact of anthropogenic activities on the distribution and concentration of organisms within the estuary. The nutrient chemistry crew measures the concentration of pollutants in Winyah Bay from both point and non-point source pollution as well as examines the basic constituents of the water in Winyah Bay in an attempt to determine the environmental health of the ecosystem. The geological processes and sediment dynamics crew is interested in studying the structure and geometry of Winyah Bay. This crew also studies the volume and type of suspended material in the water column. The physical oceanography crew is interested in the currents and circulation of water throughout the

estuary as well as the impact of watershed runoff and tidal conditions on salinity values within the estuary. The remote sensing crew uses aerial photography to observe the surface flow features of the estuary. In collaboration with the physical oceanography crew, the remote sensing crew is also trying to determine if surface features such as foam lines represent subsurface frontal mixing boundaries.

The authors of this manuscript have been involved in MARE since the first expedition conducted during our freshman year. On the first research expedition, we were primarily involved in data collection but not analysis. With each additional trip, we took on bigger roles and more responsibility. We also became more interested in the data analysis and interpretation, attended conferences as observers, and began to conduct our own research. On the fifth expedition, two of the principal leaders of MARE (seniors at the time) were unable to go, and so we had to assume, as sophomores, the overall responsibility for conducting the expedition. This experience proved to us that we were ready to take over leadership roles and also initiated the transition from the first to second generation of MARE leadership. In the future, the newer members will fill our positions as leaders.

Along with our own personal growth, the group has also undergone several transitions. As members graduated, the group structure had to adapt. This included a change-over not only in leadership but also in the direction of the research being conducted. Crew development became more dependent on the membership of the individual crews. Some crews rapidly became well established due to increased member involvement and ambition. The success of these crews served to motivate the other crews to excel. As a result of these evolutions, MARE has formed into a hypothesis-driven team of scientists, split into research crews that collaborate with each other in order to function as one larger research team.

BENEFITS AND CHALLENGES

As students involved in MARE since our freshman year, we have witnessed the evolution of the team as a whole. We felt it was time for us to take a step back and critically examine the benefits and challenges of team-based research. One of the main advantages of participating in a group like MARE is that all members are allowed to share and generate new ideas. We have created a forum conducive to communication of ideas by holding weekly meetings to discuss research directions and upcoming events. Having a diverse group of undergraduate members creates a broader learning base for students. This allows for a vertical exchange of knowledge across class rankings, maturity levels, and experiences from courses and time spent in the field. By working in a team, members are learning the importance of collaboration and cooperation. We recognize the necessity of maintaining a level of mutual respect for our colleagues. By becoming a member of MARE, more students gain exposure to actual research environments. "Also, a single professor can deal with a greater number of students when the students have organized themselves into a research team. A very important aspect of working in a team is the ability to build character as well as gain and improve self-confidence and self-esteem. Furthermore, students improve their socialization, communication, and listening skills. Conducting and presenting our own scientific research gives student-scientists the opportunity to learn about professional courtesy, such as who receives credit for work, and proper conduct at conferences, aspects of science which cannot be taught in the classroom.

While there are numerous advantages to MARE and team-based research, it is not perfect, and we recognize that there are challenges inherent in this program. The main challenge

of working in a large group such as MARE is the lack of communication. Another challenge involves questions as to who is in charge, who takes responsibility for running expeditions, and who receives credit for the work. As student-driven, undergraduate research, the scientific process is inefficient at times. We are constantly figuring things out for ourselves and making mistakes along the way, but this is itself an important part of the learning process. We are further tasked with sustainability, both in terms of recruiting new members and securing financial support. As MARE is a model outside of the traditional apprenticeship model, faculty may be hesitant to become involved for fear of being overwhelmed. Moreover, within team-based research, some students may get taken advantage of and end up doing other members' work. There is also the potential for students to volunteer too much time and become over-committed, which may have repercussions on class performance. Also, inherent within any group, there will be personality conflicts and clashes. We are a fairly accepting group but it is always possible that we will run across people with whom we do not get along or with whom it is hard to work. While this may not be preferable, it adds to our professional and personal skills. Initiating a program like MARE is risky, for it is difficult and overwhelming to begin due to the scope of the endeavor. However, student-driven team-based research forces students to take responsibility for their own learning and growth. Furthermore, involvement in MARE may be stressful and intimidating to newcomers. Members are forced to compromise, to trust and rely on each other, and to deal with people with whom they would normally not associate. People who help but do not become involved in the science and people who use MARE for personal advancement only challenge us. The last challenge is more of a hypothetical one, which MARE has not experienced, but there is the possibility of having our ideas stolen by other students and professors.

Within this list of challenges, there are some that MARE can clearly improve upon and there are some that are inevitable within any group. For those that we believe can be improved upon, we are working on solutions. For instance, we have sign-up sheets for equipment and hold weekly meetings to improve the communication within our group. To make the organization less complicated, individual members or crew leaders must now present a float plan for upcoming cruises and follow up each expedition with a cruise report. Along the same lines, a member must illustrate worthy need for resources in order for them to be allocated. We are naturally becoming more efficient by gaining familiarity with sampling protocols and location. Furthermore, to ensure the sustainability of MARE, we have documented our protocols and are working on teaching data analysis and interpretation skills to newer members. By demonstrating our professionalism, we are slowly developing the trust of hesitant faculty, and finally, we are writing proposals that are more hypothesis oriented, to combat our funding problems. Nevertheless, there are those challenges, such as personality conflicts, riskiness, stress, volunteering too much, getting taken advantage of, and trust issues that we will never see totally disappear.

ISSUE REACTION

Three main issues were addressed by discussion participants. They were how MARE is funded, the personal benefits of team-based research, and the roles of the individual members. The issue of funding was raised as to what other sources of funding are available. Initially, MARE was funded by personal funds from Dr. D. Williams. Currently, MARE is funded primarily by the South Carolina Honors College, which provides $5,000 with matching funds

from the Belle W. Baruch Marine Laboratory in terms of technical support and data analysis. In terms of both the educational impact and research conducted, MARE is a very cost-effective program. Nevertheless, with increased funding the scope of MARE can expand, and suggestions were made as to ways to increase MARE's funding. A suggestion was made about the possibility of working with faculty to trade monetary funds for research while still maintaining a student-run structure. Another suggestion was to attach MARE to a bigger effort. MARE may be able to provide data to a larger study, such as those conducted by government and environmental agencies, and obtain funding to support MARE's effort. However, when questioned about the possibility of formalizing MARE into a university funded academic program, we concluded that it was not the ideal way to increase financial support. We felt that if MARE were to be formalized it would be restricted in terms of membership, and students would be forced to adhere to a curriculum designated by the university. Thus, the formalization of MARE would result in a loss of spontaneity of commitment, and the beauty of a student-driven team-based research program would be lost.

The next main topic of discussion centered on what we as students personally gain from our involvement in MARE. Involvement in MARE connects directly to our career plans by giving us an opportunity to practice our professional life skills, research skills, team-working skills, and presentation skills. By helping other members with problems, MARE members improve their problem-solving abilities and interpersonal relationships. In addition to these practical skills, by attending scientific meetings, we have developed a network of faculty and researchers from around the nation. Being involved in MARE is gratifying because the work is our own, and we are able to make connections between the classroom and the "real world," providing us with a sense of accomplishment and personal growth. One student commented that before becoming involved in MARE, "I was just getting a degree, now I'm getting the most out of my education."

The last main topic discussed was the specific role that members play within the organization. Individuals can only benefit from MARE if they decide to put in time and effort. No one works for anyone else within the group. The data collected are available to all members, regardless of class rank, and while the entire group receives acknowledgement for their contributions, it is those who take the initiative to analyze the data and draft proposals who receive the scientific credit. The menial tasks associated with our research, such as cleaning the boats and acid-washing bottles, etc., are not assigned exclusively to the freshmen or newcomers but shared among all members. There is no punishment for being the new member. Hypotheses are decided upon based on the research objectives of individual crews, but each crew has to persuade the whole team to allocate our limited resources to work on their research idea. Even though the crews work on different projects, the data are shared amongst all.

CONCLUSIONS

Team-based research is possible and rewarding. It is not easy, and there are many challenges. As a result, student-directed research requires highly dedicated and motivated people to succeed. With a group of this nature, however, the rewards are numerous. Students are able to generate, design, and implement their own research agenda. Many students are able to gain valuable hands-on experience as well as gain a new outlook on science and how it is conducted. This experience also reinforces and excites our interest in regular classes, which we feel is one of the most fulfilling aspects of MARE. Ultimately, in devising this list, we realized that these

rewards directly reflect the ideals of Critical Connection Courses and Research-Based Learning, illustrating the extreme possibilities of these educational innovations.

ACKNOWLEDGMENTS

AUTHOR BIOGRAPHIES

Traci Heincelman, from Derwood, MD, was a junior in the Marine Science Program and South Carolina Honors College at the University of South Carolina and the recipient of a McNair Scholarship.

Edward Majzlik is a native of Aiken, SC, and currently enrolled as a junior in the Marine Science Program at the University of South Carolina. He is also the leader of the Physical Oceanography crew of MARE   Following graduation from USC, Edward plans to attend graduate school in oceanography.

Christie Robinson is from Great Falls, MT, and currently is a junior in the Marine Science Program and South Carolina Honors College at the University of South Carolina. Within MARE, she works with the nutrient chemistry crew and the biological oceanography crew. Ultimately, she would like to go to graduate school and study deep-sea ecology.

Lindsey Wise is a junior at the University of South Carolina double majoring in Chemical Engineering and Marine Science. Her focus in MARE is examining the human impact on the health of the Winyah Bay system, including point (International Paper discharge) and non-point (farm run-off) sources of pollution into the bay and rivers.

MASS PROGRAM AT PENN STATE

SERGE TABACHNIKOV
THE PENNSYLVANIA STATE UNIVERSITY

ABSTRACT

The MASS program--Mathematics Advanced Study Semesters--at Penn State's Mathematics department was founded in 1996. MASS is a unique, innovative, intensive program for select groups of undergraduates recruited every year from around the United States and brought to Penn State's campus for the fall semester. This program provides a unique and mutually reinforcing blend of learning and research activities for its participants.

PROGRAM ELEMENTS

MASS is unique among mathematics programs for undergraduates in the U.S., quite distinct from honors programs, math clubs, and summer educational or research programs. The principal difference is the comprehensive character of the program: all academic activities of the participants for a semester are specially designed and coordinated to enhance their learning and introduce them to research in mathematics. A key feature of the MASS experience is the intense and productive interaction that takes place among the students. The environment is designed to encourage such interaction: a classroom is dedicated to MASS and furnished so as to serve as a lounge and a computer lab outside of class times. The students live together in a contiguous block of dorm rooms, they eat together, and they pursue various social activities together. The effect of such conditions is dramatic: the students find themselves members of a cohesive group of like-minded people sharing a special formative experience. They quickly bond, and often remain friends after the program is over. They study together, attack problems together, debug computer programs together, collaborate on research projects, and, most importantly, talk about mathematics all the time.

The main components of MASS are:

- **Three core courses** designed exclusively for MASS students on topics chosen from the areas of Algebra/Number Theory, Analysis, and Geometry/Topology. Each course features three, I-hour lectures per week, a weekly meeting conducted by a MASS Teaching Assistant, weekly homework assignments, a written midterm exam, a final project, and an oral final examination/presentation. For example, the core courses taught in fall of 2001 were:
  Geometry and Relativity: An Introduction (Nigel Higson),
  Combinatorics (George Andrews),
  Mathematical Analysis of Fluid Flow (Andrew Belmonte).
- **Individual student research projects,** which range from theoretical mathematics research to computer implementation. Some projects are related to the core courses while others are developed independently according to the interests and abilities of the student.

- A weekly 2-hour working seminar run by the director of the MASS program (the author of this article), devoted to selected topics in mathematics, and helping to unify all other activities.
- MASS Colloquium, a weekly lecture series by distinguished mathematicians, visitors, or Penn State faculty. These lectures are instrumental in focusing interest of the MASS participants on various research areas of mathematics both during their participation in the program and later in their selection of graduate programs.

No account nowadays would be complete without a reference to a web page; the reader is invited to visit the MASS web site for the list of the core courses that have been offered in the MASS program, previous MASS Colloquium talks, and a wealth of other information: www.math.psu.edu/mass

PROGRAM SUPPORT AND RECRUITING

The MASS Program is funded by Penn State and the National Science Foundation. Penn State provides fellowships for out-of-state students that reduce their tuition to the in-state level. Further support comes through the NSF VIGRE grant. In particular, MASS participants whose tuition in their home institution is lower than Penn State in-state tuition receive grants for the difference. Starting the fall of 2000, merit scholarships are awarded too.

A new feature of the MASS Program is its close relation with the Schreyer Honors College at Penn State. Starting the fall of 2001, all MASS courses are offered to Schreyer students. They have two options: either to take the full MASS course load that amounts to 16 credits (in which case the students are very strongly encouraged not to take other classes) or to be part-time MASS participants (to take one core course and the Seminar and/or the Colloquium).

Another summer program in mathematics for undergraduate students is called REU (Research Experience for Undergraduates). REU at Penn State is by no means unique--there are about 45 similar programs offered by various US universities. REU is formally independent of MASS but it is run by the same pool of instructors, and about half of the REU participants stay at Penn State for MASS. Moreover, some REU participants continue their research projects at MASS.

PROGRAM SUCCESS

Some REU/MASS participants have produced significant pIeces of mathematical research. For example,
- James Kelley, a MASS-98 partICIpant, studied the representation of integers by quadratic forms, a classical problem in number theory. Kelley made significant progress in this hard problem, and his paper has been submitted for publication in a refereed journal. James Kelley is currently a mathematics graduate student at UC Berkeley; he has been awarded an NSF Graduate Research Fellowship.
- JaclYll (Kohles) Anderson (University of Nebraska, Lincoln, MASS-98) is a winner of the Alice T. Schafer Prize For Excellence in Mathematics by an Undergraduate Woman.

- Benjamin Chan (University of Rochester, REU and MASS-2000) is a winner of the Undergraduate Student Poster Session in New Orleans, January 2001.

Further evidence that the MASS program is working as hoped is provided by the students' assessments. For example, Suzanne Lynch, a MASS-96 participant, who is now a graduate student at Cornell and about to obtain a doctoral degree in mathematics, wrote in an unsolicited letter:

The MASS program has been the best semester of my life. 1 was immersed in an environment of bright motivated students and professors and challenged as never before. 1 was pushed by instructors, fellow students and something deep inside myself to work and learn about mathematics, and my place in the mathematical world. 1 loved my time there, and never wanted to leave. 1 believe the MASS program helped to prepare me for the rigors of graduate school, academically and emotionally. The MASS program has been very instrumental in opening grad school doors to me, and giving me the courage to walk through them.

Another evaluation, from Jared Speck, MASS 99, University of Maryland stated,

My overall impression of MASS was WOW! This has been the best academic program of my life. Thanks to the program, 1 am now sure that 1 want to go to grad school in mathematical physics. It was wonderful to be around so many intelligent people who are my age.

AUTHOR BIOGRAPHY

Serge Tabachnikov has a Ph.D. in mathematics from Moscow State University (1987), specializing in geometry and topology. He was head of the Mathematics Department of *Kvant* magazine, 1988-90. *Kvant* (which means Quantum) was a popular magazine on physics and mathematics for high school and college students in the USSR with circulation of 200,000-300,000. From 1990 to 2000 he was professor of mathematics at the University of Arkansas, Fayetteville, and, since 2000, professor of mathematics, MASS, and honors Director at Penn State. He is author of more than 60 research and expository papers and books.

ISSUE REACTION: HONORS THESES IN THE CREATIVE AND PERFORMING ARTS

JOANNE RUTKOWSKI

PANEL MEMBERS: TAYLOR AITKEN GREER,
MARY HEATHER HARTLEY
THE PENNSYLVANIA STATE UNIVERSITY

ABSTRACT

This 'Issue Reaction' focuses on describing the meaning of an 'honors thesis' in the creative and performing arts and defining appropriate approaches for guiding students on their thesis work in these fields. In general, a 'project' complements the thesis (the work of art) and is the written reflective component. The process for completing the project and written work will vary according to the nature of the work and student. One approach is to establish why the project is important and should be undertaken, how it will be completed or approached, and who will be involved or what the outcome will be. For this approach, students often keep a journal to reflect on the project during its formation. In another approach, students complete the artistic work and then reflect, analyze, and critique. Both approaches are equally valid and each requires the faculty advisor to play a critical role in ensuring the inclusion of a reflective component.

DISCUSSION

The issue reaction takes shape around two questions: What is a thesis in the creative and performing arts? What process is most appropriate for students in completing a thesis?

The experience of the authors is that projects tend to be interdisciplinary. For example, one thesis may be in musical theater while another includes a sociological perspective of Bob Marley with a focus on a study of his lyrics (Greer). Some expose students to equipment and require students to participate in workshop sessions or to extend the thesis projects over two semesters (Hartley). Finally, some projects are traditional and are conducted along the social and behavioral sciences; however, even in those cases there is a developmental process that students undertake in selecting their topics. For example, one student left for the summer with a project identified but got involved in another project over the summer. When the student returned she apologized for not working on her thesis. In fact, she had, it was just a different thesis topic! One view is that the work of art, or project, stands alone as a thesis. The other view is that the work of art, or project, is an important part of the thesis but students must be able to reflect on their work and write about it. Hartley summed up the value of the latter by stating, "Because these are undergraduates, they must not only create but also take the time to make it conscious." And while the reflection on the work does not need to be long, it is a critical component.

Two approaches emerged for the thesis documentation. One approach is similar to that of other theses. Students first make decisions about the project before it is undertaken. Questions such as why, how, who, and what are answered through the written work prior to undertaking the project. In this approach, students often maintain a journal as they work to reflect during the process. The other approach is the opposite. Students complete their project

first, then go back and reflect, analyze, and critique. Both these approaches are valid and are usually determined by the nature of the project and the student's individual approach to his/her work. As Greer concluded, "There are different modes of approaching art: SYnthetic, analytic. They aren't always complementary. There are different ways of incorporating the two."

Finally, the term "project" tends to be more appropriate for the reflective works than "thesis". Regardless of the approach, selecting a faculty advisor who has particular expertise in the field is critical.

AUTHOR BIOGRAPHY

Joanne Rutkowski specializes in music for children aged birth through early adolescence. She teaches undergraduate and graduate courses, works with young children in various settings and conducts research on the nature of children's singing voices. She has been an honors advisor for over 10 years.

III. Course Models that Include Undergraduate Research

Individual courses are often the best place to begin integrating research into the student academic experience. As demonstrated by the five papers in this section, research can be included in a wide array of courses. The authors of the papers included in this section use discipline-specific and general education courses to introduce research methods and project-based techniques. One of the recurring themes emerging from their papers is the importance of providing opportunities for the students to learn the foundation material in the context of addressing problems or probing questions. This problem-based learning approach is outlined very nicely in Edwards' paper. Both he and the authors of "Honors Collaborations: The Presidency in Speech and Composition" and "Leaving Home with IT" recognize the advantage of team-teaching when the topic becomes broad enough that meaningful investigation often extends beyond the educational realm of one discipline. Additionally, the latter paper by Devon and Buvat presents the challenges and rewards when including significant international collaboration in the projects. Elements of problem-based learning are recognized in each of the other successful courses; e.g., in the case of the "Ancient Myths in a Modern World" course, Walker requires individual exploration and elaboration for specific stages of the project and team activities for other stages, including the presentation of course material. And at the outset of the course "Berlin in the 1940s," the instructor emphasizes the importance of an environment for scholarly advancement, including trust and collegiality.

In addition to providing a framework to consider when developing a course that includes a research component, these papers include the valuable insights of those who developed and taught courses using this approach. The authors are candid about what worked and how they would make adjustments for future offerings, making these papers all that more valuable.

MULTI-DISCIPLINARY STUDY, RESPONSIBLE POLICY-MAKING, AND PROBLEM-BASED LEARNING IN HONORS COURSES

MICHAEL EDWARDS
BARAT COLLEGE OF DEPAUL UNIVERSITY

ABSTRACT

This paper explains how problem-based learning (PBL) is incorporated into a multi-disciplinary, team-taught honors seminar, "Poverty amidst Plenty," by means of an eight-step process that implements a curricular metaphor-student as legislative aide. The process allows students' self-directed skills to develop while faculty roles in the course change from instructors to resource and research guides. In turning their research into policy position papers, students develop and share sources, strategies, and solutions. They also acquire web-design skills in order to cultivate informed "outside constituencies" supportive of their policy positions.

In addition to a course-planning strategy that can be modified to fit most course contexts, whether for honors students or the general student population, the paper provides an outline of the important elements of the PBL approach-problem, process, student, instructor, learning goals, and outcomes-and offers reasons for its success. "Poverty amidst Plenty" gives students the opportunity to acquire an understanding of economics and ethics and to form an integrated, multi-disciplinary knowledge base. This occurs in a "real-world" context that demands that students gather information, evaluate it, and then use it to make judgments. As a result, the course satisfies important measures of authentic learning and fosters a form of learning that typically emerges only after students have graduated from college.

INTRODUCTION

In fall 2000 I joined forces with an economist to teach an honors seminar at Barat College, a wonderful opportunity for a philosopher to make a direct connection to concrete issues. The course we developed was entitled "Poverty amidst Plenty," a fitting reference to the fact that the Barat campus in affluent Lake Forest, Illinois, is barely five miles from an overburdened soup kitchen.

Some consciousness of national and international economic inequality already existed on campus, as evidenced by the recent tradition of holding an annual "Hunger Banquet." The featured speaker in 2000 was the director of research and public policy at America's Second Harvest, the nation's largest domestic hunger relief organization. There was also a student speaker, a junior enrolled in "Poverty amidst Plenty." The student's talk-on hunger in India, its nature, its extent, its victims and its causes-was informed and informative, passionate and compelling. Indeed, so compelling that she was offered a paid summer internship at America's Second Harvest.

How did this student come to be so well prepared that she could walk right out of the first class in which she had ever studied economics or ethics and into an internship that will see her travel to Washington, D.C., to lobby Congress?

METHODOLOGY

Like many other honors programs, Barat's offers team-taught courses that bring a multi-disciplinary approach to the study of themes, ideas, and policy issues. Often, however, while students experience stimulating courses, they do not come away with the skills needed to sYnthesize multi-disciplinary perspectives into coherent learning frames. To avoid this pitfall and provide students with the necessary pedagogic pragmatics, Barat faculty have included problem-based learning (PBL) as a key curricular emphasis in the honors program.

Although the ancestry of PBL has been traced back to the first quarter of the 20th century and perhaps as far back as Plato's Academy, it is a pedagogy first systematically developed in medical schools beginning in the 1960's and now widely employed in medical education. From medical schools it spread to K through 12 and then found its way into professional schools. Only recently has it started popping up in liberal arts curricula.

A working definition of PBL involves five elements. PBL must be built on "messy" real-world *problems.* A messy problem is open-ended or "ill-structured," such that there is no anticipated solution and no set formula to reach one. Being ill structured does not mean lacking in structure; indeed the problem must be carefully structured so that important content is covered naturally, emerging from the exploration of the problem.

The *process* is student-centered, integrated, and collaborative. It seeks to capture the ways people solve and resolve problems and meet the recurring challenges that they encounter both as individuals and as citizens. Notwithstanding the distinctions that are sometimes drawn between inquiry-based or research-based learning and problem-based learning, PBL is rooted in inquiry. The problem generates inquiry, which leads to the acquisition of new information, which in tum causes an evolution in the problem.

The *students* become self-directed learners, stakeholders having authority, accountability, and responsibility for their learning. They must assess what they know and what they need to learn. They must gather the necessary information, then generate and evaluate hypotheses in light of their research, a process that typically requires more research.

The role of the *instructor* is to set up and present the problem, then to serve as tutor, coach, and resource, guiding research and assisting in the interpretation of data.

The final element is *learning goals and outcomes.* Students acquire an extensive, integrated, multi-disciplinary knowledge base; critical and creative thinking competencies; problem-solving proficiency; self-directed learning strategies; and collaborative skills. Moreover, retention, retrieval, and appropriate use of information are improved.

"POVERTY AMIDST PLENTY"

Television broadcasts of hearings held by the Senate Foreign Relations Committee show a row of senators perched on high. Seated in a second row behind the senators are their legislative aides. It is these bright young men and women who have done the research and created the policy papers that inform the questions and comments of their august employers.

The "Poverty amidst Plenty" seminar was planned around a curricular metaphor-the twelve students, each assuming the role of Senate legislative aide, were given the task of preparing a responsible economic policy position on a given country that could affect U.S. foreign aid to that country. The instantiation of the metaphor may be summarized in eight steps:

1) Create a picture of the present economic state of the student's chosen country-pairs of students select pairs of countries that share certain similarities but also present potentially revelatory contrasts, e.g., China & India; Haiti & Cuba; Singapore & Indonesia.
2) Determine the degree of (in)equality in assets and income, as well as its nature-if there is a divide, is it racial, ethnic, religious, regional, hereditary, etc.?
3) Research the factors that have contributed to the present state of (in)equality-these factors turned out to be political, social, cultural, religious, educational, historical, and, interestingly, geographic.
4) Judge the desirability/optimality of the present distribution of wealth in economic and human terms.
5) Determine what policies-both internal and external-are contributing to the maintenance of, or changes in, that distribution and evaluate their effectiveness in economic and human terms.
6) Recommend any changes in present internal policy or new internal policies that would be effective given the factors discovered in step (3) and provide a rationale.
7) Recommend any ways in which U.S. policy toward the country of study could support the recommendations in step (6) and provide a rationale.
8) Design and create a website intended to develop "outside constituencies."

This metaphor turned out to be so close an approximation of the real world that it was barely metaphorical at all: Our Hunger Banquet speaker, himself a former legislative aide on Capitol Hill, urged the audience to visit the Second Harvest website, learn about his organization's initiatives and then write their Congressional representatives.

As their semester-long research project evolved, the students
• presented oral reports to the class on step (1),
• produced initial html documents on steps (1)-(3), with bibliography and web directory,
• presented oral reports to the class on their penultimate drafts,
• produced single-country websites, and
• synthesized the seminar's findings.

Future versions of the course would include mock committee hearings for the campus community.

The course assumed no prior knowledge of economics, moral and political philosophy, or web-design skills. In the classroom and out, the professors provided instruction in those areas, while also offering guidance in data-gathering and interpretation. The economic state and policies of the U.S. and other countries were used as extended instructional examples.

Students' final web products are available for them to demonstrate vividly to graduate schools and potential employers their ability to
• perform research in subject areas where they may have little initial knowledge,
• analyze the information they gather,
• evaluate public policy in context,
• make informed recommendations backed by persuasive evidence, and
• present a compelling case both orally and in written and graphical form in the latest medium of communication.

WHY THE COURSE WORKED

Why did this course succeed? Because the PBL approach produces authentic learning and contextual knowing. Consider the five measures of authentic learning identified by Newmann and Wehlage:
- Higher-order thinking
- Depth of knowledge
- Connection to the world beyond the classroom and academic setting
- Substantive conversation
- Social support for student achievement

All five of these measures were satisfied by "Poverty amidst Plenty." Students synthesized information in order to develop and then test hypotheses. They developed arguments and constructed explanations on the basis of carefully drawn distinctions. The consideration of real-world problems led them not only to propose solutions but also to engage in advocacy of them to others. The interactive process led to pooling of information, sharing of insights, and development of collective understanding. An atmosphere of high expectations and mutual respect produced quality results. (As a philosopher, I like to think of the Socratic method as the prototype of authentic learning.)

Marcia Baxter Magolda's research indicates that the most epistemologically sophisticated kind of learning, which she calls "contextual knowing," typically emerges only *after* students have graduated from college. However, the PBL approach as incorporated in "Poverty amidst Plenty" requires that students engage in the simultaneous and ongoing assessment of their own beliefs, the evidence they gather, and the perspectives of their peers, the kind of assessment that is central to contextual knowing.

FURTHER APPLICATIONS OF THE MODEL

It is my hope that the theoretical overview and the course outline I have given provide a course-planning strategy that can be modified to fit most honors course contexts as well as many contexts outside the honors domain. I anticipate using it in a course that includes a significant experiential learning component. The course, entitled "Chicago Hope," will examine the four prerequisites for the pursuit of happiness and the people who lack them: those who do not have dependable access to food, shelter, healthcare, and education. Students will visit public schools and a healthcare clinic and work at a soup kitchen and homeless shelter. Having gained this firsthand experience, the students will choose an issue, research needs and policies related to it, and create a policy recommendation. I anticipate that their research will include work in libraries and on the Internet, as well as emailing, telephoning, and interviewing representatives of government agencies and nonprofit organizations. I can easily envisage a course on environmental concerns that has the same structure. Surely there are as many course possibilities as there are social causes to work for, corporate interests to assert, and political issues to address.

SELECTED SOURCES

Educational Leadership, a journal published by the Association for Supervision and Curriculum Development, devoted its April 1993 issue to "Authentic Learning." The complete

issue is available online at <http://www.ascd.org/readingroom/edlead/9304/toc.html>. Of particular interest are

- Newmann, F. M. and Wehlage, G. G. (1993). Five standards of authentic instruction,. *Educational Leadership* 50:8-12. Available online at:
  <http://www.ascd.org/readingroom/edlead/9304/newmann.html>.
- Stepien, W. and Gallagher S. (1993). Problem-based learning: As authentic as it gets. *Educational Leadership* 50:25-28. Available online at:
  <http://www.ascd.org/readingroom/edlead/9304/stepien.html>.

Both these articles are reproduced in the useful anthology:

- Fogarty, R. Ed. (1998). *Problem-Based Learning: A Collection of Articles.* Arlington Heights, Ill.: Skylight.

For PBL at the college level, see

- Wilkerson, L. and Gijselaers, W. H., Eds. (1996). *Bringing Problem-Based Learning to Higher Education: Theory and Practice.* San Francisco: Jossey-Bass.
- Savin-Baden, M. (2000). *Problem-Based Learning in Higher Education: Untold Stories.* Buckingham, England: SRHE and Open University Press.

On the Internet, a good starting place is the website run by the dean of PBL, Howard Barrows, M.D., Professor Emeritus, Dept. of Medical Education, Southern Illinois University:

- "Problem-Based Learning Initiative." <http://www.pbli.org/core.htm>.

The research underlying the notion of contextual knowing may be found in

- Magolda, M. B. (1992). *Knowing and Reasoning in College: Gender-Related Patterns in Students' Intellectual Development.* San Francisco: Jossey-Bass.
- Magolda, M.B. (2001) *Making Their Own Way: Narratives for Transforming Higher Education to Promote Self-Development.* Sterling, VA: Stylus.

For a clear, concise guide to web design, see

- Castro, E. (2000) *HTML 4 for the World Wide Web.* 4th Ed. Berkeley: Peachpit.

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HONORS COLLABORATIONS: THE PRESIDENCY IN SPEECH AND COMPOSITION

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ABSTRACT

Typically at Penn State University, Honors English Composition (30) is offered fall semester as a pre-requisite for Honors Speech Communication 100, offered in the spring. This arrangement may reflect the intellectual shifts within these disciplines, implicitly signifying the distance that has grown between them and casting in relief the question of who "owns" rhetoric. In developing our courses in Speech and Composition, we sought to close this rift and in so doing create a community for our students in which issues in speech are explicitly recognized as issues in writing and vice versa. In addition, we wanted to create a new model for collaboration and team teaching, one that would embrace flexibility and integration, and demonstrate how teachers and students may work together toward common goals. To reinforce this sense of common investment, we decided to share a topic: both classes would focus on the presidential election. Jeffs class would examine how the media arbitrate political discourse; Sandy's class would explore the construction of leadership historically. This paper will describe our model in more detail, the issues such an approach raises, and our conclusions regarding its success and potential promise for teachers and students in a variety of learning contexts.

INTRODUCTION

In 1940 Speech and English became separate departments at Penn State, or as the history of Penn State puts it, Speech "was taken" from English; both, however, were still part of the Liberal Arts College, as they are today (Dunaway, 1946, p. 330). More than forty years later, another Pennsylvania University, Duquesne, experimented with a pilot project that combined Speech Communication and English Composition. Their reasoning may be said in some sense to respond to the separation of the two disciplines exemplified by Penn State's departmentalization. In their report on the Pilot project, they explained their decision:

> The tum of the century ushered in the present disjunction between speaking and writing which is bureaucratically and pedagogically perpetuated by the separate departments of Communication and English. Duquesne's recent venture into development of a University Core Curriculum presented the opportunity to force collaborations between these now divorced disciplines. (Friday and Beranek, 1984).

Their initiative was part of a campus-wide program requiring all core courses to be interdisciplinary and, therefore, "all new courses were required."

Neither of us wished to propose new courses in the required Penn State curriculum. To do so would have been a rather long and cumbersome process, one we saw no need in negotiating. Our aim was not to erase the disciplinary distinctions: we did not team teach in the usually understood sense. Unlike the Duquesne program, our project did not enroll the same students into one portmanteau class. Students enrolled either in Jeffs Speech Communication

class or Sandy's English Composition class, courses that have been part of the required Penn State curriculum since 1961-1962 (The Pennsylvania State University Bulletin, May 1961). Our arrangement may be said to have anticipated Vincent Leitch's argument for post-modem interdisciplinarity, which assumes that "In this postmodem conceptualization, there is no denying the existence, necessity, and value of the disciplines or of their boundaries and struggles. Interdisciplinarity during postmodem times designates the de facto intermixture of the disciplines, new and old, plus recognition of their differences and conflicts" (Leitch, 2000). By redesigning courses already in existence we acknowledged the changes in what it means to teach an introductory English or an introductory speech class, yet we simultaneously retained disciplinary as well as individual autonomy. Rather than directly challenge the validity of disciplinary borders, our class sought, as Leitch's ideal interdisciplinary, "to increase permeabilities and deterritorialize fixed cognitive maps" (Leitch, 2000). By deterritorializing rhetoric, we also sought to create a community for our students in which issues in speech are explicitly recognized as issues in writing and vice versa. In addition, we wanted to create a new model for collaboration and team teaching, one that would embrace flexibility and integration and demonstrate how teachers and students may work together toward common goals.

This kind of collaboration, finding the interconnections between disciplines and the ways in which one discipline informs another, is, we believe, the future of higher education, if not invention itself. Other institutions have expressed a commitment to this view: for example, when Harvard announced what it was seeking in a new university president, Dr. Gray explained that "Harvard needs someone who can deal with'... the new ways in which various disciplines inform one another,' among other things" (Goldberg, 2000). Still, having a sense of what matters pedagogically and intellectually is not the same thing as knowing exactly what to do or how to do it.

SUMMARY

When Jeff agreed not only to teach the Honors section of Speech Communication 100 but to try something "new" for both of us, we were faced with another dilemma: What were we going to do? We talked about our ideas, that we both wanted to do something on the Presidency, that we wanted to work together, that we wanted a community service component or some way to reinforce civic responsibility, and that we would have a number of field experiences, though we had not identified what these would be or how we would do all these things. Throughout the summer, Jeff and I kept in touch through e-mail: he suggested we participate in Debate Watch, a nationwide, nonpartisan program sponsored by the Commission on Presidential Debates which aims to get more people talking about the candidates and issues; I suggested various field trip possibilities, for example, Washington, D.C. We sent each other our latest syllabus and <.responded to each other's plans. Finally, we decided that early in the semester we would combine our classes for a short time, so the students would gain a very basic introduction to one another and the different disciplinary approaches to the presidency we would be taking: Jeff's class, a mix of first- and second-year students, examined how the media arbitrate political discourse; Sandy's class, all first-year students, explored the construction of leadership historically. As it happened, the separate courses were composed entirely of different students. For ease of interactivity, the classes were scheduled back-to-back on Tuesdays and Thursdays, Jeffs speech class at 12:15 and Sandy's writing course at 1:40; having them at the same time would have had some advantages-for one, avoiding students' schedule conflicts when we

wanted to bring the classes together-and some disadvantages, the main one of which would have been the difficulty of visiting one another's classes.

During the course of this journey, we discovered that the approach to teaching we developed has several benefits: faculty may work together on classes without having to engage in the politics of release time-in other words, this approach requires no extra resources. In this sense and others, our collaboration models how businesses, if not education, perform. We work together when the common intellectual threads of our courses beckon us to unite our resources as teacher-scholars. When there is a specific project to be done, the students from our classes, like units from different departments of a business, collaborate to share skills, insights, and strengths; we facilitate this community by participating in it. Our approach rejects artificial constructs that typically beleaguer conventional team-teaching arrangements, wherein faculty expend precious energy on questions of process (e.g., Who will teach what parts of class? On what days?). We exchange syllabi, share suggestions, and consider how ideas from our courses may overlap. Working together to draft relevant grant proposals and periodically attending one another's classes, we model for our students the teamwork in which they are expected to engage and the interdisciplinary mindset to which they should aspire.

CONCLUSION

What made our experiment so rewarding was that we embraced autonomy within our respective classes and demanded intellectual accountability from one another throughout the semester. Admittedly, a dance of this sort is not easy to maintain. A more traditional team-teaching model, however, would have stifled and burdened the creativity, enthusiasm, and vision we exercised in our classes. The conventions of that traditional model, its emphasis upon logistical and procedural concerns as opposed to intellectual ones, as we have noted, would have enslaved us to material conditions and shackled the permission, and encouragement, we gave one another to experiment, to take risks, and to stretch the ideas we explored with our students. The model we advocate is not vocational or skill-driven in its focus but instead underscores, as the late Richard Weaver astutely observed, that ideas have consequences. Our model affirms the value of deliberation, reflection, and judgment, among colleagues as well as within and outside the classroom; moreover, it exemplifies the notion that so-called book-learning need not assume the form of a disembodied specter students only encounter in the dim light of the library.

The boundaries that traditionally impose themselves upon an academic arrangement like ours were absent. Our model worked because we acted as independent agents; the approach succeeded because we demanded from each other accountability predicated upon sharing ideas, perspectives, points of view, and approaches. We asked students throughout the semester to step out of their intellectual comfort zones through the vehicle of performance, written and oral. Our commitment to this assignment-centered approach served us well. Completing their various assignments was for many students akin to an intellectual reckoning. This observation, we believe, must become the central practice in honors education. Thus we maintain, and we believe the empirical and anecdotal evidence confirms, that our approach represents a compelling model for our colleagues and our students.

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LEAVING HOME WITH IT:
USING INFORMATION TECHNOLOGY TO CREATE CROSS-NATIONAL DESIGN TEAMS

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ABSTRACT

This paper describes a five-year use of information technology to create cross-national design teams in an engineering design class. The program features robust, interdisciplinary, industry-sponsored projects that are presented and solved using a wide array of inexpensive, readily available technology. The structure should not be viewed simply as providing an alternative to actual travel. On the contrary, it raises the likelihood that the exposed students actually will travel.

INTRODUCTION

The main issue in internationalizing the curriculum is that study abroad means going abroad. This triggers the constraints of cost, time, foreign language competence, and the schedule for completing the degree.

However, it is quite feasible now to expose *all* students to the world using information technology. Lectures, discussion, and projects may be done with faculty and students from any university in any country that has the technology available. Some types of technology, like MSN Messenger and NetMeeting are now available free. Adding camera, microphone, and speakers to a microcomputer can cost less than $100; therefore, expensive satellite or PictureTel room systems are no longer required. There are many other collaborative tools that may cost money, such as the PictureTel 550, which is a nicer version of NetMeeting for about $1300, but you don't need to buy it. And MSN Messenger, like NetMeeting, lets you save money by having voice conversation free without the telephone charges unless you use a modem and pay a local fee. In engineering, there are commercial collaborative tools like Alibre Design, Groove Net, and CoCreate, but, again, there are also collaborative tools built into most of the CAD software that engineers already use. Some of these companies are making generous offers to universities to spur adoption of their software.

Our foreign students are quite familiar with some of these tools for staying in touch with their friends and relatives, and most American students are using MSN Messenger or AOL Instant Messenger. So it is becoming more and more curious as to why information technology is not being used more to internationalize the curriculum.

HISTORY

The cross-national design teams are a project of the honors section of the first-year engineering design course and students in a second-year English course of a two-year program in industrial engineering (OGP) in the Institut Universitaire de Technologie (JUT) of the Bethune campus of the University of Artois in Northern France (Devon et aI., 1998a). They have been run each fall from 1997-2001, although in the first year it was not in the honors section. The project has taken place within a collaboration begun in 1994 that also features faculty-industry workshops and student internship placements both ways (Devon et aI., 1998b, 1998d). The first trial in 1997 was a direct result of a faculty workshop earlier that year.

In 1998, the project received funding from Alcoa under the name Alliance by Design that was also used to start a formal global Internship and Coop Program in the Penn State College of Engineering. Students from the winning team at Penn Sate have always visited France, but since the fall class of 1999, the top ten students, as ranked by their design project scores, have gone to France for a weeklong tour of French industries. This score includes a rating of how well they collaborate with their French partners. The tour is financed by the Schreyer Honors College and the JUT. The placing of students overseas and sending them for the tour led to the creation of a I-credit international orientation class. That has now run for several years. The Alliance by Design website has information about this class, the industry tours, and all the student projects done each year: http://ww.ecseI.psu.edu/alliance/.

A collaborative design project was first run in the fall of 1997. Ten teams of three Penn State and three Artois students were each given the same design problem drawn from an industry near Penn State. Taking advantage of information technology to deliver a cost-effective IEEE program, the students collaborated by email, FAX, the WWW, and audio-video conferencing. The documentation for the design solutions was placed in bilingual sites on the WWW. Students on the winning teams were given travel vouchers to visit each other. This has been documented elsewhere (Devon et aI., 1998a) There were considerable problems of scheduling and technology, but the collaborative project was so successful that it was continued. Over the next four years, we became more sensitive to each other's calendars. In fact, sharing calendars is the first step in any such collaboration.

THE PROGRAM

The Collaborative Design Projects

All projects are provided by industry either in France or in the USA. In fall 2000, there was one of each, which we decided was too much work, and the quality suffered. In the fall of -2001, we had a representative of the sponsoring industry in France visit the JUT and engage in an audio-visual consultation with the Penn State students. This was an objective we had had for a long time but have only achieved with this project from the French side. At least one industry tour in France has included the site of the sponsoring industry for the design project.

Almost all the cross-national interaction takes place within weekly student team meetings. There are only a few plenary sessions.

Objectives

Why have we been doing this? (See Devon et aI., 1998c.) The Alliance by Design objectives are

- To teach students about the world to better prepare them for careers and lives that will be far more international than before, because;
  - o Our graduates will work for multi-cultural teams in multinational organizations,
  - o It promotes advances in knowledge, culture, justice, and peace.
- To use infonnation technology to internationalize the curriculum in real time without travel. Theoretically, it has excellent possibilities for scale-up and would allow us to bring the world to all the students.

The Technology

We soon found ourselves using everything we could for communication. The IUT has poor TCP-IP bandwidth, so we have used ISDN lines for audio-visual (A-V) conferencing using PicTel room systems on the Penn State side. We also used a number of Internet technologies, such as WWW, Telnet, FTP, although downloading was slow sometimes at the IUT. Whereas the British like phone calls and the Americans like email, the French are fond of the FAX, so we put one in our computer lab. We also use low-tech items like sketch pads using dark b or 2b leads for showing design sketches in front of the camera, FAXing them, or scanning them into the computer. We have still had trouble with the sound quality on the A-V conferencing, so we will supplement it in 2002 with a speaker telephone and possibly MSN Instant Messenger. Although we have used ProShare and now PicTel 550 at Penn State, the IUT has used a different package and it is only compatible at the A-V level and not for application sharing.

The Languages

All designs are documented in bi-lingual websites and all A-V conferencing is bilingual. All Penn State students must have at least two years of a foreign language prior to admission, but in practice students seem to need four-plus years to speak with sufficient proficiency. If we use eight teams, three to five will have a Penn State student with reasonably good French skills, and about the same will have an IUT student with good English skills. Penn State provides bilingual, wage-paYroll student interpreters for the conferencing and on-line translators. The IUT hires a translator to help. The participating faculty are both somewhat bi-lingual. In addition, all the students are aware of the on-line translation tools available and many use them. They are imperfect, but, with good editing, they can provide a fast way to a passable translation.

Language, then, is not a major impediment. Getting the students together so they can learn about each other and, in so doing, to learn more about themselves is one of the success stories. As we get past the trial-and-error stage of creating these collaborative experiences, we intend to be more systematic about the students' learning from cultural differences, including studying different engineering codes and different design and manufacturing practices.

A key to collaboration requires clearly conveying basic design concepts in various graphical language systems, and the use of sketches and CAD drawings have been very important. We hope to use Alibre Design next year, which allows both sides to import their CAD drawings into a common CAD environment for viewing and discussing.

Design Teams: Interpersonal Skills

      The curriculum that has been developed at Penn State for teamwork skills has not generally been shared with the French partners, although this is an obvious area for future development. The main features of this curriculum are

- Training in conflict resolution and listening skills. The materials include a video on active listening that is both humorous and effective: "Getting from No to Yes" [Video Arts] and the Thomas-Kilman self-knowledge test about the five basic approaches to conflict.

- Penn State students' learning to speak *English* well; slowly, clearly, in complete sentences, in simple words; no jargon, idioms, or metaphors. This is one of the valuable lessons learned from the first collaboration and followed ever since.

- Learning that other teams, not the French on your team, are the competition. This important and humorous lesson is learned anew by each new class of students.

THE RESULTS

Cross-Cultural Learning: Anecdotes of Student Reactions

      A major goal is to teach students about the world to better prepare them for careers and lives that will be far more international than before. These graduates will work for multi-cultural teams in multinational organizations, which require many collaboration skills as well as a moral sense of global ethics.

      Language is an issue, but its effect is mainly one of slowing the exchanges rather than preventing them. Cultural differences have been noticed but are not major. An assessment of different conceptions of what it takes to be a good team player was carried out during one of the collaborative design projects. This found that work had rather more influence than culture, and that the concerns of the French and American students were quite similar. One clear difference seemed to reflect what was in vogue in both countries rather than a deep cultural difference. The French stressed being "impliqu6" (involved) in the project while the Americans stressed being a "good team player" (cooperative, helpful).

      The same thing was found in an exchange between Penn State students and the Artois students in a different course on design ethics that took place in the spring of 1998. The students were discussing the relative worth of right action ethics (deontological approach) and right outcomes ethics (consequentialist approach). At the time, there was an international debate about using military action against Iraq to force compliance with the deployment of UN weapons inspectors. The American students were very prone to advocate taking the right (military) action against the "monster." The French students usually stressed that innocent Iraqi citizens would suffer rather than Saddam Hussein (a consequentialist argument), and that it was a UN decision not just an American decision (this is a social ethics argument that stresses the social arrangements for how a decision is to be made). The positions taken by the students reflected the way the issue was presented in their respective countries by their governments and their media. Thus we were able to expose students to different perspectives and show how they could learn from each other. Hopefully, this experience provides some antidote to the influence of the media in both countries.

      Apparently we have been getting better at what we do. In the fall of 2001, we ran a project developed by Professor Buvat for an industry in France. We knew it was working very

well, but, even so, the student assessments of the course at Penn State were extremely positive about the collaborative project and some even suggested continuing it for another semester. This is a very rare comment in the student assessments of our introductory design course even though it is typically well reviewed.

Logistics

The heart of the collaboration, why it works when it works, and why it does not when it does not, rests on the logistics. Achieving quality requires planning. You begin with two professors who want to do it and who have a course in which it can be a required element. We find modular approaches with projects and curricular modules are far easier to do than shared courses and degree programs even though university administrators may prefer the latter.

The next step is to share the calendars. We share information concerning when the classes meet, when the classes are in session, and when there are holidays or other disruptions in the sequence of the course. The time difference is important; the Penn State course runs from 8-10am on Tuesdays and Thursdays and also on Thursday afternoons. We always use the Tuesday morning time for communications, which is 2-4 pm (1400-1600) in France. Penn State has Labor Day, Thanksgiving, and a Fall Break of two days. The IUT has an orientation week in early September, a holiday week (Toussaints) at the beginning of November, and Armistice Day shortly thereafter. The semester calendars are fairly close, with Penn State starting in the last week of August about ten days before the IUT and finishing classes in the second week of December about one week before the IUT, although we schedule the awards ceremony during the finals week at Penn State, which ends in the third week of December.

Follow-on Effects

This project directly led to the Alcoa funding at Penn State that has been used to start a Global Internship and Coop Program in the College of Engineering. We now target sending and receiving twenty students each year. In particular, the collaboration with the IUT has led to an increasing number of students going both ways to engage in internships (stages) for eight to ten weeks. We are exchanging about five each way now. The IUT pays for the lodging of the Penn State students and Penn State finds a position that pays at least $600 a month for the French students and a place to stay that costs almost that much. A domestic or international internship (stage) is required each year for the French students. At Penn State, students are strongly encouraged to take a co-op after completing their sophomore year. We have been encouraging students even after the first year to take summer internships. In fact, a few students from the introductory honors class have pursued an internship in a foreign language environment (France or Germany) for the last three years, after completing only one year of college.

In addition to the internship program, this project has allowed us to develop the orientation course and also the industry tour. We also have under development a website that explores technology around the world. Alliance by Design was also very strongly featured in the site visit by Boeing that led to Penn State's being awarded the Boeing National Engineering Educators Award in 1998 [http://www.ecse1.psu.edu/edg/]. Future plans include expanding the project to other courses at Penn State, and we are creating a multi-national consortium that will feature such projects. At the IUT, the project is featured each year in its open house for recruitment.

Alliance by Design Obstacles

The obstacles are mundane and have little to do with culture or language. Projects like this start with a collaboration between faculty at universities in two different countries. To date, universities typically do not have incentive systems in place to make this happen, so it has been relatively rare. (The FIPSE program at the Department of Education in the United States has been extremely successful in starting international collaborations with modest funding, but it has concentrated on funding actual travel.)

A survey at Penn State in the fall of 2001 found about 100 engineering faculty (25%) expressing interest in international engineering education. This seems like almost an order of magnitude increase over the last five to ten years, so perhaps it will translate into rapid growth in such programs as the one described here, thus overcoming one obstacle, faculty hesitation.

As noted earlier, other logistic issues such as the calendar, the time difference, curricular institutionalization, and compatible technology are all important factors. Cost is not an obstacle. This is not expensive to do. On the contrary, cost effectiveness is one of the two main attractions of such a project--the other being its universal potential.

One other obstacle is time. Resolving the logistics for a cross-national project like this adds considerably to the time needed for teaching any course. It should get easier over time, and the technology should help this, but some "slack" should be built into the planning. Hiring a few student assistants to help with the technology and the translations is a very good idea.

Alliance by Design: Assessment

Assessment is known only in terms of the ancillary effects on behavior such as the new programs and the subsequent behavior of students. In this regard, the program has been extremely successful, driving the creation and development of many other programs. Still, it is time to track each cohort and see how they feel about the program in hindsight and whether it has spurred more activities of an international nature. Anecdotally, the answers here appear to be very positive.

Of the twenty-four students in EDG 100H in Fall 2000, ten went on a 2001 industry tour in France and two others for a summer internship in Germany. In Fall 2001, fifteen of twenty-four wanted to go on the industry tour and ten will. One other student will take an internship in France. We feel it is important to get the students involved starting in their first year to develop their interest, language skills, and experience. Waiting until their junior year reduces the likelihood of their getting involved in international programs.

The Future

This project has been very successful, and all our plans involve replications and expansion of this project and the ancillary activities that it has spawned. There are a few other such cross-national design teams,[1] and we have started working with the one between Leeds University and Arizona State University.

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1 Other design collaborations include the University of Michigan, Oxford University, and Seoul National University (http://www.indec.or.kr/gpd main.htm), and one between Leeds University and Arizona State University, (http://www.mech-eng.leeds.ac.uk/GEDT).

CREDIT

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ANCIENT MYTHS IN A MODERN WORLD:
A MULTI-MEDIA APPROACH TO HONORS EDUCATION AND
UNDERGRADUATE RESEARCH

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ABSTRACT

This Honors seminar examines a number of myths generated by diverse cultural groups (American Indian, Central and South American, African, and Asian) both in their ancient context and, wherever possible, in their actualizations in modem society. The title of the seminar should be viewed rather as a question than as a statement: Can we observe the traces of myths and/or forms of mythic thinking in the various structures, activities, and beliefs of modem societies? The scope and the diversity of cultural content makes the course appropriate as a general education course; it requires the student to think critically and analytically about the nature of mythic thinking, the role of myths in society, and the significance of mythical expressions (myths, legends, poems, tales) in the development of a self-concept as well as the concepts of cultural identity that underlie societal organization. The course does not deal with cultural areas in isolation from one another but rather emphasizes cultural diversity and the cross-cultural aspects encompassed by the universal nature of mythic thinking. A student should emerge from this course with a new respect for and understanding of the unity of mythic thinking within the diversity of cultural representation, i.e., the actual forms that myths take in cultural transmission over time.

THE COURSE AND PROJECTS

This course uses the study of myth and theories of myth analysis to introduce students to the broader objectives of literary and cultural analysis. The specific goals for the student are to read and write critically and analytically, to articulate opinions clearly, to become familiar with expert theories, to examine personal beliefs, and to become actively involved in the learning process. The overall course objective is to understand the nature of mythic thinking and mythic imagination by exploring the universality of mythic themes and images. All course discussions center on Joseph Campbell's *Myths to Live By,* supplemented by other texts related to the topics of "myth and modernity," "how myths function in a cultural context," and "the interaction of myth studies with science and other disciplines." These topics are explored in some depth by relating them to traditional approaches of myth analysis: Myth and Ritual (1. G. Frazer), Myth and Psychology (Jung/Freud), Myth and Primitive Thought (Levi-Strauss & Structuralism), Myth and Religion (M. Eliade).

The models of mythic narrative include texts and audio-visual resources. Beginning with a collection of Native American and Mesoamerican Creation Myths, analyzed according to one or more of the theories mentioned above, students are then asked to reflect on the mythic imaginative narrative underlying the opening "Ape sequence" from Stanley Kubrick's film *2001-- A Space Odyssey,* and the final "Big Bang" sequence from his film *2010.* Comparisons of this type are well suited to consideration of both the medium and the message, whether text, film, or,

in the Kubrick case, the addition of music to enhance an idea. A similar approach was used to discuss myth and ritual, or the manifestation of mythic thought in social contexts. The text is an eyewitness account of a cremation ceremony in Bali (1847), included in Clifford Geertz's *Local Knowledge.* This narrative of heightened ritualized attitudes towards death leads to a viewing and discussion of the videotape of the funeral of President John F. Kennedy, followed by an analysis of a video excerpt from the opening ceremonies of the Sydney OlYmpic games, 2000.

The section of the course dealing with "Ways of Thinking" draws upon two types of materials: myths as text, and the mythic thinking underlying modem attitudes. The first category includes four types of myth (Creation Myths, Hero Myths, Afterlife Myths, Apocalyptic Myths), with each team responsible for a group of myths representing each type from the part of the world to which that team has been assigned (Team I: Europe, excluding Greece and Rome; Team II: Africa, North & Sub-Saharan; Team III: North, Central, and South America; Team IV: Asia & Australia). The second category is issue-oriented articles that require students to take a position regarding the argument and to assess the mythic significance of the point(s) of view. While a variety of materials are used in this way, examples of provocative articles are "Stephen Hawking, the Big Bang, and God," a web-based article about the Flat Earth Society, and "Peyote Rituals in Utah," an article from the *Salt Lake Tribune.* The creative imagination and mythic thought finds challenging expression in the poems "The Second Coming" by W.B. Yeats and "Natural Music" by Robinson Jeffers. In each case a standard literary analysis can lead to identification and analysis of mythic themes, mythic imagery, and conceptual structures developed out of myth narratives.

Given the emphasis on collaborative-cooperative learning, most class activities involve some form of teamwork, either teams of five students or, in some cases where articles are analyzed, pairs of students. In the interest of controlling the ethnic and gender diversity of the teams, students are "assigned" to teams, with the understanding that team membership can change so long as the diversity balance is not disrupted and/or an equal change is made, i.e., the size of the teams remains the same. For the discussion pairs, where articles such as "Funeral Rites of Hindus and Buddhists" and "A Role Model for Jesus" are discussed, students are encouraged to seek out a partner without regard to the team status of the partner. While the team concept formalizes the student-student interactions, and this is required as preparation for each class assignment involving an in-class oral presentation, the pairing of students leaves room for personal linkages. Since all Honors students live in the same dormitories, these arrangements are easy to maintain and facilitate significant contacts between students outside the classroom.

The class format, active and student-centered, ensures that every student is involved in the planning and presentation of materials, either as a team participant in the discussion and development of assignments, as a team-designated spokesperson, or as an individual presenter on a team presentation. While class assignments are determined in advance and presented in the syllabus, the teams develop the structure of the class for most assignments, each chapter of the Campbell text being divided between two teams. Students are responsible for identifying major themes, developing collateral questions (and potential answers), and providing transparencies and handouts for the class presentation of materials. No student is able to make it through this class without some form of active participation. Students are graded accordingly: an individual grade and a group grade for each assignment, as appropriate. The group grade (an evaluation of the team presentation and an affirmation, based on inquiries, that each student contributed to the team effort. Functionally, the group grade can be used to raise a lower individual grade, if needed, according to a scale set up by the instructor.

The major research activity of the course is the final project, which has team and individual components. The project is a cooperative, collaborative effort that should result in a discussion/research product revealing what students learned about the forms and expressions of mythic imagination in the cultural area to which they were assigned. The primary tasks of the project are dealt with in class discussions and through group and/or independent research throughout the semester. Students are introduced to research methods and resources through a library workshop conducted by library staff; the staff also create a web page of resources relevant to the course that is actively maintained throughout the semester. The library staff conducting the workshop are also resource persons for the project, if needed. The responsibilities of the team(s) are to (a) develop a definition of "mythic imagination" based on readings and class discussion; (b) develop familiarity with at least three approaches to myth studies; (c) develop, in consultation with the instructor, the cultural criteria by which the forms or manifestations of mythic imagination are to be evaluated; and (d) search for texts that illustrate "mythic imagination" in the assigned culture region, using handouts from class, texts in the library collection, or the Internet for additional materials, using the links given in the syllabus. The body of the project is an analysis of selected texts on the basis of (1) mythic significance, (2) cultural significance, and (3) contemporary relevance. Teams are responsible for preparing class presentations for the end of the semester, using a designated spokesperson, to relate the individual textual analyses within the team to some aspect of Campbell's book. Each student is required to prepare a written product based on research, team discussions, and any essays written during the semester.

Although the course emphasizes a student-centered approach, the role of the instructor is crucial to the success of the class. Communication between faculty and student is facilitated by "course-mail," a communications vehicle provided to each instructor by the Scheduling Office, WebCT, a password-access course management tool, and the instructor's departmental web site, a centralized source for the syllabus, non-copyrighted course materials, such as self-tests, duplicating the WebCT offerings for students who prefer not to use the password access. E-Mail is a primary means of communication for questions that arise during out-of-class team discussions, for individual inquiries of a class or personal nature, and for transmitting course-relevant articles from major newspapers such as the *New York Times* and *The Washington Post.*

The instructor's role includes mentoring and motivating; students need to be shown not only how the course relates to one's academic specialty and research interests but also that the broader humanistic questions being raised are important parts of one's educational philosophy. The level and intensity of student involvement relates directly to the extent to which students can see the personal value the instructor places on the success of the class as a learning experience.

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AUTHOR BIOGRAPHY

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HONORS COLLOQUIUM: BERLIN IN THE 1940s

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ABSTRACT

"Berlin in the 1940s" is an honors course that can foster high levels of communication, creativity, personal responsibility, intellectual community building, and synthetic analysis. The seminar itself provides an interdisciplinary and international approach to understanding "local" Berlin (Germany) during its wartime, 1939-1945, and postwar, 1945-1949, crisis periods. Students have the opportunity to stretch themselves between and among an assortment of disciplines, including diplomatic, economic, social, intellectual, architectural, and film studies, among others. Despite the limitations of time (one 75-minute meeting per week) and resources (primarily my own), the students still had available to them virtually all of the primary and secondary materials the course requires. Methodologically, the class promotes creative exploration, use of available sources, and independent study, while providing minimal instructional intervention, lecture, and common reading.

INTRODUCTION

The course begins with a basic historic treatment of "1940s Berlin" before students, in subsequent weeks, engage one another (and the professor) in discipline-specific and cross-disciplinary document evaluations, discussions, oral presentations, and paper writing. During the same initial meeting when the historic background is laid out and discussed, the class participants introduce themselves and their reasons for subscribing to the course. At this same point in time when student-colleagues learn the basics of mid-century Berlin and become acquainted with one another, the professor defers to them the degree to which their final grade will rest on three components: discussion, oral presentation, and paper presentation. The student provides a confidential, written response to the professor that values each area with a minimum grade weight of 15% and a maximum of 70%. The total weighting must add up to 100%.

The purpose in starting the course off with a combination of basic history, personal introductions, and individualized evaluation emphases is to set the tone for collegiality, serious scholarship, and intellectual enjoyment. Consider the following suppositions and working assumptions. First, if the environment for advanced learning is built on trust, then it is critical for professors and students to work, together, to sharpen everyone's critical thinking skills, to explore unconventional questions, and to realize that the "classroom" extends beyond the traditional setting. Second, if the classroom of learning is more than a physical place--a lecture hall, a professor's office, or a boundaried campus--then even the globe is too confining. Third, if the assessment of learning should be more than a letter grade earned by a student and assigned by a professor, then give the students some control over their fate from the outset. The more invested they feel in the process of evaluation, the more likely they are to perform at a higher level in the course. And, fourth, if the meeting of minds must necessarily function as an open forum for the free exchange of ideas, then doesn't it follow that the professor should be "the first

among equals"; that all values are acceptable but one, intolerance; and that the student who most fully engages in the course also emerges most fulfilled.

OPENING DAY SYLLABUS

The outline and general parameters of the course are in place with the "first day" syllabus. The fact that the students will determine their future book and/or film choices, the date on which they make their oral presentations, and the weighting of grades across areas of evaluation significantly attaches each class member to the overall success of the course. At least that is the theory going into the class.

This course, Honors Colloquium: Berlin in the 1940s, provided an interdisciplinary and international approach to understanding local Berlin during its wartime, 1939-1945, and postwar, 1945-1949, crisis periods. The class provided plenty of room for creative methods, use of available sources, and in4ependent study. Beginning with a basic historic treatment and then branching out into diplomatic, economic, social, intellectual, architectural, and film studies treatments, among others, students engage one another (and the professor) in discipline-specific and cross-disciplinary document evaluations, discussions, oral presentations, and paper-writing.

Grades were determined by the quality of discussion, one oral book report, and one analytical research paper. The latter was an analytical essay based on two or more books, two or more films, and a series of documents. Students addressed the contribution that each book, film, or document provides for advanced understanding of Berlin in the 1940s. In other words, students described what is each author's purpose in writing the book, each filmmaker's objective in producing his or her work, or the document's historic meaning. Then, through comparative discussion and the use of argument, evidence, and analysis, the students evaluated the books/films/documents for method, effectiveness, significance, and insight.

For the oral report, students chose an additional book or film title for an 8-12-minute in-class, oral presentation. They discussed the author/filmmaker's argument (i.e., what he or she wants us to believe), purposes (e.g., a political/personal agenda or a pursuit of truth), sources/evidence (e.g., testimony, interviews, letters), method (e.g., organization, form of presentation, pace), and the degree of "success" in delivering the product.

SUMMARY

To say that "Berlin in the 1940s" exceeded expectations would be a mild understatement. While I did not have fixed measures of success in mind before embarking on the honors course, I did have modest hopes. I adopted an approach to building a class that had neither occurred to me, in synthetic form, prior to fall 1999-spring 2000 (when I designed the seminar) nor that I had thought deeply about before instituting. Sometimes, the best classes are those that develop instinctively and as works-in-progress. The fact that so many highly motivated and mature students landed in one classroom at one moment in time, I believe, explains our success more than anyone factor. Still, there were additional elements at work-some planned, some unplanned, and some institutional--that provide further plausible explanations for the high performance we enjoyed.

In terms of the institutional context, the 12-year-old Honors Program at Delaware Valley College of Science and Agriculture is still--in my estimation--in a nascent stage of development. As it turned out, because I came along at a time when few other professors offered honors

courses, when almost no one else competed for the minimal resources allocated to the Honors Program, and when quality students craved an intellectually challenging seminar that also emphasized shared success, individual responsibility, and student ownership, the course was well positioned to excel.

Having discussed in brief some of the institutional, planned, and unplanned elements that conspired successfully on behalf of the course, there finally remains the topic itself, "Berlin in the 1940s." The fact that Berlin was at the center of two global crises in the span of a decade--during the Second World War, 1939-1945, and the early Cold War, 1945-1949--makes it a study area rich with possibilities. Given the many volumes written by, and about, the actors and events of mid-century Berlin, the wealth of newly released archives related to wartime and postwar Berlin, and the multiplicity of disciplines and approaches that can be used to explore an even greater number of questions surrounding the topic, you have a ready-made honors course.

COURSE RESOURCES

Primary Sources (partial list):
      Andreas-Friedrich, *Berlin Underground,* 1938-1945
      Andreas-Friedrich, *Battleground Berlin: Diaries, 1945-1948*
      Heidelmeyer and Hindrichs (eds.), *Documents on Berlin,* Vol. I, 1943-1957
      Planning for Gennany (microfilm in Krauskopf Library)
      Shirer, *Berlin Diary: The Journal of a Foreign Correspondent, 1934-1941*
      Shirer, *This is Berlin: Radio Broadcasts From Nazi Germany*
      State-War-Navy Coordinating Committee: State Department Documents on Postwar
      Vassiltchikov, *The Berlin Diaries, 1940-1945*
      Vogel, *Bad Times, Good Friends: A Personal Memoir*

Secondary Literature (partial list):
      Battle of the Cold War
      Beck, *Under the Bombs: The German Home Front, 1942-1945*
      Bering, *Outpost Berlin: The History of the American Forces in Berlin, 1945-1994*
      Erickson, *The Road to Berlin: Stalin's War With Germany*
      Farr, *Berlin! Berlin! Its Culture, Its Times*
      Fehrenbach, *Cinema in Democratizing Germany: Reconstructing National Identity After*
          Hitler
      Gay, *My German Question: Growing Up in Nazi Berlin*
      Giangreco and Griffin, *Airbridge to Berlin: The Berlin Crisis of 1948*
      Grathwol and Moorhus, *American Forces in Berlin: Cold War Outpost, 1945-1994*
      Haydock, *City Under Siege: The Berlin Blockade and Airlift, 1948-1949*
      Ladd, *The Ghosts of Berlin*
      Launius, *The Berlin Airlift: Constructive Air Power*
      Miller, *To Save a City: The Berlin Airlift, 1948-1949*
      Murphy, Kondrashev, *Bailey, Battleground Berlin: CIA vs. KGB in the Cold War*
      Naimark, *The Russians in Germany*
      Parrish, *Berlin in the Balance: The Blockade, The Airlift, The First Major*
      Pennacchio, *The United States and Berlin,* 1945-1949 (unpublished dissertation)
      Pike, *The Politics of Culture in Soviet-Occupied Germany, 1945-1949*

Pommerin (ed.), *Culture in the Federal Republic of Germany*
Schivelbusch (trans.), *In a Cold Crater: Cultural and Intellectual Life in Berlin, 1945
-1948*
Taylor, *Berlin and Its Culture Willett, The Americanization of Germany,* 1945-1949

Films (partial list):
Bolthead Productions, *Berlin: Journey of a City*
Carter, *Swing Kids*
Cromwell Productions, *The Russian Front: The Battles for Berlin*
Duke, *The Berlin Airlift*
Fassbinder, *The Marriage of Maria Braun*
Riefenstahl, *Triumph of the Will*

AUTHOR BIOGRAPHY

Charles Pennacchio, who teaches history, political science, and honors at Delaware Valley College of Science and Agriculture (PA), has received several teaching awards and is co-author of *American History in a Box* (2002) and *The Philippine-United States War, 1899-1902* (2003).

IV. Undergraduate Research via Service Learning and Outreach

Recent national trends to incorporate service learning in academic programs demonstrate the growing commitment to the scholarship of engagement by universities. This chapter features papers that address both the student rewards of being involved in meaningful research that touches the community and the challenges associated with developing and maintaining these unique projects.

Carubia et al. describe a model of student research that integrates service leadership vertically within a university education, thus allowing students to develop their vision for addressing a local or global community issue. Vender chronicles a rigorous service learning experience by peppering student reflections throughout her description of the three-part model. Dupont-Morales summarizes the issue reaction of the conference discussants that grappled with defining and creating service learning opportunities. Mueller presents an issue reaction on social inquiry and the challenges that instructors face when having students confront communal issues. The paper provides some valuable suggestions to address those research challenges. Finally, Brown and Brown describe an honors symposium and their efforts to instill and develop student leadership qualities in the context of engaging students in research projects that address a community need.

PATTERNS OF ENGAGEMENT IN SERVICE LEADERSHIP: FIRST YEAR TO SENIOR YEAR

JOSEPHINE CARUBIA, SARA FABER, SOMA KEDIA, NICOLE SANDRETTO, ADAM TAROSKY AND JOANN C. VENDER[1]
THE PENNSYLVANIA STATE UNIVERSITY

ABSTRACT

This paper describes a model of service leadership that can be followed by university students throughout their academic career. The intent of this project is to help students understand their growth in civic responsibility and leadership and to put it in context with the growth of other students. Using a grounded-theory approach from quantitative and qualitative surveys and case studies, the research team of seven undergraduates and two staff members from the Schreyer Honors College developed three distinct, non-exclusive tracks that revolve around a theme of vision development. The three tracks include *Service to the On-Campus Community, Service to the Local Community,* and *Service to the National/Global Community.* The results, although addressing different questions, are consistent with the developmental model of service leadership proposed by Delve, Mintz, and Stewart (1990). Future research directions include refining the survey and expanding this pilot study to include a larger sample of students.

INTRODUCTION

This study describes a model of service leadership that any incoming student can pursue. Moreover, this model is offered to administrators, faculty, staff, and student leaders in the hope that it will be used as a guide to encourage students to fulfill civic responsibility through service leadership. Three distinct, non-exclusive tracks revolve around a theme of vision development. They are based on students who have been successful at following a service leadership track. In detailing the tracks, two methods were used: a survey and case study interviews.

While data about service and service leadership was collected both quantitatively through the survey and qualitatively through the case studies, this project did not begin with a definition of either term. Through discussion, it was found that definitions of service and service leadership are as diverse as the people defining them. As a result, each of our case study subjects was asked to define the two terms, and the following definitions were compiled:

Service is to share one's talents to benefit others and to fulfill community needs. It is to give more than one expects to receive in return.

Service Leadership is the process of inspiring, motivating, and empowering others, getting them involved in service and pushing them beyond what they believe they are capable of achieving.

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1 In addition to these authors, Schreyer Scholars Ivan Bialostosky, Eric Hough, and Hilary Oman, also contributed to the research and development of this study.

METHOD

In order to gather quantitative data, a survey was sent to 575 Penn State University undergraduates (after eliminating cross-organizational members) in the following organizations or designations:

- Alpha Phi Omega, a co-ed service fraternity
- Male campus residents in a special living option residence hall (Living-Learning Environment)
- SAIL, a Schreyer Honors College service organization
- ACT, a Schreyer Honors College organization for one-time service opportunities
- Alpha Xi Delta, a sorority
- Omicron Delta Kappa, a leadership honors society
- The Intrafraternity CouncillPanhellenic Executive Board
- The Schreyer Honors College Scholar Assistants (student leaders and programmers)

Forty-two responses were received, a response rate of seven percent. Although no formal survey question addressed demographics, the respondents were mostly between the ages of 18 and 24, with roughly equal numbers of males and females.

Fifteen Penn State University undergraduates and graduate students participated in qualitative data collection. These participants were between the ages of 19 and 23. There were 9 females and 6 males. All interviewees were active participants and leaders in service.

The Service Leadership Survey (Table 1), a simple six-question survey, was created for the purposes of this study. Questions were asked regarding participation in service and service leadership during each year of the undergraduate career. Participants were asked to respond with both the raw numbers of service activities as well as the organizations in which they were involved.

Procedure

The Service Leadership Survey was distributed by electronic mail to all participants, who were asked to complete the survey and send responses via e-mail. After each participant was asked to describe the general service and leadership activities per year as an undergraduate, each was then asked to give definitions of service and service leadership.

Table 1: Service Leadership Survey

When answering the survey, please note that "service organizations" and "service-oriented activities" include both university and non-university groups, and any organization in which a community of people (on or off-campus) is served. This can range from Habitat for Humanity to student government, or paid positions of service.
1) What year are you at PSU?   a) 1st yr? b) 2nd yr? c) 3rd yr? d) 4th yr? e) 5th+ yr? f) graduate student or professional? (If you are a grad or professional who did your undergraduate work at Penn State, we'd appreciate your responses as they relate to your undergraduate experience only)
2) In how many "one-time" service activities (MLK Day of Service, PNC Day of Caring, etc.) did you participate during your: a) 1_{st} yr? B) 2nd yr? c) 3rd yr? d) 4th yr? e) 5th+ yr?
3) In how many service organizations or service-oriented activities were you an ACTIVE member during your: a) 1_{st} yr? B) 2nd yr? c) 3rd yr? d) 4th yr? e) 5th+ yr?
4) In how many service organizations or service-oriented activities did you hold a leadership role during your: a) 1_{st} yr? B) 2nd yr? c) 3rd yr? d) 4th yr? e) 5th+ yr?
5) In how many service programs or service activities, etc., did you participate during: a) summer break(s)? b) fall break(s)?   c) winter break(s)?   d) spring break(s)?
6) List the activities (both "one-time" and long-term) in which you have participated, according to each year in school.   a) 1_{st} yr? B) 2nd yr? c) 3rd yr? d) 4th yr? e) 5th+ yr?

Data Analysis

Mean and standard deviations for each year in school, including data from each class,[2] were calculated using Excel. Survey responses for one-time activities and general organizations were added together, and the mean was calculated for the combined number, as well as for the "service leadership" question.

Analysis of qualitative data involved a grounded theory approach of reviewing and coding interview transcripts to identify patterns and develop these patterns into distinct tracks of service leadership.

In examining the quantitative data, focus was placed on two main areas of service involvement: general participation in service as a *member* of a group, and more involved participation as a *leader.*

The first aspect examined was average service involvement by class. Figure 1 shows levels of general participation, without focusing on any leadership positions. It is important to note trends rather than raw numbers. Because many survey respondents listed no service

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[2] From this point, *class* shall refer to the student's current year designation (i.e. freshman, sophomore, junior, senior, senior +) and *year* refers to the year in which they participated in service (i.e. 1st, 2nd, 3rd, 4th, or 5th).
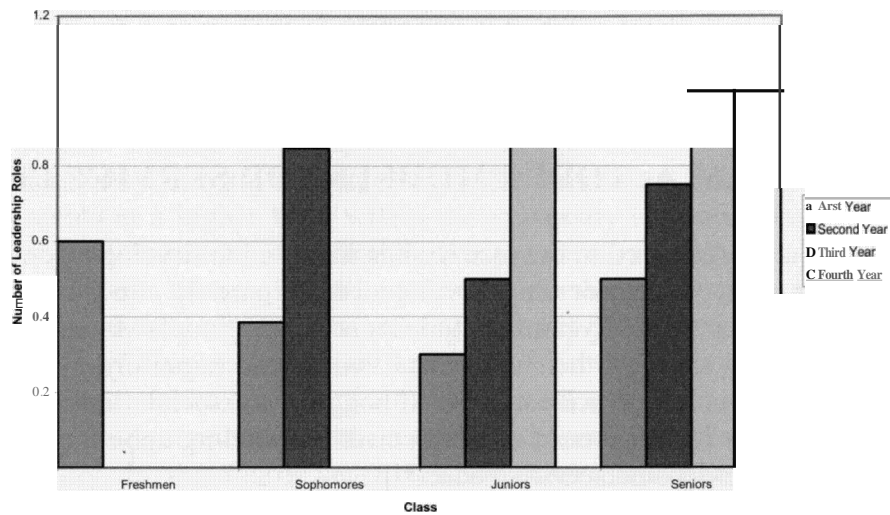
involvement across the board, the averages may seem low, but the researchers were more interested in four-year trends than actual numbers. The first and most obvious trend presented in Figure 1 is the steady increase in service involvement each year. As a student progresses from a first-year student to a sophomore and from a sophomore to a junior, he or she tends to participate in more and more activities. In addition, there is a slight drop in involvement in the senior year. Two possible explanations for this trend are the following: First, seniors have new concerns (e.g., seeking employment or entrance to graduate/professional school), so it is possible that the increased responsibilities of being a senior took up time that would otherwise be spent in service. Alternatively, it is possible that seniors did not do less service at all, but rather participated in more "specialized service"; in other words, they became more intensely involved in a group (particularly as a leader), instead of being only a member of many groups. Further evidence described below supports this theory of "senior specialization."

*Figure 1: Average Service Involvement by Class*
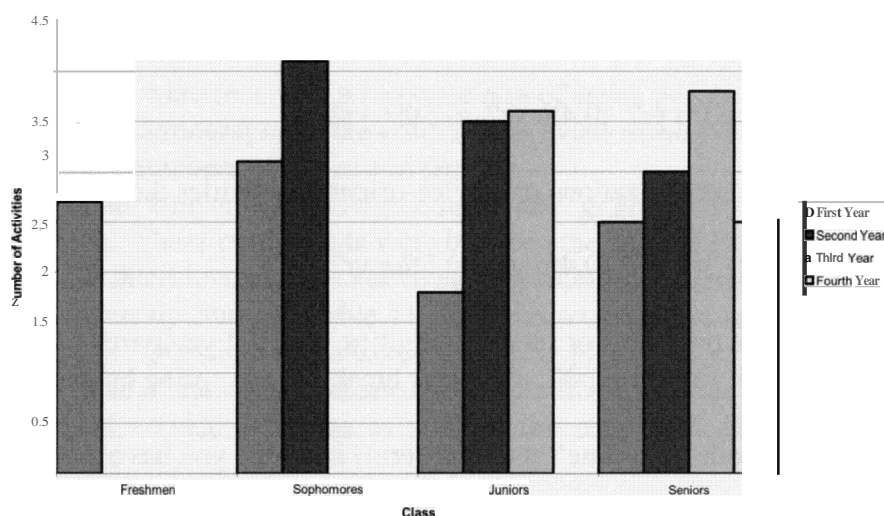
The next aspect examined was service leadership and how it might have evolved over a four-year period. Figure 2 depicts average service leadership roles by class. Once again, service involvement as a leader increased each year over the four years. There is also evidence for the "senior specialization" theory. Although, as discussed previously, overall involvement dropped in the senior year, leadership involvement actually increased in the senior year. Another interesting trend may be called the "junior plateau": service involvement appears to be at maximum level during the junior year. Although seniors continue with service, the sharp increases associated with the first year and sophomore year are not apparent. This "plateau" may have resulted because juniors and seniors were moving more into leadership commitments instead of general involvement.

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Trends in general service participation vs. service leadership are presented in Figure 3, which shows the percentage of leadership roles compared to general participation over the four years. Service leadership roles increase each year relative to general membership roles. On average, by the time students are seniors, almost half of their service involvement will be in the form of service leadership.

Figure 3: Percentage of Service and Service Leadership Roles by Class

First Year   **Second Year**

Third Year   **Fourth Year**

83
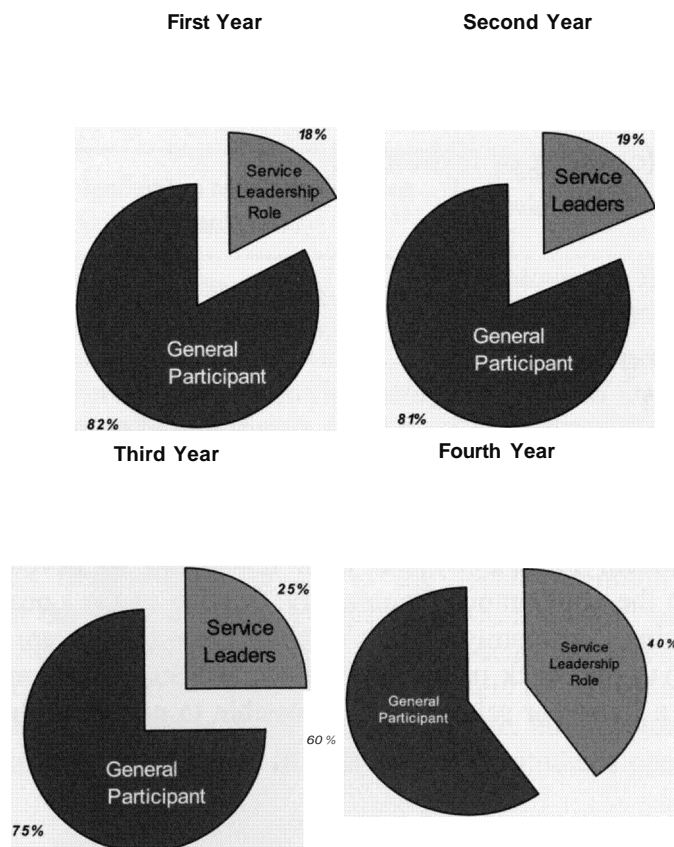
Two points from this quantitative analysis are applied to the tracks detailed below. First, it is important in the early years and throughout to increase service involvement each year. Second, in the junior and senior years, it is important to encourage a move away from increased amounts of general participation and toward more committed involvement in the form of leadership roles.

CASE STUDY DATA: THREE MODELS FOR SERVICE LEADERSHIP

The information gathered in the case studies was used to develop a general framework for consecutive levels of service leadership development (Figure 4). In their first year, students explore visions. By their second year, the students accept a group's vision and work towards it. In their third year, they develop their individual vision, and hopefully by the fourth year they have begun to share that vision with others. Although we associate these levels with years in school, the process may be lengthened or compressed, depending upon the individual and his or her experiences with service and service leadership.

Figure 4: Framework for levels of service leadership development

Exploration of Visions

Acceptance of a Group's
Vision

Development of Individual
Vision

Sharing Individual
Vision

For case study data, we interviewed fifteen senior students who have successfully completed a service leadership track. From analysis of these interviews, we developed and offer three distinct tracks: Service to the On-Campus Community, Service to the Local Community, and Service to the National/Global Community. While distinct, these models are not exclusive; students can engage in more than one track or overlap between tracks. Furthermore, although these models are proposed for a four-year schedule, it is possible to condense the four steps-

each consisting of one year-into a shorter length of time, or to extend the steps over a longer career of service.

Service to the On-campus Community

Service to the on-campus community involves serving one's peers (Table 2). Frequent choices of these leaders include involvement in student government or in tutoring, planning events for the student body, serving on university-wide committees that address student issues, or representing students at a higher level within the university infrastructure. During the first year, students participate within an organization, demonstrating some level of commitment. In the second year, the students take on a mid-level leadership role and begin to plan service events within the organization of their choice. Overseeing planning events is a key development in the third year, combined with higher levels of leadership. Furthermore, in the third year these students seek inter-group relations, working with other service organizations towards a common goal. By establishing such cooperative efforts, these leaders gain the ability to pursue larger-scale projects. Finally, in the fourth year, these students demonstrate the highest level of commitment and leadership, combining these qualities with roles as mentors to future leaders. Also crucial to this phase of leadership is the sharing and initiation of individual visions as service activities and projects.

Like many students who choose this track, our case study selected student government as her mode of service. In her first year, she became involved in her residence area government, comprising a group of residence halls. In year two, she took on the highest leadership position in that local organization, and she began to volunteer with other organizations. In year three, she became involved in the all-campus area government and moved up in terms of overseeing events. Finally, in her fourth year, she held the highest level of commitment and leadership, which has allowed her to initiate new visions.

Table 2: Service to the On-campus Community

Year		
Year 1	Participate in service events (in an organization)	Campus Area Government Treasurer, Movin' On Volunteer (general)
Year 2	Take mid-level leadership role, Plan service events (in an organization)	Campus Area Government President, Movin' On Volunteer (hospitality), All-Campus Government Council Member
Year 3	Oversee planning events, Seek inter-group relations, Aim for large-scale projects	Movin' On Hospitality Committee Leader, All-Campus Government Treasurer and Fundraising Co-chair
Year 4	Hold highest-level of commitment and leadership, Mentor and encourage new leaders, Initiate visions	Movin' On Assistant Director, All-Campus Government Executive Vice President and Elections Commissioner

Service to the Local Community

Students involved in service to the local community show the highest level of commitment at the earliest stages, compared to students who select the other tracks (Table 3). Moreover, while committed to service, these students are flexible in alternating the groups to which they dedicate themselves and sample a variety of service organization choices. The depth of commitment and service increase with each phase, but the students may shift their focus from one group or interest to another. In year one, these students commit to and participate in many

one-time service events and service organization(s). Students expand their roles as participants during the second year and take a leadership role in community outreach as well. Year three reveals these students to be leaders of already established projects and creators of new initiatives. Similar to the previously described on-campus model, the institution of inter-group relations expands the service ability of the students and the scope of that service. Besides seeking cooperative efforts, these students also search for gaps in service or try to discover unmet needs of the community. Such efforts translate to action in year four, as these students lead proactively, not only in improving existing projects but in thinking large-scale and applying their expertise to new areas of service. These new applications emphasize that students in this track of service shift their focus among different community service efforts while increasing the depth of their commitment. This shift in the last year may provide a clue to the survey data, which indicates that fourth-year students engage in fewer service activities than younger students. Such a seeming decrease in service may result from the extra level of commitment fourth-year students show to a select number of organizations, drawing their efforts from many organizations to concentrate on one or two that are especially in need of leadership. Again, the efforts of student leaders to act as mentors during their fourth years are vital to a healthy community service organization.

Our case-study student became very involved during his first year. In year two, he took on a leadership role as coordinator of "Into the Streets," a service program comprising a series of one-day activities, and he also became a United Way student representative; both of these activities involved off-campus service. In year three, he began to initiate new projects, such as "Fresh Start"-a one-day service program for first-year students held at the beginning of the fall semester-and the Council of Lionhearts-a consortium of service organization leaders. In year four, he began to initiate new visions, thinking larger-scale, and to apply his expertise to new areas as he applied for a grant for a local service day for high school students; he also shifted to become a leader in his fraternity.

Table 3: Service to the Local Community

Year 1	Commit to and continually participate in many one-time activities, and some service organizations	Into the Streets Team Leader, many one-time service activities
Year 2	Expand participatory role, Take on leadership role in community outreach	Into the Streets Overall Coordinator, many one-time service activities, United Way Student Representative
Year 3	Lead established projects, Create new initiatives, Seek connections between groups, Discover gaps in service	Into the Streets Overall Coordinator, United Way Student Representative, Initiated Fresh Start, Council of Lionhearts
Year 4	Mentor new leaders, Lead proactively, Improve existing projects, Think large-scale, Apply expertise to new areas	Aimed to improve Student Day as Coordinator, Earned Grant for local service day, Philanthropy Chair for Fraternity

Service to the National/Global Community

Service to the National/Global Community is the track most tightly linked to self-exploration and to curricular choices. Also, fall/spring/summer breaks are very important in the pursuit of national or global service, because those are the times convenient for students to travel to engage in non-local service.

Unlike participants in the other models, students following this track spend the first year exploring projects and themselves in determining where they want to invest their time, with the result being a lower level of initial commitment. In year two, these students commit to outreach organizations and are already formulating a bigger picture, delving into where they fit in the worldwide scheme of service. After the explorative phases of years one and two, year three consists of students sharing their worldwide vision and directing their involvement in a local leadership role that reflects this ambition. Moreover, students use the experiences of leadership and sharing in this phase to prepare themselves for their chosen mode of service. Finally, fourth-year students in this model act out their visions in national or global service and apply the experience they gain to create new venues for service.

A sociology major, the student case study was experimenting in her first year, as she was a member of several organizations and participating in the groups' activities. In her second year, she remained a member of the same organizations, but she also began to develop a bigger picture and to expand beyond the local community, traveling to New York City to work with the homeless. In year three she studied in Thailand, where she was a protester, translator, teacher, and organizer of some outreach activities. In year four she brought the experience back, developing a national non-profit organization to promote service after study abroad, showing that she is using the experience she gained to create new channels of service involvement for other students.

Table 4: Service to the National/Global Community

Year 1	Explore project and self through one-time outreach initiatives (locally)	Students for a Free Tibet Organizer, Amnesty International
Year 2	Commit to outreach organizations, Explore beyond immediate community, Develop "Bigger Picture"	Students for a Free Tibet, Amnesty International, Spring break trip to NYC to work with homeless
Year 3	Take leadership role locally, Share larger message, Prepare for more national/global participation and service	In Thailand: Assembly of the Poor Protester, Translator, English teacher, Prepared American Outreach activities
Year 4	Act in national/global service, Apply experience gained to create new "channels" for service	Developer of national non-profit to promote grass-roots service after study abroad

Relationship of Case Study Tracks to Vision Growth

All of these tracks follow the vision development trend introduced earlier (see Figure 4 and Table 5), in that in the first year, students explore visions, by exploring what they themselves want and then trying to match their interests with the service activities and organizations available. The second phase of all models correlates to commitment to an organization's vision, followed by an expanded individual vision inspired by or based on the organizational vision in the third year. Finally, in stage four, student leaders in service mentor others and augment their service repertoire, indicating that they share their vision with others.

Table 5: Patterns of Engagement in Service Leadership: First Year to Senior Year

Track	Service to the On-Campus Community	Service to the Local Community	Service to the National/Global Community
Year 1	Participate in service events (in an organization)	Commit to and continually participate in many one-time activities, and some service organizations	Explore project and self through one-time outreach initiatives (locally)
Year 2	Take mid-level leadership role, Plan service events (in an organization)	Expand participatory role, Take on leadership role in community outreach	Commit to outreach organizations, Explore beyond immediate community, Develop "Bigger Picture"
Year 3	Oversee planning events, Seek inter-group relations, Aim for large-scale projects	Lead established projects, Create new initiatives, Seek connections between groups, Discover gaps in service	Take leadership role locally, Share larger message, Prepare for more national/global participation and service
Year 4	Hold highest-level of commitment and leadership, Mentor and encourage new leaders, Initiate visions	Mentor new leaders, Lead proactively, Improve existing projects, Think large-scale, Apply expertise to new areas	Act in national/global service, Apply experience gained to create new "channels" for service

FUTURE DIRECTIONS AND RELATED STUDIES

This paper offers interpretations and conclusions from a very small pilot study conducted in the spring of 2001, but the researchers are hoping to expand the study, using a larger sample of students. The study did not start with any preconceived notions of models for service leadership, but rather used a grounded-theory approach to discover if there was a trajectory. The qualitative case studies were particularly illuminating, as the models discussed above emerged from the experiences of the students who were interviewed.

It is important to specify the questions that were not asked. There was no explicit effort in this project to understand why people do service, nor was there an attempt to assess intellectual or developmental growth in terms of values or other characteristics resulting from service activities. Delve, Mintz, and Stewart (1990) have addressed these issues. Their model includes five phases; it is consistent with what we found, but asks slightly different questions. Their five phases-exploration, clarification, realization, activation, and internalization-could be accomplished in one year, or spread out over a five- or six-year period of student development which may or may not coincide with an undergraduate education, as some students have significant service activities in high school and may come to college at the third or fourth stage of Qelve et al. (1990). In the exploration phase, they found that students were committed to their own interests and self-development, and the outcome was self-satisfaction; they may be motivated by a tangible incentive such as a pizza party or t-shirt. In the clarification phase, they found that students became committed to a group, and the outcome was a sense of belonging to that group. In the third phase, students became committed to an issue as they became more involved over a longer period of time, and the outcome was a sense of understanding of an issue to which they were making a commitment. In the activation phase, they continued that commitment to an issue, with the outcome that they were empowered to make change, not only in their own lives, but also in the larger community. There is a continuity between phases three

and four, but it is much more intense and turns outward in the fourth phase. In the internalization phase, students redefined their moral sphere, such that their commitment was to social justice, and the developmental outcome was a sense of living one's own values. The researchers felt that what they had discovered through case-study interviews was consistent with Delve, Mintz, and Stewart's (1990) study.

It is hoped as this work continues, that it is not only descriptive but that it can help students understand their growth and put it in context with other students' growth, not only at Penn State but across the country as we look at other studies. It is important for students to realize that it is not necessary to continue doing more if they want to contribute, but that they can participate in a deeper way. In that latest stage, students often join advisory boards at Penn State, so that many students become part of community-wide teams that are also trying to set goals and visions for the university and local community, and that is definitely a service leadership role.

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AUTHOR BIOGRAPHIES

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COMMUNITY ACTION RESEARCH: A THREE-PART SERVICE-LEARNING COURSE MODEL

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ABSTRACT

This paper discusses a model for a three-part service-learning course developed by the Schreyer Honors College and Department of Geography at Penn State. Piloted during the spring, summer, and fall semesters of 2001, "Geography 298H--Experiences in International Service Learning: Juarez, Mexico" was designed to engage participants in a meaningful community development project while learning about the conditions, challenges, and prospects of a specific world region. After a semester of background preparation that included discussions with faculty members across many disciplines and team research resulting in a 148-page field guide, participating students traveled to Ciudad Juarez, Mexico, where they constructed a single-family home for recent migrants to the area. The students maintained written and photographic journals during the trip and submitted excerpts upon their return. During the fall semester, the class reconvened for several sessions of reflection and discussion; assignments comprised writing addenda to the field guide, editorials on some aspect of the trip that would be appropriate for publication in campus or hometown newspapers, and an open-ended evaluation of the experience. Throughout the process, students built leadership skills through networking, fund-raising, and making presentations to school students and civic groups in their home communities. The course is serving as a model for other service learning projects, notably "Geography 297H--Experiences in International Service Learning: HOINA, India" and "Architectural Engineering 297H: Tribal Housing."

BACKGROUND

The Juarez project was the brainchild of Jane Peacock, director of the WIC nutrition program for the state of New Mexico and a Penn State alumna, and Cheryl Achterberg, Dean of Penn State's Schreyer Honors College. The two have worked together on nutrition education projects for the past decade and a half. Their brainchild came to light in the form of a course developed and piloted in Penn State's Department of Geography, entitled "International Experiences in Service Learning: Juarez, Mexico." In keeping with the Schreyer Honors College's four-part mission (academic excellence with integrity, internationalization, leadership development, and civic engagement) and the Department of Geography's initiatives in global issues and service learning, the course was designed to engage participants in a meaningful community development project while learning about the conditions, challenges, and prospects of a specific world region, as well as to build leadership skills through teamwork, networking, fund-raising, and making presentations to school students and civic groups.

Class members were undergraduate Honors students, nearly three-quarters of whom had just completed their first year at Penn State. It was a life-transforming experience, not only for Dulce and Adolfo, the young couple for whom the group constructed the house that week, but

also for the twenty students and four instructors who labored physically and mentally to make it possible. Cheryl Achterberg has called it "the most uniformly powerful learning experience I have ever observed."

Part I: Preparation

The group had worked throughout the spring 2001 semester to learn about the conditions, challenges, and prospects of the Juarez-El Paso border region. During class meetings, faculty from geography, women's studies, architecture, landscape architecture, architectural engineering, and marketing shared their expertise on poverty, economic development, social and demographic characteristics of the area, reading the landscape, sustainable design practices, home construction, fund-raising, and service learning. Dr. Carolyn Tubbs, Faculty Residence Mentor for the Living-Learning Community of Atherton and Simmons Halls, brought a "taste of home" to her session: after sharing her experience of growing up in a bi-cultural neighborhood of El Paso, she surprised and delighted the class with a tasty treat of *pan dulce,* which her mother had purchased at a favorite Juárez bakery and shipped to University Park just for the class.

For almost all students, it was their first introduction to the discipline of geography and its integrative perspective. It was also their first foray into preparing publication-quality work. While each individual focused on a particular aspect of the *milieu* that comprises Ciudad Juarez, they worked together in teams of 3 or 4 to fashion coherent chapters on the landscape, population, infrastructure, politics and administration, economic development, and cultural patterns of the area. The result was a 148-page field guide, entitled *Geographic Perspectives on Ciudad Juarez, Mexico.* [1] The volume began with an overview of the physical landscape, land use, environmental concerns, and cultural landscape of the region. The next chapter discussed issues of demography, health, nutrition, and education. The third focused on housing and services available to Juarez residents. The fourth chapter surveyed historical and contemporary politics, border relations, and the North American Free Trade Agreement (NAFTA). The fifth covered economic foundations of El Paso del Norte, the *maquiladora* industry, formal and informal sectors of Juarez's contemporary economy, and the city's economic development in the larger contexts of Mexico and the U.S. The final chapter offered insight into aspects of contemporary Mexican culture, including religion, holidays and celebrations, literature, theater, art, music and dance, and family entertainment.

But before the group could depart, the students had to raise $3,000 to cover construction costs of the home they would build. They did this by drawing on community connections, linking university students with organizations and individuals in their home communities, and ultimately with the community in Ciudad Juarez in which they served. Participants received donations from high school student councils, church youth groups, Rotary Clubs, Lions Clubs, building contractors, family, and friends. To thank these sponsors, the students sent postcards from the field and made presentations about the experience at group meetings in the summer and fall. Student travel was funded in part by Schreyer Ambassador Travel Grants, and a grant from the Kellogg Foundation Leadership for Institutional Change (LINC) Initiative helped to underwrite logistical expenses.

Part II: Participation

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1 An electronic version of the field guide is available on the course website at http://web.shc.psu.edu/~juarez. The field guide is also available at Penn State's Paterno Library, call number HN120.C48G46 2001.

The group arrived in El Paso on Saturday, May 12 and crossed the border into Juarez on Sunday. After a tour of Arbol de Vida (Tree of Life) orphanage and playing with the children there, they toured the worksite in a *colonia* (shanty-town neighborhood) on the far western edge of Ciudad Juarez. The physical labor began on Monday. Tom Childers commented in his journal that day,

> *Yesterday, we had seen the cement foundation that was put in before we arrived, and today I was a little nervous because the time we actually begin the work that we had prepared for and anticipated for so long was so near. I had wondered with some of my classmates if we would be able to do what it took to build the house... Our first day soothed my worries as everyone was able to contribute in a significant way, and the coordinating instruction was smooth. We ended up working in small groups rather than as individuals or large groups and could accomplish many difficult tasks at once.*

That "coordinating instruction" came primarily from Bob Blakemore, founder of *Manos de Dios* (Hands of God) mission and our construction leader. He was ably assisted by David Riley-Assoc. Professor of Architectural Engineering at Penn State; Rev. Dan Klooster-director of Gateway Mission Training Center, an El Paso organization that coordinates cross-cultural service experiences in Mexico for young people and adults from the United States; and Eufemio Loya-Bob's apprentice, who goes by the moniker "Junior." Board by board, the house frame went up, followed by drywall, chicken wire, and stucco. Eric Hough wrote in the group journal on Wednesday, May 16, our third day of construction:

> *"Woah," was my initial reaction when we all pulled up to the worksite this morning. I must have been too tired to notice yesterday when we left, but today we had what actually looked like a house. It seemed as though it had just sprung out of the ground overnight... when I started framing the interior walls, I was still outside. But by the end of today, I stepped back and realized that I was all of a sudden inside a house. The front door became a front door, not just an area... I understood what Dean Achterberg meant when she said that it all starts out as a pile of lifeless materials but eventually it develops personality.*

Marimar Aponte recalled the landscape in her group journal entry from Monday, May 14, "The view to both sides from the construction site was beautiful in two different ways. To one side we had the Anapra community with its characteristic small houses and smiles on people's faces. To the other side we had an incredible panoramic view of the mountains." She also remarked on the "non-pretty" side of Anapra, with its "[barbed] wires, covered by plastic trash bags that were thrown to the ground and blown by the wind," that served as fences dividing property.

As a geographer, I was struck by the fact that from our worksite on the edge of Anapra, we could look to the west and see a tall white pylon on a dusty desert bluff, marking the point at which the states of Texas, New Mexico, and Chihuahua come together; look to the south and see the Juarez Mountains rising in the distance beyond the *colonias;* look to the east and see the bustling central business districts of Juarez and El Paso; and, most striking of all, look directly to the north to see the edge of Anapra pushing against the brown ditch of the Rio Grande-marking

the U.S.-Mexico border-and, in the distance, a swath of green along the base of the Franklin Mountains: the country clubs of El Paso, strikingly verdant compared to the arid *colonia* in which we worked.

But some of the most memorable aspects of the trip for many of the group occurred during interactions with the neighborhood children. Shortly after we arrived at the worksite, several children approached and offered to help with carrying boards, fetching tools, pounding nails. By mid-afternoon Tuesday, there remained few tasks with which the children could assist, so we formed play-teams to channel their energies constructively and keep them out of the workers' way. The kids enchanted us and exhausted us. Together we drew pictures, read stories, tossed a ball around, held a construction contest with scraps of wood, and played *caballito* (piggy-back rides). Then they showed us around their neighborhood: small groups visited a few of the kids' homes at different times during the week, and just before the house dedication on Friday, they proudly gave us a "grand tour." Mike Still shared in the group journal on Thursday, May 17:

> *I got to see Rosio, Jesus, and Rosalba's house today…Their family moved into Anapra from a town near Durango; they lost the kids' papers and can't afford the registration fee, so they cannot attend school…The thing that struck me about their house was that although there were few possessions and living conditions were cramped, everything seemed to be very well cared for… I saw a family of seven looking at difficulty, but still happy about life. That gave me hope.*

We put the finishing touches on the house Friday morning and held a dedication ceremony after lunch. There wasn't a dry eye among us. Cori Thatcher observed in her journal that day,

> *Today was incredible…! was fine one minute, then the next thing I knew I was opening my mouth to ask Marimar to translate a thank you to the family for the experience they allowed us to have, and the tears just came flooding out…Today I finally felt a true connection with the people here in Mexico, in our little corner of Anapra. The children's laughter rang with an extra sweet sound today, and I just felt so…good!*

One lesson the students learned rather quickly was that although secondary research offers an essential foundation for understanding a topic or situation, experiential learning provides a deeper level of understanding. Tom Bowler wrote in his journal on Thursday,

> *My highlight of this day was the reflection at the end of the day. This went on for about two hours. Everyone gave heart-felt insights on the experience, attesting to the amazing impact it had on each one of us. It became clear that there are many facets to an experience like this. The trip allowed us to create something with our hands that we can be proud of It also brought the group closer together as friends. Finally, it allowed us to make a difference in the lives of people who truly needed our help…Tonight's reflection attests to the great potential of service learning to change the lives of students. Conventional classroom learning is educational, but it is easy to intellectualize the world's problems and forget that*

they are real. This dispassionate distance cannot exist in a service-learning environment.

Lacey Wingard, one of two juniors on the trip, agreed, writing,

Before traveling to Juarez, I searched for information concerning the nutritional status of Mexico...Reading several books and articles, I felt that I had a good understanding of the food patterns and nutritional needs of Mexicans throughout the country... Nothing could have prepared me for the reality of Ciudad Juarez. It was not until Mexicans had faces and names that I began to understand the extent of their problems and even still, the beauty of their being. As we worked together in the community, my eyes were opened to the hungry people all around me.

Lacey returned to Juarez later in the summer to conduct research for her honors thesis, which deals with nutrition education. "My experience in Ciudad Juarez has greatly affected the way that I study nutrition," She observed. "It has made a permanent impact on my life."

The students concur. Christine MacAulay summed up the group's sentiments in a journal entry from May 19, our last day in Juarez:

How do you describe one of the most incredible weeks of your life? This week has challenged me and changed me... this week has opened my mind, my eyes, and my heart. I have seen what it is to have a little but still have a lot... As we have demonstrated this week, there are people who want to make a difference. Maybe the landscape and the history and the landmarks will escape us, but hopefully the lives and the stories of the individuals we have been privileged to serve will be etched in our hearts forever.

Katie Myers wrote her entry in the group journal on the flight home from El Paso. She concluded,

This has been one of the most amazing experiences of my life. I hope to carry a sense of the incredibly wonderful opportunities I have been offered in life, for the rest of it. I will never forget the people, the culture, and the land of Juarez. And I will go back. It may be next year, or in thirty, but I am going back. Thank you everyone who has made this possible.

Part III: Reflection and Sharing

An essential element of *service learning* that distinguishes it from *service projects* is the reflection--on the service performed, its context, and its impacts upon the people served and serving-which occurs before, during, and after the actual experience. The follow-up for this experience consisted of several class meetings during which participants reflected orally and in writing on the Juarez experience. In her evaluation, one student described the course as follows:

The objective of this project was to provide a true service learning experience in the sense of incorporating three parts: preparation, action and reflection. The preparation part allowed us to become educated of the issues, landscape, culture

and lifestyle of those we *would be working and also provided a chance for group members to get to know one another and bond as a group. The action part involved actually traveling to Ciudad Juarez, Mexico and working with Gateway Missions to accomplish our goal of building a home for a poor family while further examining the issues* we *had researched the previous semester. The reflection part of the trip was the culmination of our experience and had the objective of drawing conclusions and hypotheses from the things* we *learned and developing ways in which* we *could use the knowledge gained now and in the future.*

Some students were initially disappointed by how different their research findings were compared with what they saw on site. But they came to realize that the partial knowledge they gained during the spring semester was extremely valuable, if incomplete. As a result, their first assignment when the class re-convened in the fall semester was for each student to write an addendum to the field guide, commenting on the similarities and differences between their secondary research and observation. Farzad Noubary noted in his addendum,

As a dynamic process, land use in Juárez is affected by so many interrelated, continually changing, and intangible forces that trying to capture them all in [secondary] research is extremely difficult... Although we *can never escape our own biases, primary research in addition to secondary research brings us closer to the truth than either type can on its own.*

For their second assignment, the students wrote editorials suitable for publication in campus or hometown newspapers, based on some aspect of what they researched, observed, or experienced during the course and/or trip. Themes on which they wrote included the politics of immigration and border relations; economic conditions and the North American Free Trade Agreement (NAFTA); crime-notably drug trafficking and serial murders of young women in Juarez; culture and community; children and education; and community service and altruism. At least one editorial, that of Cori Thatcher, entitled "In Mexico, Reality Defined," has been published in a local newspaper.

At the end of the fall semester, students completed a 17-item, open-ended evaluation (see Appendix). The same questions are being used across Schreyer Honors College-sponsored service-learning projects in order to improve upon each course and to draw comparisons among the projects.[2] Evaluations of the Juarez course were positive. All of the participants would recommend the course to other students, and some have already done so enthusiastically. Many of the suggestions for improvement concerned a perception of disorganization-particularly during the first semester-in terms of specific plans for the trip and fund-raising. These students did recognize, however, that most of the uncertainty resulted from the fact that this was the inaugural offering of the course and that they were helping to establish the groundwork on which future classes would build. One student wrote, "This was its first year, so, of course, there were lots of bumps along the way, but it was organized to be as educational and also life-changing." Another noted,

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2 As of spring 2002, projects include Juarez, Mexico; HOINA-India (both offered through the department of geography); and Tribal Housing (offered through architectural engineering).

The class let me learn a lot about not only Juarez Mexico, but also Penn State, because I got to see the class being created, as well as taking it and learning its content. I think that made the class very difficult as well as educational. While it gave some flexibility, such as in the assignments, and the meeting times, it also forced us to meet Friday afternoons, and even during canning weekends! It also forced us to be patient, as many of the details of the class were not prepared well in advance. That aspect did not bother me too much, but I can see where the vagueness of the plans frustrated other people at first.

The following three evaluation excerpts illustrate the range of impacts the Juarez experience had on participating students:

This project met and exceeded my expectations. To be perfectly honest, I felt a little shaky going into it. I cared about the information we had learned, but not having been there, it still seemed more distant and impersonal. I also had a feeling that the work we were going to be doing was maybe just a kick-fix handout kind of thing. I was also worried because I didn't know many of the other group members as well as they seemed to know each other. As it turns out, I realized that our work truly was valuable and the lessons derived are priceless, and the people that I had the privilege of spending that week with are some of the kindest, most interesting people I have met.

When we were leaving the work site for the last time, I knew that we would probably never see those kids again. And though we could leave and return to a comfortable life, life for those kids would continue to be hard. I was crying and I looked at Tom and he was crying, I think at that moment I understood exactly why we had come there. It's not enough just to understand the world, you have to go out and be a part of it. Sitting in the basement of Atherton and reading about what Juarez is like, the problems and the poverty would not have reduced me to tears. I needed to first become a part of place.

Before entering the classroom, I assumed that the Juarez project's main focus was on community service and the personal work and rewards that are intrinsic parts of such service. However, I believe that the most rewarding objective turned out to be the challenge to compare primary and secondary research about the community in which our service was performed. This objective connected academics, emotions, and service, therefore providing a much greater, educated, meaningful impact.

Thinking about such impacts, Cheryl Achterberg observed "Service learning differs from volunteerism because it is a planned activity that *integrates* academic learning with service to the community or society." She continued,

Service learning is powerful. It is also an ideal means through which to teach leadership. It is the kind of learning that keeps teaching, long after the student has left the 'classroom.' For some students, even a single service learning

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experience can be life changing. This course was a good example. Although service learning is costly, I am convinced that it's a sound investment and an important development in teaching and learning.

David Riley noted, "As an educator, one of the most compelling elements of this kind of project is that the students go down there thinking that they're providing a service, helping people out. But they go through a transition during the experience, realizing that it's more than the bricks they carry, holes they dig, walls they put up--they gain tremendously from the experience themselves. That's really gratifying to see."

The writings and conversations of the Juarez participants reflect sentiments of appreciation, accomplishment, and hope. Students returned from the experience with a broader perspective on living conditions along the Texas-Mexico border and/or global issues, as well as new perspectives on their own lives and potential contributions to society. Several participants are enrolled or intend to e.nroll in advanced courses on poverty and development issues, and many have expressed a desire to continue their involvement in service-learning projects and leadership initiatives. Their enthusiasm has generated a great deal of interest among other Schreyer Scholars to participate in future service-learning projects. Student evaluations of the project were positive, and the course or elements from it are serving as a model for service-learning initiatives in departments of architectural engineering, geography, and landscape architecture.

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AUTHOR BIOGRAPHY

JoAnn C. Vender is a Ph.D. candidate in Penn State's Department of Geography. During the 2000-01 and 2001-02 academic years, she served as Assistant Coordinator of Student Programs for the Schreyer Honors College and, with Cheryl Achterberg, was the coordinating instructor for the Juarez course.

Appendix: <u>Geog</u> <u>298H,</u> <u>Fall</u> <u>2001</u> - <u>Class</u> <u>Evaluation</u>

Experiences in International Service Learning-Juarez, Mexico

(Please say what you can on all of these issues, even if after reflecting on the matter you realize
that you haven't reached firm conclusions or judgments.)

1. Describe Juarez (the project on which you worked) as it appeared to you: its objectives, organization, leadership, staff, location, etc.
2. Why did you choose to participate in this project?
    a. What did you hope to get out of it? (Academically, socially, morally, etc.)
    b. Were you surprised at any level?
3. Describe the kind of work you performed, how much you worked, with whom, your daily pattern, etc.
4. Why was your work needed? Was your work of value? In what ways and to whom? Was it of value to you?
5. How would you describe the overall impact of your experience?
    a. In what ways was that impact different from what you would expect in a traditional classroom?
6. Did your service and overall experience change the way you think about some things? Please explain.
7. In what ways has your definition of "development" and/or "globalization" changed?
8. Can you recall an instance or example from your experiences in Juarez that enabled you to see the underlying "theories" of the course?
9. What, if any, ethical questions (for example, about fairness/justice, freedom, responsibility, etc.) have the experience raised or illuminated for you?
10. In thinking about the service component of the project, what is your most lasting memory?
11. To what extent did the project meet or fail to meet your expectations?
12. Is there any preparation activity, service, or resource that would have made it easier for you to participate in the project and achieve your goals?
13. Is there anything that might have made the experience more meaningful for you?
14. Are there any aspects of the project that should NOT under any circumstances be changed or deleted?
15. What do you see as the area that needs the most improvement?
16. Have you recommended this course to anyone else? What did you say or would you say?
17. Please include any other comments that you would like to make.

ISSUE REACTION: INTEGRATING SERVICE LEARNING INTO ACADEMIC COURSES

M. A. DUPONT-MORALES
THE PENNSYLVANIA STATE UNIVERSITY, CAPITAL COLLEGE

Service learning is the collaboration between academia, the community, the student, and a discipline. Such collaboration is a powerful introduction to the complexities of problems and the impact of those problems on the community. Students return to the classroom after completion of service learning for critical discussion of social issues, contemplation about policy, collaborative planning of alternative solutions, awareness of cultural impact, and perceptiveness about the complexities of service efforts and accomplishments. A distinction between service learning and academic learning is the concrete interaction with the community. The goals of the curriculum need to mesh with the mission of the community agency, the processes used to meet objectives, and the potential role that service learning may play in the educational and career interests of the students.

The service-learning Issue Reaction addressed concerns about the importance of service learning and the need to comprehend its integration into the curriculum. While participants were quick to address the academic side of service learning, the service aspect posed a challenge to creativity.

Participants were seeking paths to initiate the service component into classes. Social justice and service to marginalized populations or populations experiencing personal challenges provided a framework. The adaptation of the classes was one aspect for consideration as the preparation of the students for community interaction was introduced. Students may need to be prepared for the experience or research the planned activities before they move into the community. Agency sites may need to collaborate on what the preparation should consist of and how best to introduce the particular service and the population receiving the services.

Concern was expressed that service learning might be seen as volunteering and that a service-learning class might need validation concerning its academic rigor. The old adage that "honors classes are supposed to be harder" was met with "honors classes need to be different." Scholarly learning can be initiated collaboratively in the community, outside the classroom, and with interactive learning opportunities. It was noted that all students might benefit from engaging in service-learning activities. This activity needs to be chronicled by the students as a foundation for later academic research related to the class. The chronicles may be completed in a number of ways and should stimulate creativity in the students. Some students may keep journals while others may use photography or WEB pages to document their experiences. Interaction between the student, the community, the service receivers, and scholarly activity reflects innovative learning. The instructor needs to see documentation that students comprehend the impact and importance of this commitment. The students need to share their experiences with their colleagues and department as a means of encouraging the activity. These activities are documentation of university community outreach and service.

The Issue Reaction team concluded that service learning could be introduced across the curriculum in different capacities. It is dependent upon the creativity of the faculty, the commitment of the institution to service learning, and the participation of the community. Leadership for embracing service learning as an institutionalized activity needs to come from the administration. Workshops for faculty run by faculty and students who have participated in service learning may prove useful. Some aspect of service learning may be integrated into any curriculum--it only takes commitment.

AUTHOR BIOGRAPHY

M. A. DuPont-Morales is an associate tenured professor in the School of Public Affairs at Capital College, Penn State Harrisburg. Her students have presented at Honors conferences and

participated in Learning Abroad educational experiences. She has been the Director of the Honors Program for three years and requires service learning as part of the curriculum.

ISSUE REACTION: INTRODUCING STUDENTS TO SOCIAL INQUIRY RESEARCH

ALFRED G. MUELLER II
THE PENNSYLVANIA STATE UNIVERSITY

Social inquiry courses provide students with the means necessary to confront significant social issues, typically through a mixture of quantitative and qualitative research methods. Faculty members who teach these types of courses, however, encounter four basic problems. First, students often resist taking the critical postures necessary to do social research, largely because such postures in some way threaten the stability that students try to impose upon the world. Second, the ambiguity surrounding social issues and approaches to social research frustrates students' desires to maintain the type of order they were accustomed to at the secondary level, leading to further resistance from students to the idea of "doing research." Third, students' differing abilities can work against group cohesion and individual effectiveness, turning an already difficult course into a mechanics nightmare. Finally, students' desires to tackle significant issues, when such desires are manifested, often face the impediment of institutional research boards, which increasingly are becoming hindrances rather than ethical gatekeepers. This "Issue Reaction" offers four suggestions: structuring students into carefully designed teams, using problem-based learning techniques to guide discussion, using public data to train students in the mechanics of research, and having students conduct research within the confines of the classroom.

In the past, institutions reserved social inquiry courses for students who had reached the junior or senior level of study. With the increase of general education requirements at many institutions across the country, a much broader audience populates today's courses. Many incoming students tend to be "socially reticent," that is, unwilling to extend themselves beyond a cohort group that acts, thinks, and even dresses as they do. Forcing these students to confront communal issues intrudes upon the stability with which they seek to surround themselves. These students find that many of the questions they are being trained to pose threaten, or at least necessitate a re-evaluation of, some of their own core beliefs and values. More and more these students retreat from the critical stances they should be taking as educated and contributing members of society.

A related problem involves the ambiguity that surrounds social inquiry courses. To allow students enough latitude to approach the issues creatively, instructors craft assignments in these courses in abstract terms. Many students want the stability offered by more traditional course structures (e.g., a basic textbook, multiple-choice exams, etc.). Consequently, professors are often tom between providing practical experience and avoiding harsh evaluations for not accommodating their students' wishes.

Instructors also face pedagogical impediments above and beyond those associated with methodology (e.g., getting students accustomed to new terminology, using methods correctly, etc.). For example, many students simply do not know how to pose questions. This is not to say that students are simply asking questions that are too general to be useful to the research enterprise. Nor is it to say that students are having the ordinary difficulties associated with survey construction. Rather, there are increasing numbers of students who cannot formulate *questions* in any coherent *grammatical* fashion. Consequently, one further encumbrance an instructor must face in social inquiry courses involves teaching English grammar as well as theory and methodology.

Finally, instructors often need to confront sometimes overly burdensome policies from their institutions' research boards. Regulations regarding research on human subjects keep increasing exponentially. Although these regulations are based on the best of ethical intentions and are meant to ensure both confidentiality and anonymity in the research study, they make teaching social inquiry courses very difficult at times. For example, when it takes three months for a board to approve a student survey on a controversial issue like self-reporting of sexual preference, the board is only succeeding in steering students and faculty away from socially beneficial research avenues. The dictum by which all

researchers stand is "Do no harm," but at the same time instructors of social inquiry courses would like to be able to *do some good.*

Issues Reaction participants suggest the following to circumvent, address, and ameliorate these issues.

Renata Engel of Penn State University suggests structuring the class around teamwork. The instructor constructs the teams based upon demonstrated ability and self-identified desired grade outcomes. Thus, students "working for an A" are grouped with like students, students "happy with a C" are grouped with like students, and so on. Students quickly find that refusing to "adjust attitudes" and that working with "like-minded" individuals may not always be appropriate strategies.

Use more problem-based learning strategies in the classroom. For example, Jeff Lewis of the University of Illinois at Chicago presents students with the problem of analyzing the lives of immigrants who own grocery stores in the neighborhood. The students then conduct research on what kinds of data they would need to collect, a discovery that naturally leads into discussions of survey design.

Both Lewis and the author suggest having students examine data published in appendices of recent articles or books. It provides students with an opportunity to practice and develop needed research mechanics and offers models of good research for them to reference.

The author suggests conducting in-class research, using the other students in class as focus groups. In my organizational communication course, for example, when we discuss time and motion studies, I have students actually run a time and motion study using backpacks, books, and a flight of stairs. The student researchers think beforehand that, as you increase the number of books, the student subjects will slow down. But when they run the tests, they consistently find students hitting a peak speed with three or four books in their backpacks. Their reaction is always this: "If I didn't see it with my own eyes, I wouldn't believe it." The sample size may be small, but the students can still feel, as Whitney Garcia of Towson University put it, "some of the excitement of actually doing research with human subjects."

AUTHOR BIOGRAPHY

Alfred G. Mueller II (Ph.D., University of Iowa) is Assistant Professor of Speech Communication at the Pennsylvania State University, Mont Alto campus. His research centers upon rhetorics of identity, with his most recent theoretical statements focused upon performative rhetoric, politics, and identity formation in the former Soviet Union.

ENRICHING THE ACADEMIC COMMUNITY THROUGH A SEMESTER-LONG HONORS SYMPOSIUM

EARL BROWN, JR., MARGARET C. BROWN
RADFORD UNIVERSITYINATIONAL COLLEGIATE HONORS COUNCIL

ABSTRACT

This paper will focus on the theory and practice of a semester-long honors symposium on a current topic of significance to the academic and area community (e.g., the environment, service learning, ethics, the search for peace, cultural diversity). One purpose for such a symposium is to provide leadership opportunities for students to develop a topic, organize events (including time and place), find and contract speakers, create and distribute publicity both on and off campus, arrange for receptions and book signings, find students to introduce speakers, and create opportunities for students to present and share their research. A second purpose is to engage students in research on the topic and give them the opportunity to share their research with others, thus providing multiple perspectives on the topic. And, finally it offers the community a forum in which to come together to consider in depth an issue of social and political importance.

Ways to develop and facilitate a semester-long honors symposium will be discussed, as will a timetable for planning a symposium and ways to adapt courses, develop extra-curricular activities and programs, encourage student research, and involve the entire academic and area community. Additional topics include funding, student leadership and involvement, and using local expertise as well as bringing to campus nationally recognized authorities. The paper concludes with an exploration of ways to adapt courses to fit different symposia topics.

OVERVIEW

To create a semester-long symposium, a faculty member or Honors Director needs to work with all departments, with religious organizations, with fraternities and sororities, and with area community leaders to create as broad and diverse a perspective on the subject as possible. Funding may be discovered in a wide variety of places. The Radford University Symposium received funding from the host university, the Virginia Foundation for the Humanities, the NCHC and the SRHC, to name just a few.

Symposia averaged approximately 100 events across a fifteen-week period, from experiential learning activities (field trips, service learning) to major speakers (Cornel West, David Mayberry-Lewis, Harold Hodgkinson, Allen Ginsberg, Noam Chomsky, and Tim O'Brien), to speakers from the community, to art exhibits, to musical performances, to Native American Powwows, to film series, to weekly talks with Vietnam veterans and their families, and to a Northern Kentucky University student's exhibit of a labyrinth she had created as her final honors project to promote greater awareness of women's issues. All of this culminated in an honors week with two or three major speakers, student presentations, and an honors banquet.

But the highlight of this symposium was the student presentations. Some twenty to thirty honors and non-honors classes focused some part of the semester on the symposium topic. Many of them would require students to do independent research and give a presentation on that research during Honors Week or during the University's Undergraduate Forum.

To adapt a course to fit the symposium topic, Maggie Brown would change books, use different films, and get different speakers to enhance her ENGL 102 honors section on the Vietnam War as well

as keep her weekly meetings with Vietnam veterans. During the Search for Peace sYmposium, she had students read books on the theory of war, brought in a poet to discuss his experience as a medic, and focused her film series on films dealing with war and its effects. During the sYmposium on Cultural Diversity, she used films about Vietnam, brought in a Vietnamese ex-prisoner of war, and read books detailing the experiences of blacks and women in the war.

Challenges of creating a semester-long sYmposium include the logistics of creating an honors colloquium for in-coming freshmen and determining a timeline, funding, assessment, and the number and variety of courses that participate in the sYmposium as well as the time allotted for the sYmposium topic during the semester in a particular course. Another challenge is how to get honors students involved in such or similar undertakings. A special opportunity is using the sYmposium as a model for students to present their research. Strategies for success include sending out letters in the summer to get students involved in making decisions, giving them a sense of ownership of the sYmposium and its topic, and reducing the frustration by providing students with explicit guidelines and assignments. Finally, it is very important to inform faculty of the opportunities available for their students during the semester-long symposium.

The sYmposium is an excellent means of involving the academic and area community in exploring a topic in depth. Some such activity whether it is a sYmposium or other similar endeavor is an important means of providing research and developmental opportunities for students. One participant offered this observation, "A major lesson of the Radford sYmposium example is that students should be involved in speakers and programs. It gives a tremendous sense of ownership and leadership experience."

SAMPLE SYMPOSIUM INFORMATION DOCUMENTS FROM RADFORD UNIVERSITY

1. Pre-Semester Publicity for the 1995 Symposium

The Honors Program this spring is sponsoring a symposium celebrating diversity. The coordinating committee, chaired by Aliya Ishaq with Dr. Jeri Carter as her faculty advisor, have planned numerous activities as well as co-sponsored many others. The purpose of this and our other four symposia have been to bring to our campus and local community a greater awareness of the symposium's focus. We hope that through a close analysis we can all come to a greater understanding of and respect for each other and the world in which we live. But celebrating diversity is not enough for the coordinating committee. The committee feels very strongly that it is important to examine the validity of the concept of diversity. Is diversity always worth celebrating? Would it be better on some occasions if the world were less diverse? What role, for instance, has diversity of language played in hindering communications? Are we really willing to share our world with diseases intent on killing humanity? We need to explore all the ramifications and implications of diversity--celebrating it is not enough. The Honors Program believes that through the many honors courses that are focusing on this subject this semester and the many activities dealing with this subject that many of these and other issues will be raised. Only by giving this subject the close scrutiny it deserves can we all make our own decisions about the nature of diversity and its importance in our community, nation, and world.

Events this spring will kick off with a graffiti wall to give our university the opportunity to express their views on diversity followed by Dr. Karl Pribram's talk entitled "The Brain, A field of Dreams." Other major events include a talk on demographics by Dr. Harold Hodgkinson, Director of the Center for Demographic Policy, thanks to generous grants from the NCHC Portz Fund and the SRHC Dollars for Scholars; our keynote speech by Dr. Cornel West, Chair of the African Studies Department at Princeton, and author of Race Matters *and other equally important works on race relations in the United States; a talk during honors week by Ms. Melinda Paras, Executive Director of the National Gay and Lesbian Task Force--both of these lectures are thanks to the generosity of the Scholarly Lecture Series; and The International Bartok Congress and the Bartokl Kabalevsky Piano*

Competition, one of two congresses held in the United States, but the only one featuring Bartok's son as a guest speaker.

Other events which the Honors Program will sponsor or co-sponsor this spring include the annual Native American Heritage Association Powwow, Myer Reed's two panel discussions--gays in the family and gays in the workplace, Anna Fariello Gallery Exhibit, entitled "Defining Ourselves"; International Student Association's World Fest Week and their monthly coffee houses, Appalachian Awareness Day, the Bread for Life Monday luncheons with a series of speakers on diversity cosponsored by the campus ministry; Dr. Karen Ross speaking on "Black Images in TV," co-sponsored with the Center for Gender Studies; Dr. Muriel Lederman speaking on "Feminist Science"; Ms. Opal Moore and Ms. Joy Harjo (cosponsored with the English Club and a grant from the Scholarly Lecture Series) reading from their poetry ; Buddy Timberg's film series comparing foreign films with their American counterparts; Maggie Brown's weekly series on Vietnam with films about Vietnam and a Vietnamese prisoner of war, and a panel of refugees put together by David Maxey.

But the highlight of this and all our symposiums will be the student presentations during Honors Week (April 3-8). When students get together to give presentations focusing on diversity, the university community has the chance to see true interdisciplinarity in action. The students drawing on their class discussion and assignments to make presentations create a dialogue which informs other students and faculty about diversity from that discipline's perspective.

What makes this symposium truly different will be the number of events dealing with diversity being sponsored by so many organizations this spring. It is as though the entire university has seen the need to discuss the issues of diversity. Organizations within the university have sponsored workshops, panel discussions, and talks on this subject. We are most pleased that through the enumerable activities on our campus this spring that diversity will not remain some abstract ideal but will become a part of all of our lives

2. Teaching a Course Focusing on the Symposium

The advantage in having a course focus (in whole or in part) on the symposium is to give students taking one or more honors courses a chance to integrate material and ideas about that theme into their honors coursers). So that a discussion in a sociology course may take advantage of a speaker on chaos theory and discuss the effect that theory may have on society. Or, a film dealing with the theme may help students gain a different perspective on that theme than one they have gotten from your honors course.

1. Opportunities will be available to take advantages of additional resources:
1. Speakers, panels
2. Workshops
3. Field trips
4. Service-learning activities
5. Films and other programs

2: Students will have opportunities to:
*1. Give presentations, especially during **Honors Week or at the Undergraduate Forum.***
2. Introduce speakers
3. Display artwork
4. Take on leadership roles--for more information, contact Allison Rose (arose@runet)

How you take advantage of these opportunities or how you integrate them into your course is up to you but we hope that you will give students credit for attending events, giving presentations and providing other support roles for and during the symposium. (The Symposium Organizing Committee will arrange for students to pick up slips at the event to prove that they attended if you need some sort of verification. I

*myselfhave students write a response to each event that they attend. We also create a published record of our symposium and **if** your students' responses are good, we would like to publish them in our book.)*

AUTHOR BIOGRAPHIES

Margaret Brown taught honors courses for many years at Radford University, focusing particularly on the Vietnam War. She is currently the Editor of the *National Honors Report,* a quarterly journal published by the National Collegiate Honors Council, and is working on her second novel.

Earl B. Brown, Jr. served as Director of the Radford University Honors Program from 1984 to 1997. He currently is in his second term as Executive Secretary/Treasurer of the National Collegiate Honors Council.

V. Learning Strategies that Support Undergraduate Research

This section provides an excellent overview of learning strategies that are conducive to supporting undergraduate research in the classroom. Whitfield opens with an overview of the value of a problem-based learning curriculum. Although it is couched in terms of the College of Medicine, the paper is applicable to many disciplines as well as undergraduate and graduate students. She highlights some of the pitfalls, practical tips, and problem development strategies so as to derive the maximum benefit from problem-based learning methods. Williams, Sederberg and Eddins describe research-based learning (RBL) and illustrate the learning strategy with the Marine and Aquatic Research Experience project at the University of South Carolina. RBL presents an alternative educational model that blends research activity, instruction, and curricular offerings to expand the research opportunities for undergraduate student teams while rejuvenating the curriculum. Chaszar focuses her attention on the value of interdisciplinary research. Not only do many research advances occur at the intersection of disciplines, but also honors curricula often carry the distinction of being interdisciplinary and attracting students who integrate fields of study. In their Issue Reaction, Lane and Cawley provide a working definition of "inquiry-based learning" and an accompanying list of resources for further study. The final paper emphasizes the importance of libraries in the successful implementation of either inquiry-based or problem-based learning. Wright makes the point that libraries provide the infrastructure to support the inherent elements of research found in these active learning strategies. She also describes one course designed and offered by the library to support undergraduate thesis research. The course includes a breadth of relevant topics such as database manipulation, identification of appropriate resources, portfolio development, information literacy, and Internet navigation and evaluation.

Two innovative learning strategies have been suggested by a recent graduate who was himself a very successful undergraduate researcher. Ken Urish described the educational value of (a) students mentoring students in research, and (b) student researchers applying for outside resources to fund their own projects.

(a) *During my junior year I had an internship away from school and commuted back on the weekends to finish a series of repetitive experiments. Progress was slow, but I wanted to keep the project moving. The experiment itself was simple so I recruited three underclassmen to help finish the work. During the week, they would complete the experiments, and on the weekends, I would help them analyze the data and explain the theory in depth. After a semester of working with my project, they moved on to their own projects in the lab.*

This student mentoring relationship worked exceptionally well. It forced me to take more responsibility for the project and give it direction at a time when I was frustrated with its lack of results. It oriented the other students to the lab, training them in techniques and giving them experience to handle their own projects. The student mentoring turned a difficult part of the project into something a little more enjoyable. It also became an excellent source of recruitment for talented and motivated lab rats.

(b) When I needed an expensive piece of equipment and had no funds, I found company vendors would temporarily loan pieces of equipment. To purchase the equipment, company recruiters would donate small grants. This worked well for both parties because they were looking for ways to help support the department to increase their recruiting ability. An undergraduate can leverage the influence of a large university with corporate contacts and equipment salesmen to secure funds through non-traditional means. Finding their own sources of funding gives the students more ownership of the project and a larger vested interest in its completion.

PROMISE, PERIL, AND POTENTIAL: DEVELOPING, IMPLEMENTING, AND ASSESSING PROBLEM-BASED LEARNING AT THE UNDERGRADUATE LEVEL

CAROL F. WHITFIELD
THE PENNSYLVANIA STATE UNIVERSITY, COLLEGE OF MEDICINE

BACKGROUND

In an effort to cope with the vastly expanding body of knowledge in medicine, medical educators in the last 20 years began to realize that not all the facts one needed to know to practice could be 'taught' in four years of medical school. Furthermore, recall of material learned during the 'chock-full-of-facts' early years was discouragingly poor, and learned information went out of date very quickly. Educators came to the realization that producing students who were life-long self-learners was a reasonable solution. Even earlier, a few schools such as McMaster University in Canada began using problem-based learning (PBL) in their medical curriculum. Medical scholars recognized that this technique might also be part of the solution and began implementing it in their curriculum. Now, over 50% of medical schools have a significant problem-based learning component in their curriculum.

Use of PBL is becoming widely accepted and used in various forms. There are many examples of its use now in primary and secondary (K-12) and post-secondary (college) education, and in disciplines such as law, engineering, architecture, social work, optometry, management and administration, economics, nursing, and dentistry, to name a few.

THE POTENTIAL OF PBL

The potential of this method of learning is to produce students who are enthusiastic self-learners. They gain increased depth of understanding, enhanced recall of learned material, greater facility in using knowledge applied to real problems, satisfaction in learning, and confidence in tackling new areas of study. They can learn to work effectively in groups, improve their communication skills, and learn to efficiently locate sources of information when they need it.

PBL AT PENN STATE COLLEGE OF MEDICINE

PBL can be described as a learning technique that starts with a real-life problem in the areas of study. It is a problem with interdisciplinary features that demand integration of traditional disciplines. As it is used in Penn State College of Medicine, students, working in groups of 6-7 with a faculty facilitator, first call on their prior knowledge to begin analysis of the problem (the brainstorming or hypotheses-generation step). Then with sequential disclosure of additional information about the problem, they begin to realize what further knowledge they need in order to understand the problem, and they develop learning objectives to meet these needs. After a period of self-study, they meet again and discuss the new knowledge they gained, reinforcing it, seeing it from others' points of view, applying it to the original problem, and fixing it more firmly in memory (the elaboration-of-knowledge step). The initial problem and the recalled previous knowledge act as a scaffold for organization of the new knowledge. Most PBL methods contain these basic features in some fashion: brainstorming, group collaboration, student-selected learning objectives, self-study, and elaboration.

Penn State College of Medicine began with a self-selected PBL track for medical students in 1992. The track replaced the traditional two pre-clinical years with two years of PBL. There were no scheduled lectures, but students 'processed' 60-70 clinical cases per year, carefully chosen to lead them

to the core material deemed essential for progression to clinical work. The track ran successfully for six years, after which it was combined with the traditional lecture-based track to provide a significant amount of PBL for all students. In the hybrid curriculum, there are fewer lectures and more unscheduled time for study.

A brief review of the outcome of the PBL program shows that PBL students did equally well on the first external exam in the medical licensing procedure (Step I of the NBME, now called the United States Medical Licensing Exams). This result documented the fact that they had achieved the expected knowledge base (Figure 1).

Figure 1. Board Scores As Outcome:
Comparison Tracks

Track\Year	N	Mean Score	SO
PBL (Yrs. 1-6)	144	209.44	19.70
Lecture (Yrs. 1-6)	483	209.46	21.14
PBL (Yrs.2-6)*	113	211.35	19.00
Lecture (Yrs.2-6)*	388	210.83	21.51

Board scores are scores of the NatIOnal Board of MedIcal Exammers exam, Step I.

*Years 2-6 were analyzed separately to allow adjustment for the MCAT covariant, since the method of MCAT scoring changed between year 1 and 2.

In their third-year clinical work, in the six required clinical clerkships, PBL students achieved significantly higher scores for 'Fund of Knowledge' from their clinical preceptors (Figure 2). This difference remained statistically significant after adjusting for covariants such as age, race, gender, year, pre-admission grade point averages, and Medical College Admissions Test scores.

Figure 2. Comparison of PBI and lecture-based Student Clerkship Scores

Condition	Fund of Knowledge p value	Clinical Problem-Solving Skills p value
Unadjusted	0.0004*	0.0182*
Adjusted for all covariants	0.0316*	0.3949

Scores for 'Clinical Problem-Solving Skills' were not significantly different after adjusting for covariants. This was attributed to the fact that these skills are judged by observation of student-patient interactions such as interviewing and physical examination, where PBL and lecture-based students received the same training. Anecdotal information from students and preceptors suggest that PBL students were more comfortable approaching a new clinical problem, asked more questions, and were more active in discussions in the clinical setting. Students also related that they felt their recall was good and that they enjoyed the learning environment.

PROBLEMS OR CHALLENGES OF PBL

From my experiences with PBL, I can relate some of the challenges and pitfalls of PBL, in implementing and administering such a different approach to learning, and perhaps offer some advice to faculty who would like to implement it in their undergraduate courses.

Challenges

Difficulties include these:
1. Lack of students' confidence in their self-learning abilities; they doubt their skills.
   It takes time for students to gain this confidence; they need to engage in PBL for a while to gain this confidence in themselves.
2. Lack of confidence by faculty in students' self-learning ability and self-motivation. It takes time for faculty to change their "if I don't tell them, they won't learn it" approach.
3. Difficulty in designing good problems. It is hard work and takes a lot of creative energy on the part of faculty to design good problems.
4. Decreased breadth of exposure to material in the discipline. Because students are taking more time to go into greater depth in the learning objectives of a case, it is not possible to "cover" as much ground.
5. Competition with courses running concomitantly. A student taking five traditional courses with one course using PBL is unlikely to have sufficient time to get the maximum benefit from PBL.
6. Difficulty in assessment of student performance. Assessment should match the learning, but this is difficult to achieve in many cases.
7. Administrative challenges if PBL is used in an entire program rather than one course or part of one course.

Pitfalls

Traps that faculty can fall into when implementing PBL in their courses are related to the difficulties described above:
1. Not preparing students for the experience. The process and expectations for student performance must be explained beforehand. Some preparations to help students work within groups are helpful. Preparation should include helping students become familiar with how and where to obtain information.
2. Underestimating the workload. It takes significantly longer for students to research the learning objectives on their own.
3. Overestimating the amount of material that can be 'covered'.
4. Using poorly designed problems.

5. Over-populating student groups. The optimum size of groups is in the range of five to eight students. Larger groups do not function well because it is difficult for all students to participate equally and have meaningful input.
6. Involving faculty who have not been trained to function as facilitators. Faculty must allow the educational experience to be student-centered, and to realize that their role is to be guides, not lecturers, directors, or leaders of the group.

FACTORS IN DESIGNING A PBL COURSE

A general checklist of activities that occur during development of a PBL course is given below. It is difficult to generalize an approach when PBL can be used in so many ways, and to various extents e.g., part of a course, as a whole course, as an entire program, and when the problems themselves can be so varied.
1. Develop an overview of the course. Will there be lectures? If so, how many? How many problems will be used? Where should the problems be placed?
2. Design the problems. See below.
3. Prepare the students for the experience.
4. Train the faculty, if more than one (you) will be involved as facilitators of the groups.

Steps in Development of Problems
One way in which to go about developing problems is as follows:
1. Determine the desired learning objectives. List them. This should be a manageable list that is consistent with the time available for study.
2. Choose a real-life problem in which these learning objectives would naturally arise. The topic of the problem should be meaningful to the students and be something they would encounter. Students who can see the relevance in what they are learning become much more enthusiastic learners.
3. Assess the level of development of the students. Design a problem that is within the abilities of the students.
4. Determine where these learning objectives would best fit within the other sequences of activities or lectures within the course.
5. Write out the problem, and determine if additional information should be given to the students, and if so, when in the process it would fit.
6. Decide on the resources (texts, lab equipment, computers, or other) and make sure they will be available. PBL places additional loads on a library, for example, and librarians should be prepared ahead of time.

Resources for Faculty
The references below are good sources to use to get started in developing PBL. An impressive source of ipformation is the Internet, where descriptions of the use of PBL at all levels of education can be found. There are examples of problems actually used in undergraduate education, and descriptions of PBL programs in use at various universities.

CONCLUSION

There are a large number of potential benefits of PBL, many of which have outcomes that are difficult to assess. Traditional assessment methods, such as multiple-choice exams, often cannot detect the skills that are being learned in a PBL environment. They can determine that the PBL student has an equivalent knowledge base, but skills in locating information sources efficiently, working effectively together in groups, communicating more clearly, gaining self-confidence, reasoning through a problem

more effectively, and becoming life-long self-learners are difficult and rarely assessed. An often-stated criticism of PBL is that it has not been shown to produce a better final product (do students become 'better' doctors or administrators, etc.?). Therefore, the question becomes this: is it worth the considerable effort to institute PBL into the curriculum? How important is it that students enjoy their learning? How important are the unmeasured skills that can be developed? Those of us who have become sold on the process and the values would say the potential gains are well worth the effort. My advice is to prepare for the pitfalls, and go for the potential.

HELPFUL REFERENCES FOR PROBLEM-BASED LEARNING

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MEETING THE BOYER CHALLENGE: A MODEL FOR TEAM-BASED, STUDENT-DIRECTED UNDERGRADUATE RESEARCH

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ABSTRACT

At most research universities, a major divide separates the world of the undergraduate student and the world of research. The standard model of undergraduate research is the apprenticeship model in which students are transported across this divide with little cognitive or practical preparation. Sinking or swimming, the student is then presented with a problem or project, shown the basics of how to solve the problem, and allowed to give it his/her best shot. This effort frequently takes place under the guidance of graduate students and/or research associates who themselves have little cognitive or practical preparation for this role. This research experience most often takes place late in the student's course of study and is usually pedagogically and epistemologically distinct from his/her course of study. Thus the degree of ownership in the work by the student varies widely, and interestingly, rarely does the experience lead to scholarship outside the home institution. Without questioning the intrinsic merits or approach of this model, it is nonetheless clear that universities and their faculty do not have the resources nor the will to make this experience a regular part of the academic life of a large majority of undergraduates. In this contribution we present an alternative model based on a case study of a team-based, student-directed research effort in the area of marine environmental science. From our research, we believe that team-based research by undergraduates holds the promise of meeting the educational, intellectual, and emotional needs of an increasingly diverse population of undergraduates and an ever-changing world/work place. Research-Based Learning (RBL) provides the structural strategy for linking this new undergraduate research model to both the classroom and the curriculum.

INTRODUCTION

Because of the nature of their mission (to create new knowledge), research universities have the potential to engage undergraduates in inquiry-based learning. The Boyer Commission (1997), however, concluded that "nevertheless, the research universities have too often failed, and continue to fail, their undergraduate populations." The "blueprint" report concluded with the challenge that "the research universities need to be able to give to their students a dimension of experience and capability they cannot get in any other setting" (Boyer Commission, 1997). Left unanswered were several questions: How can the challenge of providing meaningful and authentic research experience for undergraduates be achieved?

Almost in parallel with the Boyer Commission, the South Carolina Honors College, a liberal arts college imbedded within a research university, has developed a strategy to address the "How?" mentioned above: Research-Based Learning (RBL), an approach to undergraduate education that merges research activity, instruction, and the curricular offerings (Fig. 1) (Eddins et aI., 1997; Eddins and Williams, 1997a,b). RBL encompasses a variety of initiatives to expand opportunities for undergraduate research, develop new curricula, reinvigorate existing curricula, and support innovation within the existing course structure. The RBL strategy brings together collaborative teams of students and faculty with shared interests, thus striving to elevate the level of student/faculty interactions in and out of the classroom and empowering students to participate actively in their learning and to develop lifelong learning and professional skills.
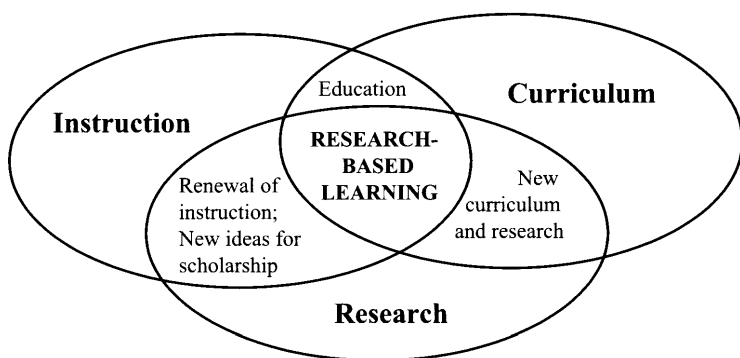
Figure 1.
RBL merges the university's most vital missions, research and instruction, with an educational structure, the curriculum. Ideally, new and exciting results appear at the interfaces between academic missions and structures whose fusion represents RBL (Eddins and Williams, 1997a)

HOW RBL FUNCTIONS

Besides the team approach, a unique element of RBL is a series of "critical connections" courses that help bridge the divide between the world of the classroom and that of research. In the natural sciences, we have developed the "Fundamentals of Scientific Inquiry," the "Design of Inquiry," and the "Implementation of Inquiry" which engage students as early as the freshman year in the process, ethics, social fabric, and psychology of the world of research and the creative process. These critical connections courses can then be linked to the usual independent study (399) and directed independent research (499) opportunities or be the launching pad for the formation of an assembly of self-selected students who choose to work together as a team. Of course the most crucial part of an RBL team is its focus, its research theme, and how the individual student-scientists engage themselves in working to solve the common research agenda. Ideally, faculty mentors guide the RBL activities but do not exert direction except when safety, legal, or potentially erroneous procedures are involved, especially in regard to data collection, interpretation, and preservation (archival). Faculty-scientists support the student-scientists through all of the following: (a) their presence at various activities, (b) advice, (mostly when asked for), (c) training, (d) funding for research activities and for scientific meetings, (e) negotiations with other faculty about time and expertise when needed for the students' research momentum, and (f) explanation of RBL as a model for team-based, undergraduate research.

A SPECIFIC OUTCOME OF RBL: MARE

The Marine and Aquatic Research Experience (MARE, *mare,* Latin for *sea)* is a model developed in cooperation with the Marine Science Program at the University of South Carolina for hands-on, team-based, science research and education for undergraduates by undergraduates. RBL is the philosophical underpinning of MARE. The overall goal of MARE is to enhance the learning opportunities for students aspiring to become scientists, for students to practice being scientists from conception, to planning, to execution of scientific tasks. MARE was originally conceived by undergraduates while taking two critical connections courses: "Design of Inquiry" and "Implementation of Inquiry." The student-scientists wanted MARE to be an opportunity to study the physical and chemical dynamics of a major estuary with potential impacts from industry (pulp and steel mills), agriculture (various cash crops), and development (residential, commercial, and recreational, especially golf courses and marinas). This adopted estuary (Winyah Bay) is part of one of the largest watersheds on the eastern seaboard. The idea of students' adopting such a major estuary, connected to such a complicated watershed, was both ambitious and naïve. For one reason, a complete understanding of this system is still beyond the reach of any individual student or even assemblage of student-scientists within the span of their time in college. And yet, after three years of effort, two generations of MARE leaders and over a dozen major expeditions, some involving up to 25 students and several observational platforms (boats and planes), MARE is thriving, not despite these challenges, but because of them.

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MARE student-scientists have published nearly 20 abstracts, accompanied with poster and oral presentations at national and regional scientific meetings (for example, MARE, 2001). From this exercise at scholarship, including several senior theses, the current MARE members are moving to the next level of professionalism by writing manuscripts for publication and proposals for funding and launching an on-line, student-managed and reviewed, journal for the publication of undergraduate research in the marine sciences *(MarSci)* (Pickard et aI., 2001).

MARE is different in other fundamental aspects from most undergraduate research experiences (MARE, 2001). MARE was not established as part of any professor's regular research program, but instead student-scientists recruited faculty participation from both inside and outside their home institution. MARE was not established to fulfill a degree program requirement but to bridge the gap between an academic curriculum in marine science and the practical world of practicing marine scientists. MARE is therefore connected to, and yet separate from, the students' normal course work. MARE is the students' own enrichment program, totally democratic and non-hierarchical. It is not a social club or scientific society with dues- paying members. It is a student-initiated, student-directed, student-managed research endeavor (Heincelman et aI., this issue).

CONCLUDING REMARKS

Based on our five years of research developing Research-Based Learning and using MARE as an experimental RBL model in the natural sciences, we choose to end with remarks on four important considerations that space does not allow us to fully develop in this contribution: (a) the features that distinguish RBL from problem- and inquiry-based learning, (b) the potential for extending the MARE model into a laboratory-based scientific theme and into the social sciences and the humanities, (c) the biggest challenges to the adoption of RBL in research universities, and (d) the revolutionary nature of the MARE model.

First, RBL differs fundamentally and practically from problem- and inquiry-based learning by assuming their respective goals and premises while striving for scholarship, for authentic communications of the results of learning and discovery. RBL's focus is on the production of new knowledge and scholarship that does not lie dormant in term reports and even excellent but unpublished senior theses or capstone reports. The professional dissemination of the new knowledge gained from RBL activities ideally takes place outside the originating institution in order to present student-researchers with opportunities to learn networking and relational skills. For example, student-scientists of MARE have published nearly 20 abstracts and given related presentations at seven different regional and national conferences. RBL also provides opportunities for leadership--organizational and managerial deve1opment--as part of the learning process, intrinsic features not expressly sought in PBL or IBL experiences.

Second, the prospects are hopeful and encouraging for extending the MARE model into laboratory-based scientific themes and into the social sciences and the humanities. Although preliminary, the prognosis for the former is based on a fledgling initiative by pre-medical students to form a research team interested in problems in the neurosciences. For the latter goal, extending RBL from the natural into the social sciences and the humanities, we are encouraged by discussions with faculty interested in developing critical connections courses in the fundamentals of social inquiry and cultural inquiry as part of an 18-credit "minor of inquiry."

Third, in our five-year quest, the biggest challenges to realizing RBL in research universities is the entrenched reward structure and the culture of the faculty that is inherited from and perpetuated by that structure. Of course the internal university reward structure is reinforced by funding agencies that place premiums on productivity (numbers of publications and total grant dollars) over the impact of the sponsored research on the university's principal stakeholders, undergraduates. We believe that the MARE model presents evidence of the fact that, while principally structured for the benefit of students, the RBL model is really of mutual benefit to faculty and students alike. Ideally, an RBL research team

would include collaborating faculty, graduate students as pre-servIce faculty in training, **and** undergraduates (Eddins and Williams, in preparation).

Lastly, as exemplified by the MARE model, undergraduate research that is student-initiated and directed, with collaborative facilitation, not control, by faculty, may be nothing short of revolutionary. In fact, while there is ample room and need for both models, the RBL-MARE model is in reality diametrically opposite to that of the apprenticeship model in philosophy and operation. Furthermore, the conduct of research by students in the MARE model is very much like the ideal put forth for education (learning) by the noted writer-educator bell hooks in *Teaching to Trangress: Education as the Practice of Freedom.* The MARE student-scientists, driven by internal desires, dreams, and aspirations, are practicing freedom. They have willingly taken on the responsibility for the freedom to make decisions with regard to the conduct of their research, suffering the consequences of mistakes or benefiting from successes as their research unfolds and evolves. Their relationship with their research is intimate and personal as they learn in the process and as their knowledge and awareness grows about their science, themselves, and their profession. Another huge difference between the team-based model and the better-known apprenticeship model is the solitary nature of the latter experience. Students in the apprenticeship experience are rarely afforded the opportunity to practice and hone teamwork skills so necessary for the rapidly changing technological and scientific worlds.

ACKNOWLEDGMENTS

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A HISTORICAL PERSPECTIVE ON INTERDISCIPLINARITY AND UNDERGRADUATE RESEARCH IN HONORS EDUCATION

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ABSTRACT

Honors education and curricular innovations have gone hand in hand since the first honors courses appeared in the 1920s. Undergraduate research and interdisciplinary studies are among the approaches that honors programs have adopted to further learning among their students. Both approaches provide students with opportunities to experience how knowledge is produced. Recent thinking on knowledge production, including the idea of "transdisciplinarity," parallels trends on campuses and in the broader society. Honors faculty might continue their historic role of curricular leadership by examining these emerging issues with their students.

INTRODUCTION

"The leading phenomena of our time exhibit a curiously ambiguous character. Technology may blow us up, or it may usher in the paradise of which man has been dreaming…. Bureaucracy may stifle democracy or be the backbone of democratic government. Nationalism may disrupt the world or prove to be the necessary precondition of a world community."

That is an excerpt from a speech Robert M. Hutchins gave in 1963 at a conference on the roles and responsibilities of scientists, especially those in government service. He went on to say that the resolution of those ambiguities could not be achieved through scientific procedures, and that "the essential problem is what kind of people we want to be and what kind of world we want to have." Finding solutions, he said, required "the reorganization of American education and the redefinition of its purposes." He was not trying to minimize the role of the sciences, but he wanted to put those and all other disciplines into the perspective of larger social issues. He proposed that liberal education, including scientific education, be made a priority, and equally importantly, that attempts be made to build intellectual communities outside of the American educational system and to maintain connections with those communities (Hutchins, 1963).

Hutchins was convinced that in an age of emphasis on science and technology, too many students and educators in the sciences had become too narrowly focused on their special areas. He was not the first educator to be concerned by over-specialization in higher education. At least as early as the 1930s, interdisciplinarity had been discussed as an antidote to the increasing fragmentation of the disciplines.

A kindred spirit of interdisciplinarity that also appeared around that time was general education. At least thirty colleges and universities began general education programs between 1920 and 1940, influenced by programs at Reed College and Columbia University. Hans Flexner describes general education as "a revolt against the fragmentation that had come to characterize liberal education and as a major philosophical and curricular departure" (Rudolph, 1977, p. 256; Flexner, 1979, p. 94).

Another way general education has been framed is as an attempt to balance depth with breadth. According to historian Frederick Rudolph: "General education had to make peace with specialization if it was to succeed in compensating for the narrowness that made specialization so dehumanizing, divisive, and incapable of providing any common ground or bond among educated people" (Rudolph, 1977, pp. 252-53, 256). This peace-making process took a variety of forms, including a compromise in

the form of distribution requirements that allowed academic departments to retain control over their general education course offerings.

The tension between specialization and shared knowledge has continued, and Rudolph observes that specialization has tended stay ahead. However, some institutions did succeed in establishing multidisciplinary, if not interdisciplinary, approaches in their general education courses. Honors programs were often the first place where these curricular innovations were tried.

INTERDISCIPLINARITY

Before focusing on honors, though, I'd like to give a rapid overview of some major themes and developments in interdisciplinary studies. First, what do multidisciplinarity and interdisciplinarity mean? Although numerous definitions exist in the literature, they often differ only slightly. The generally accepted characterization is that multidisciplinary studies involve the combination of two or more disciplinary viewpoints without their integration, while interdisciplinarity requires *interaction* among those disciplines. So-called interdisciplinary studies often fail to meet the latter criterion and are, in fact, multidisciplinary.

Interdisciplinary studies have developed for a variety of reasons. One common form has been the evolution of disciplinary sub-branches that crossed disciplinary boundaries and eventually became distinct fields. An example is molecular biology. Other interdisciplinary areas arose due to societal forces. An early example is American Studies, which according to Rudolph, originated in the "cultural self-consciousness of the 1930s." He suggests that American Studies might have paved the way for similar programs in English, French, Russian, etc., which could have been organized around the concept of "culture." But in fact the area studies programs of the late 1950s and 1960s "owed little or nothing to the curricular experience with American Studies." Instead, the impetus behind those programs was nervousness about American foreign policy and military and commercial success. Generous support from foundations and government helped start and sustain area studies programs and research centers, but the programs subsequently died out as financial support decreased and the teams of specialists returned to their respective fields. The departmental structure of universities played a large part in keeping interdisciplinarity "an elusive ideal" (Rudolph, 1977, pp. 249-50; Geiger, 1993, pp. 40, 51).

A renewed interest in interdisciplinarity appeared in the late 1960s and early 1970s, when colleges and universities came under pressure from teachers and students to change existing patterns of education. According to Mayville, interdisciplinary programs were vulnerable since they bore "the academic stigma of being 'nondisciplinary.' In an era of specialization, there can be no worse indictment." Nevertheless, by the end of the 1970s interdisciplinary programs were more popular than two decades earlier. A directory published in 1977 listed interdisciplinary courses and programs at over 800 American colleges and universities. Part of this growth was due to an increased willingness to change university organizational structures to accommodate university/community research programs aimed at solving social problems (Mayville, 1978, pp. 3-4).

The drop in student enrollments in some disciplines during the 1970s contributed to the growth of interdisciplinary programs. Enrollments decreased because of changes in the job market or a general lack of interest, spurring departments to create programs that were more attractive. This situation led to new interdisciplinary combinations such as business and foreign languages, and English and journalism (J. Fife, Foreword, in Mayville, 1978).

Federal support during the 1970s also contributed to the favorable environment. Support for interdisciplinary research and curricular experiments came in the form of grants from the National Endowment for the Humanities and the National Science Foundation. Both organizations were especially interested in proposals that combined the sciences and humanities, and toward this end in 1978 they began to permit concurrent grant proposals (Mayville, 1978, pp. 4-5).

Many people tend to associate interdisciplinarity with the sixties and seventies, because of its strong link to reforms of that era. The optimism of that period shifted during the eighties to a more

realistic outlook that recognized the disciplinary obstacles to interdisciplinary studies (Klein, 1990, pp. 35-39). In the early 1990s, interdisciplinary studies experienced "a resurgence of interest across multiple sectors," including K-12 education, collegiate general education, honors programs, and area studies programs. These efforts built on earlier innovations, but they also reflected new demands. A primary force behind interdisciplinarity in the 1990s was the "widespread assertion that knowledge has become increasingly interdisciplinary...." In 1994, Klein and Doty observed, "interdisciplinary courses, programs, centers, and schools have had an enormous impact on recent campus intellectual life" (Klein & Doty, 1994, p. 5).

HONORS PROGRAMS

Honors education and curricular innovations have gone hand in hand since the first honors courses appeared in the 1920s. Frank Aydelotte inaugurated Swarthmore's honors program in 1922 with the intent of "breaking the academic lockstep" that had contributed to a climate of undergraduate indifference toward scholarship. He sought a balance between too much specialization and not enough. Aydelotte felt that "the essence of liberal education is the development of mental power and moral responsibility in each individual" (quoted in Rudolph, 1977, p. 231).

Independent study was one innovation adopted by the honors programs of the 1920s and 1930s. Seminars and colloquia also became regular features of honors education at a time when lectures remained the preferred mode of instruction for most undergraduate courses (Rudolph, 1977, p. 269). In 1961 Louis Benezet, President of Colorado College, wrote in the *Saturday Review:* "Independent study and honors courses are spreading like wildfire, not only through the private colleges, but also throughout most of the state universities. Most honors programs represent enrichment of standard courses in major fields. Less is being done in interdisciplinary ventures..." (Benezet, 1961).

Joseph Cohen, director of the Inter-University Committee on the Superior Student (lCSS, the predecessor of the NCHC), protested Benezet's assessment of honors education. According to Cohen, honors programs-which numbered over 200 by November 1961-exhibited a great variety of solutions, including interdisciplinary seminars and colloquia, many involving more than one faculty member at a time. In fact, he wrote, hundreds of interdisciplinary offerings had appeared, many of them since the late 1950s (Cohen to Woodring, 1961).

The increasing popularity of honors programs in the 1960s helped create a positive climate for curricular experiments, including interdisciplinary studies. Innovations in honors programs were also made possible by funding from private and governmental sources. In 1962, for example, the ICSS received a grant of $89,000 from the National Science Foundation to study the following issues: "1) The value of research participation and independent study for the intellectual development of the student; 2) The teaching of science to non-science majors...4) Interdisciplinary approaches in the natural and social sciences" (lCSS, August 1962).

In 1962, the honors program at Washington State University received an NSF grant of $22,000 for a multidisciplinary independent study by 15 students in the problems of evolution (lCSS, Sept.-Oct. 1962, p. 28). In 1959, the Carnegie Corporation awarded $54,000 to the University of Michigan for, among other things, the introduction of an interdisciplinary course in the natural sciences and the initiation of informal meetings for junior and senior honors students aimed at "maintaining breadth of interest during the period of their specialization" (Eckelberry, 1959).

These are just a few examples of funding for curricular innovations in honors education around 1960. Honors educators have often asserted that those innovations eventually go beyond the honors program and permeate other courses on campus. An important element in all of the innovations was the shift from teaching-centeredness to a learning-centered approach.

Although honors programs did not have a monopoly on undergraduate research, certainly many of the undergraduates who participated in research programs were honors students. Research was and remains an important tool in achieving the goals of honors education, and this is indicated by the strong

link that has developed between undergraduate research and honors programs. The National Collegiate Honors Council's co-sponsorship of the National Conference on Undergraduate Research beginning in 1988, the second year of the conference, demonstrates that connection.

EMERGENT ISSUES

Now I'd like to return to the relations between disciplines, since I left that story unfinished. According to recent thinking, a new mode of knowledge production has developed and will be prominent in the future. This knowledge production is 'transdisciplinary' in that "it contributes theoretical structures, research methods, and modes of practice that are not located on current disciplinary or interdisciplinary maps" (Klein & Doty, 1994, p. 2; Peters, 1999, p. 13). According to Julie Klein, this approach reflects the world we live in, including "the erosion of older nation states, the globalization of economic activities, the development of new communication and information technologies and the emergence of new cultural 'particularisms'" (Klein, cited in Peters, 1999, p. 13).

Various scenarios along these lines have been suggested. One forecast is voiced by Henry Giroux, who writes: "Within the next century, educators will not be able to ignore the hard questions that schools will have to face regarding issues of multiculturalism, race, identity, power, knowledge, ethics and work. These issues will play a major role in defining the meaning and purpose of schooling, the relationship between teachers and students and the critical content of their exchange in terms of how to live in a world that will be vastly more globalized, high tech and racially diverse than at any other time in history (Giroux, 1999, p. 231).

Economics guide the orientation of another set of scenarios for the future developed by Peter Drucker (1993, 1994), Michael Gibbons, et al. (1994), and others. They see a future where knowledge is a commodity produced through the teamwork of specialists who have ambivalent disciplinary and institutional loyalties and where specialists are valued over generalists. With the requirements for teamwork, individual contributions are subsumed to group processes. (In a somewhat different version of this scenario, Harold Perkin (1996) sees the death of individualism.) Education becomes more crucial even as distinctions break down between universities versus other institutions, academic versus laypersons, and teachers versus students. In other words, traditional schools will not necessarily meet educational needs. Traditional community ties are expected to continue weakening.

Even if you don't agree with all elements of these forecasts, as a group or even individually such scenarios have major implications for education. The fact that several common threads are evident suggests that we might need to take them seriously.

Undergraduate research and interdisciplinary studies can reasonably be expected to examine and address the new environment depicted in these and other scenarios for the future. I'd like to suggest that undergraduate research might be well suited to answering some of the challenges of the emerging environment. Although transdisciplinarity or even interdisciplinarity might be beyond the reach of undergraduate education for the time being, I believe that undergraduate students are capable of thinking about how knowledge is constructed and what the implications are. Undergraduate research, whether in general education or the major field of study, can provide a space for problem-based explorations that include reflection on the production of knowledge. Looking to the future, honors programs might continue their historic role as sites of innovation by leading the way in tackling the emerging issues.

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ISSUE REACTION: INQUIRY-BASED LEARNING IN THE COLLEGE CLASSROOM

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Inquiry-based learning is a research-based learning technique used to promote student comprehension, self-reflection, and research skills. The implementation of inquiry-based learning methods in the classroom can look very different depending on student factors, such as academic level, and on instructional variations, such as academic discipline. In all cases, students will learn more meaningful information if inquiry-based activities are student-centered. The five phases of inquiry-based learning are (1) identification of prior knowledge, (2) student exploration, (3) focus on content, (4) organization of new ideas, and (5) application to new situations. This issue reaction explores ideas on how to implement inquiry-based learning in a course as well as the challenges of this approach.

Inquiry-based learning can be described as "the acquisition of new concepts through carefully structured student activities involving the formulation and testing of hypotheses" (Otto, 1991). Inquiry-based learning is a research-based strategy that actively involves students in an exploration of the content, issues, and questions surrounding a curricular area. Activities are designed so that students work individually or in teams to solve problems that incorporate both class work and fieldwork.

While inquiry-based, problem-based, and case-based learning all provide opportunities for students to be actively involved in their learning (Feletti, 1993), inquiry-based learning is the most appropriate instructional method to use if you want your students to become better researchers. By implementing an inquiry-based technique, students have more opportunity to reflect on their own learning and thus gain a deeper understanding of the course concepts (King, 1995).

The amount of teacher-directed vs. student-centered learning in inquiry-based classroom can vary depending upon the level of the students, their prior knowledge about the subject, and the level of experience that they have had with inquiry-based learning. In the college classroom, inquiry can vary from an activity where the instructor selects the topic and helps students formulate research questions to student-led research where the instructor acts as a support person should the students ask for help. According to Bonnstetter (1998), as inquiry-based activities become more student-centered, more meaningful learning takes place.

Though inquiry-based learning will appear different depending on the curricular areas, Boylan (1988) suggests using a five-phase learning cycle. First, the instructor must identify what the learners already know about the content. Then the students are allowed to explore events, situations, and information about the content. In the third stage, the students begin to develop a deeper and more scientific understanding of the concepts as they focus on the details of the content. To create meaningful understanding, the learners next organize new ideas and relate them to prior knowledge. Finally, the learners practice and apply what is learned in novel situations.

This issue reaction team examined ways in which inquiry-based learning could be used to involve students in research. Discussions focused on a hypothetical sociology course called "Morphing the American Family."

Researchable areas discovered for this course revolved around the changing demographics and perceptions of today's American family. These areas would give students experience conducting research that was relevant not only to the course but to their own lives. The biggest challenge that arose was not in using inquiry-based methods to teach the class but instead was determining the level of involvement of the instructor. The team recommended that the instructor would need to provide students

with background on the issues, content of the course, and the range of strategies used to address the research questions. The depth of coverage of these topics would vary depending on the students' prior knowledge and experience conducting research. However, regardless of the level of involvement, the instructor would need to guide students to the right answers using questioning techniques rather than telling the students the answer. Finally, the instructor would need to conduct evaluations of the student research periodically throughout the semester so the students would understand how well they were performing. Methods for these evaluations included the use of rubrics (grading guides) to help students monitor their own performance and to allow the instructor the opportunity to appraise student performance holistically (Wiggins, 1998).

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THE ROLE OF LIBRARIES IN HONORS THESIS RESEARCH: A LIBRARY CREDIT COURSE AS A MODEL FOR THESIS RESEARCH SUPPORT

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Libraries exist to serve both the research and instructional missions of their institutions. Supporting the thesis experience of an honors program represents the perfect convergence of these dual missions. The pedagogical mandate for the honors thesis experience is found in the 1998 Boyer Commission Report, *Reinventing Undergraduate Education,* which calls for undergraduate research experiences that incorporate information literacy as well as more advanced information retrieval competencies. *Information Literacy Competency Standards* (Association of College and Research Libraries, 2000) describes in detail the specific competencies that are the basis for selecting, evaluating, managing, and using information.

CHARACTERISTICS OF THE THESIS EXPERIENCE

The honors thesis is considered to be the capstone undergraduate academic experience. Beyond representing the culmination of course work, it can provide a unique opportunity to work in an interdisciplinary mode. Moreover, it provides acculturation to the academic environment and the opportunity to participate in the scholarly communication process. At the undergraduate level, the significance of the acculturation process is equal to, or more important than, the final thesis product. In addition to mastering subject content, students must learn the fundamentals of designing and executing research. Honors theses share several important characteristics: mentorship, originality, acceptability (consistent with current practice in the discipline), and dissemination (resulting in tangible products critiqued by others in the discipline) (Hakim, 1998).

THESIS EXPERIENCES AND THE LITERATURE-GATHERING COMPONENT

Undergraduate honors theses can take many forms, and the thesis experience can vary greatly from student to student. The primary factor that determines the nature of thesis work is the academic discipline. The significant differences that exist in the conduct of research across the sciences, the social sciences, and the humanities are of course reflected in the undergraduate thesis experience as well.

In contrast to many subject areas within the social sciences or humanities, students doing thesis work in the hard sciences and those who do creative projects often miss the critical experience of gathering information to establish their research question. Students in the hard sciences most often participate in ongoing research of the mentor, join a research team, and are assigned specific responsibilities in the lab or for particular subsets of data collection and analysis. There are clear advantages to becoming a peer in a research team. But students who participate in such projects often do not have the opportunity to establish their own research problem, determine the evidence required to solve the problem, select their own methodologies and research parameters, or perform their own literature review.

The polar opposite of this experience is the creative thesis, in which students may complete projects such as writing a computer software program or creating graphic art, performance art, photographic essays, musical scores, etc. Often, these creative theses likewise do not require an

extensive review of the literature and overlook the value of the literature review as the vehicle to provide context and perspective. Students doing thesis work on either of these extremes miss a valuable learning opportunity. Librarians can influence thesis advisors for both the hard sciences and creative projects to call attention to the inherent value in requiring students to perform literature reviews as a fundamental component of their thesis work.

FACULTY ASSUMPTIONS ABOUT STUDENT INFORMATION GATHERING

Faculty sometimes make faulty assumptions about the ability of undergraduate students to retrieve pertinent information. Faculty have developed personal patterns of conducting research, requiring "a long process of acculturation, …in-depth knowledge of the discipline, awareness of important scholars working in particular areas, participation in a system of informal scholarly communication, and a view of research as a non-sequential, non-linear process with a large degree of ambiguity and serendipity" (Leckie, 1996). They often presume that students have developed a similar personal information-seeking strategy, and that the student has familiarity with the structure and organization of scholarly literature as well as the scholarly communication process. They forget that the student has a narrow perspective, if any, of the nature of the discipline and what it means to be a professional or scholar in that community. Unaware of a student's linear approach, they presume that the student has internalized the notion of research as a recursive process, repeated for different purposes at different stages in the research. They forget that students often have a low tolerance for ambiguity. Faculty must understand that failure to recognize any of these obstacles can seriously impede a student's progress.

Librarians as partners in the thesis experience can help bridge these potential pitfalls, can facilitate the process, and can help remove barriers to successful thesis completion.

LIBRARIES AS THE FOUNDATION FOR INQUIRY-BASED AND PROBLEM-BASED LEARNING

Inquiry-based learning and problem-based learning are inherent elements of thesis research. Libraries have the infrastructure to provide the basis for each by precise use of sophisticated database interfaces and other resources. Databases can help to identify a research problem, additional research questions, and gaps in the literature. Initial scanning of databases can provide the critical context for students to understand the broad issues. Many databases support the ability to limit search results to literature reviews or specific methodologies. These search refinements can uncover important specialized treatments and provide models for project design and procedures for accommodating human subject requirements. Specialized print and electronic resources can answer specific questions posed by the research problem. Journals and research reports provide models to cite, present, and report data in a manner appropriate for their discipline.

Initially, undergraduates are anxious to find examples of successful research projects. Unlike graduate students, undergraduates typically have few models available for the design and presentation of a thesis. Examining completed theses allows them to study project organization, research design and methodology, and the standards held by various departments and thesis advisors. This is a particularly important need for students whose thesis work falls outside their academic major. Libraries can satisfy this need to identify successfully completed theses through enhanced cataloging, including searchable abstracts, keywords, and names of thesis advisors, and by employing preservation techniques such as microfilming and binding.

LIBRARY STUDIES 30tH - ONE MODEL FOR THESIS SUPPORT

Design

Library Studies 301H [http://www.libraries.psu.edu/crsweb/infolit/lst301hl] is offered by the Pennsylvania State University Libraries as one delivery option for students to develop proficiencies for thesis information gathering. It is designed to support students in the early stages of thesis exploration, problem selection, and resource identification. It is especially valuable for students who express the need for a structure to 'keep on track', and who perhaps may not have peers in the same discipline or who are at the same stage in the process with whom to share the process. It is offered for one credit, one meeting per week, with intermittent weeks unscheduled for independent work and instructor consultations. The syllabus is flexible, to accommodate students' prior knowledge, experience, and progress to date. Students use their own thesis topics as the basis for assignments.

Content

Advanced database manipulation

The prime attraction of the course is the focus on learning and practicing advanced database manipulation, which includes demonstrations and practice in selecting vocabulary appropriate for each database, techniques for using. embedded thesauri in particular databases, strategies for constructing search statements and combining search statements and concepts, ways to refine initial search results, ways to save search statement histories for later use, use of citation indexing, and learning to 'read and react' to each of the citations retrieved.

Identification of appropriate resources

Students learn the nature of the information cycle, which informs the way information is generated, produced, disseminated, and retrieved. Discipline analysis is critical, since it leads students to understand the various patterns of discourse for the problem and where the conversation is reflected in the literature. Students expect to find articles related to their topic but are much less familiar with other supplemental resources. Maps, government documents, dictionaries, encyclopedias, handbooks, annual reviews of research, statistical sources, opinion sources, and much more all have the potential to inform their work. A strategy used in the course is to demonstrate the evolution of the information-gathering process by exploring the relationship and sequence of identifying a research problem, posing questions to be answered, identifying specific formats and data types to answer each question, and then developing strategies to identify such formats in the online catalog, in bibliographic databases, and on the Web. This process results in new ways of thinking about sources and about the research problem.

Research as a recursive process

A key point of emphasis in Library Studies 30lH is exposure to and practice in the recursive nature of the research process. Students begin the course with the intent to 'find information on my topic' but soon recognize the necessity of conducting their research using a cyclical process. Indeed, the word "re-search" inherently suggests the cyclical nature of this process. They necessarily perform multiple searches in the same database and topic, for the multiple purposes of topic selection, research problem definition, methodology selection, reports of current research results, identification of significant works, and future research agendas. By the end of the course, they are a step closer to assimilating the non-sequential, non-linear research behaviors of their faculty mentors.

Internet navigation and evaluation

Rather than exhibiting an over-reliance on the web, honors students have been so frequently warned against using the web as a reliable research resource that they consequently have little or no Internet experience. A luddite approach serves students no better than over-exposure, since intelligent navigation, search-engine selection and technique, and evaluation criteria are critical in today's information environment. Library Studies 301H incorporates these issues, plus practice with reliable web sites known as the "invisible web" and discussion of current issues such as the proposal for the addition of new Internet domains.

Information literacy value-added content
Course content identified as particularly valuable and unique by Library Studies 301H students extends beyond the narrow scope of gathering information. Elements of the broader information environment not usually covered in other classes but that have significant impact for students as consumers of information include copyright issues and intellectual property, research ethics and information ethics, and patterns of scholarly communication and discipline analysis. Students report that exposure to these issues broadens their perspective on the total research experience.

Portfolio building
Students require experience in preparing proposal and thesis elements such as an abstract, a literature review, statement of consideration of ethical issues, and supporting documentation such as research logs and diaries. A number of assignments, guest speakers, and class activities support this need. Assignments and class projects, in addition to database searches, are structured to result in a portfolio that forms the basis of current and future thesis work. Students may elect to keep either print or electronic portfolios. In this way, the portfolio becomes a concrete vehicle to link the course more directly to the thesis experience and to integrate discrete project elements.

Challenges
Several challenges exist in the delivery of a credit course to support thesis research. Fundamentally, the thesis project is an individual experience and one that does not easily translate to a group classroom experience. It is sometimes difficult to establish a common syllabus that will sustain students throughout the entire semester. Depending on course enrollments, there can be a significant lack of commonality among disciplines and academic departments for a coherent presentation of resources and strategies. Several departments, but not all, offer their own research methods course, and much of our content may overlap. Students are usually in different stages of the process, and the pace of assignments and activities may not parallel their immediate need.

CONCLUSION

Each time it is offered, depending on class composition, Library Studies 301H presents different combinations of challenges. Still, the overriding advantage is that it provides a forum for students and librarians to participate in an ongoing conversation, and allows for continuity that would not otherwise exist in an informal, workshop environment. It gives structure to students who might otherwise flounder amidst a sea of resources, and it provides librarians with powerful insights that inform understanding of the entire student information-gathering process.

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VI. The Next Challenges

One of the basic principles of research and of education in general is that challenges propel new learning. This final section raises two fundamental challenges for one of the most frequent sites of undergraduate research: honors programs and colleges. The way each institution responds to these challenges can affect the direction and future of undergraduate research.

Anthony Pittman explores perceptions held by African American students about the recruitment practices and climate of honors programs and colleges. The challenge of welcoming a diverse student population pervades higher education and has implications for research programs both inside and outside honors education.

Cheryl Achterberg challenges educators as role models for undergraduate research to employ the tools of "theory-driven research and practice." Just as students are encouraged to engage in "systematic, comprehensive, and organized" research processes, Achterberg challenges honors educators to "play a pivotal and powerful role" through a commitment to theory-driven research.

The open-ended nature of the "Next Challenges" section balances the momentum of the opening section of the volume and points the way beyond what we know and do well toward those areas that seem to invite creative, intergenerational research teams, possibly the research teams of the future.

DIVERSITY ISSUES & HONORS EDUCATION[1]

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ABSTRACT

Are honors programs across the country obligated to increase the percentages of minority students enrolled in their programs? Is it necessary that honors programs prepare their members to work in a global economy with its many facets and features? The answers to both of these questions may seem obvious. However, very little research has been done to examine why there is such a disparity between whites and students of color enrolled and actively participating in honors programs at majority institutions across the United States. Consequently, many college and university honors programs fail to experience the benefits and advantages that may be found within a culturally diverse honors student population. This paper chronicles the results of a study that was piloted at the University of Connecticut by a first-year doctoral student. In order to fulfill the requirements for an Introduction to Multicultural Education Research course, the student investigated why students of color at the University of Connecticut may be reluctant to enroll in the university's honors program. The study included a small sample (n=6) of a population of 831 students. Participants in the study were interviewed and asked questions about their honors experiences and whether or not they believed their honors program maintained a vested interest in diversity issues. Students were also asked to identify perceived barriers that might prevent more students of color from participating in honors, though they may be eligible. The results of the study were divided along racial lines and may have broader implications for other majority campuses as well. Though relevant literature that addresses honors and diversity issues is limited, two pertinent resources are included in this paper. Honors program administrators may find these documents to be particularly instructive, if indeed increasing representation among students of color within their honors programs is a priority.

In the late 20th century, colleges and universities across the country took up the mantle of providing advanced instruction in the form of honors education. For example, Frank Aydelotte, in a book entitled <u>Breaking</u> <u>the</u> <u>Academic</u> <u>Lock</u> <u>Step,</u> contends that

> *The academic system as ordinarily administered is for these better and more ambitious students a kind of lock step: it holds them back, wastes their time, and blunts their interest by subjecting them to a slow-moving routine which they do not need. It causes, furthermore, the atrophy of the qualities of independence and initiative in more gifted individuals by furnishing too little opportunity for their exercise (14).*

In an attempt to reconceptualize the perception that American colleges and universities were providing their students a mediocre education, Aydelotte, in his role as president of Swarthmore College, introduced a system of honors that was predicated upon the honors school at Oxford University, commonly referred to as Greats. His new development was "…to separate those students who are really interested in the intellectual life from those who are not, and to demand of the former in the course of their four years' work, a standard of attainment for the A.B. degree distinctly higher than we require of them at present and comparable perhaps with that which is now reached for the A.M." (31).

Over the course of time, honors has undergone a series of permutations. Many of these changes have been positive; however, there are some that have not been particularly advantageous to students of color. The idea of separating students according to intellectual keenness was a noble idea at first. However, this notion of separation has extended beyond intellectualism and affected other subject

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categories such as gender, class, and race and ethnicity. For instance, out of 831 members, the University of Connecticut Honors Program contains a total minority population of 18.5%. Further examples of this epidemic can be found by examining the low percentages of students of color in honors programs at majority institutions across the country.

A recent pilot study was conducted among honors students at the University of Connecticut. It was qualitative in its design and reflected a series of structured interviews of a diverse sample of honors students. Some of the major questions students were asked were these:

(1)   Do you feel that there are any barriers in place in your honors program that may   prevent the full participation of persons of color in your honors program? Please   explain.
(2)   In your opinion, are there any reasons why persons of color might feel   uncomfortable participating in your honors program? Please explain.
(3)   Do you feel that your honors program is preparing you to interact with persons   whose race(s) may be different from your own? Please explain.

The major findings of this study were clearly divided along racial lines. For instance, nonwhite students in the honors program at the University of Connecticut perceived that the barriers that may prevent other students of color from participating in honors were lack of diversity, misperceptions of honors as an elitist organization, and misperceptions of honors as an unnecessary addition to their course loads. One student of color stated:

The only barrier I can think of is the lack of diversity in the program. Some students of color may be disheartened because they don't find as many people who they think will have anything in common with them in the honors program. They may feel that it is a program 'for white people.'

Another student of color claimed that the only perceived barrier she felt prevented more minorities' participation in honors was the belief among students of color that the honors program is an elitist organization. "It's not intended to be elitist, but that's the view among some UCONN students," she said.

Conversely, according to white students, the perceived barriers were poor performance on standardized tests and lackluster recruiting efforts. For instance, one student believes:

SES may prevent persons of color from performing as well as whites on tests. But I do not think standards should be lowered for admissions of persons of color. It's not necessary. I want people to be admitted [into the honors program} because they are high achievers and not because of the color of their skin.

Another white member of the honors program at the University of Connecticut was very critical of the program's recruiting strategies. She asserted:

They don't make a special effort to grab certain people. They don't promote themselves as much as they should. If persons of color come, they're thrilled, but they don't go out of their way to get them to join.

Despite her assertion, the student said that the persons of color who are current honors students at the university "Shouldn't feel too much uncomfortable because our honors has a pretty good atmosphere where students have the option to voice their opinions to the Honors Council whether it be about race or other issues."

The study also revealed that students of color felt that the University of Connecticut Honors Program was not preparing its members to interact with persons whose races may be different from their own. The major reason identified included a lack of diversity in terms of the University of Connecticut Honors Program curriculum. However, each white survey participant praised the efforts of the honors program for preparing its members to interact with different races. "I'm getting a worldly education, and I'm becoming more curious and more intrigued about other peoples and other countries," remarked one student. Other whites felt that the honors program's implementation of International Night, an

annual event held at UCONN that celebrates various students' nationalities and ethnicities, facilitates their preparation for relating well with persons of color.

Honors program administrators at the University of Connecticut were concerned about the issues that emerged from this pilot study and began a series of initiatives to address issues of diversity within the program. The implementation of Day of Pride Scholarships and colloquia about race and diversity, as well as the exploration of alternative means for selecting students for participation in honors (e.g., Renzulli's Schoolwide Enrichment Model), are among UCONN's Honors Program efforts to increase its minority student population.

Although little research has been done to determine why students of color are reluctant to participate in honors, though they may be eligible, honors program administrators may find Donna Ford's <u>Multicultural</u> <u>Gifted</u> <u>Education</u> and Renea-Harrison Cook's recent doctoral dissertation entitled *An Examination of Issues Affecting African American Students' Decisions to Enroll in Honors Programs or Honors Colleges at Predominately White Postsecondary Institutions* to be particularly instructive.

Ford's text, although targeting an audience of educators of the gifted, contains practical suggestions about the various strategies that teachers and honors program directors can employ to maximize "cultural pluralism,".as identified by Ford (27). Four other overarching goals in Ford's book are: an increase in multicultural knowledge, educational equity, empowerment, and improved social relations.

Cook's dissertation is predicated upon the theoretical framework of William Cross' notion of Nigrescence, which "explains the processes African Americans experience when establishing an ethnic and racial identity" (8). Honors program directors and/or administrators may find the study particularly useful because of its recommendations for increasing diversity. The following are some of the key suggestions from the dissertation:

> *1) Establish stronger support systems specifically targeting their African American students to emphasize to these students that they are important to their programs and to address their beliefs that honors education appeals mostly to Caucasian students and lacks students of color. Such support systems will also present a warmer, more welcoming campus climate and improve recruitment of black students,* 2) *investigate the feasibility of offering scholarships, grants and paid internships to African American students who enroll in their programs,* 3) *disseminate information about their programs more effectively among African American students to ensure that these students are contacted and informed about honors education. Diverse methods should be used, including direct contact from black students, invitations to recruitment events hosted by black honors students, distribution of recruitment literature, and announcements in various media. Such prevalent information will help African American students understand what honors education involves, what honors education requires of them, and how honors education can benefit them (94-95).*

Although Cook's study investigates issues related specifically to African Americans and honors, honors program administrators may find her suggestions purposeful for the recruitment of other minority groups as well.

Almost every segment of society is engaging in discussions about the most effective and the most efficient manner in which their universities, companies, and the like may become more ethnically and culturally diverse in their membership compositions. Ostensibly, there appears to be genuine concern about issues of diversity and ensuring that people in general come to understand, to accept, and to celebrate the cultures of persons who are different from mainstream majority culture. However, more work beneath the surface level needs to be done. Honors programs across the United States should not consider themselves exempt from these pursuits and in fact should be more disturbed since programs of this kind severely lack representation of nonwhite members.

Notwithstanding the limitations of this study, namely its small sample size, the generalizability of these results should not be ignored. Similar reasons as those identified may influence nonwhite students' avoidance of honors programs on other majority campuses across the United States. It is

hoped that this article will compel all of those associated with honors education to make concentrated efforts to diversify the composition of their honors programs. After all, in this era of multiculturalism and time of celebration of diversity as our strength, the percentages of students of color actively participating in honors programs should not remain weak.

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WHAT'S MISSING IN HONORS EDUCATION:
A THEORY-DRIVEN APPROACH

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ABSTRACT

If honors education is to thrive and mature in the future, better informed and more systematic thinking should be used to design and implement honors programs. The purpose of this paper is to establish a case for theory-driven research and practice as a means to improve honors education. It identifies the goals of honors education and then reasons that honors education should incorporate theory in order to advance the field. Theory is identified as a *set* of inter-related concepts, definitions, and propositions that specify how and why a phenomenon occurs. The most important function of a theory in honors education is- practical, to serve as a thinking tool. Theories, by their nature, are constructed, change, and mayor may not mix well. They tend to introduce jargon and are often confused with methods-driven efforts. In spite of these complications, however, judicious use of theory offers honors educators perhaps the single best means by which we can make forward progress, learning from each other and sharing what we learn with the university committees that invest in honors programs.

In short, honors programs have a tremendous, but as yet unrealized potential to make a difference in the quality of higher education altogether. A more widespread use of theory-driven research is an important commitment towards realizing that potential.

The purpose of this paper is to present a case for theory-driven honors education. Honors educators should be difference makers on their campuses. They should make a profound difference in the learning experience of honors students. They may also play a pivotal role in campus education more generally, serving as local leaders about how to improve teaching and learning, how to maximize student learning both in and out of the classroom, and also how to incorporate a student focus into their universities. To accomplish this vision, honors educators need to learn to work more systematically themselves. The central premise of this paper is this: it is unlikely that honors education will make significant advancements without a theory to drive further development in thinking and practice.

GOALS

Renzulli (1992) observed, "The history and culture of mankind can be charted to a large extent by the creative contributions of the world's most gifted and talented men and women." Few would argue with this statement. Indeed, many universities initiated honors programs with the express charge to locate, stimulate, and educate these gifted men and women. It is an important charge. In recent years, however, the emphasis in honors education, and certainly in writing on the subject, is more on the location and recruitment of these students than on their actual education. It is a concern driven, perhaps, by the status such students confer on a university.

Universities should do more with their honors programs. We have, as Renzulli (1998) pointed out, "a responsibility to develop gifted behavior, not just find and certify it." In other words, the focus of our business should be teaching and guiding the development of our most potentially able young people (Brown, 2001). Ideally, honors programs should do so in such a way that the whole university benefits from it.

Renzulli (1992) identified the major goals of honors education for grades K-12. These goals are adapted for collegiate education as follows:

- *Develop the talent potentials of gifted students.* The typical courses, programs, and other activities offered to college students in the general curricula may be insufficient to develop the talents and intellectual potential that gifted students have. Therefore, additional challenges and support need to be created. Different processes or methods may also be required (Brown, 2001; Renzulli, 1999).

- *Situate the honors program in the university as one of many programs designed to serve the entire student body.* An educated society is crucial to the success of democracy and the advancement of society. No group with special needs should be left out. Highly gifted and talented students have special needs as do many other groups. Neither they nor other groups should be disenfranchised.

- *Experiment with teaching and learning innovations.* Honors programs provide an opportunity to experiment precisely because they are unfettered by many of the curricular restrictions and serial course requirements common to the general curriculum. They are also blessed with smaller class size and highly motivated students, making honors courses ideal test sites to develop and test new teaching and learning innovations.

- *Transfer teaching and learning innovations from honors programs to general education in the university.* Honors programs will lose credibility if they do not give back what they have learned to the larger university. Honors programs should rightfully be judged as investments by universities or colleges, and colleagues should expect some return on that investment, not only in the realm of individual student achievement but also in the scholarship of teaching.

- *Support the continuous escalation of student engagement in both required and self-selected activities in and out of the classroom.* Honors programs should be designed to provide a trajectory that supports continued development and growth, not only in the pure intellectual sense but also in the social sense, in leadership and organization or in what Gardner (1985) would describe as multiple intelligences.

- *Infuse more effective practices into existing school structures.* All universities are going through a time of change. The most stable or sustainable changes occur from within the system. Thus, honors programs or colleges are often in a unique position to work as active change agents for the benefit of the entire school or university.

I would assert, however, that we don't know how to accomplish these activities in any systematic, comprehensive, or organized fashion. Although there are many collegiate honors programs nationally" there are few recognized scholars and no real recognized expertise in the area. As scholars, we don't know how to achieve our special goals because we haven't organized our thoughts and direction. The paradigm is thin. We have no means by which to analyze the error of our ways, to self-correct, or even to understand our successes. We need a theory to drive knowledge construction in honors education. If we consciously use and inter-relate the concepts and elements involved in the production of knowledge, we can become more effective and efficient in our efforts.

DISCUSSION OF 'THEORY'

Before I go further, this is what I mean by the term "theory". I recognize fully that different disciplines use this term in different ways. I do not mean armchair pontification, rhetoric, or

hypothesizing (though hypotheses may be derived from theories). Rather, I define theory more formally, as a *set* of inter-related concepts, definitions, and propositions that specify how and why a phenomenon occurs. In other words, theory describes patterns among groups of concepts, events, or objects. When these propositions are validated by research, they are called principles. When they are logically deduced, they are called constructs (or in some fields, theorems). When the construct is put to the test, it is called a hypothesis. In other words, active theory use demands research as well (Novak & Gowin, 1984).

The most important function of a theory is to serve as a thinking tool. As such, theories are typically used to explain and predict phenomena, but they can also be used to plan, implement, and evaluate interventions. Theories should help us organize our ideas, identify our assumptions, and structure our conversations and work efforts. The last point may be most important to us.

Is there a theory appropriate to guide honors education? Not at this point. There are, however, a number of theories that have much to tell us and that, together, may move us forward. It is beyond the scope of this paper to explore the particulars of these theories, but we may draw on theory from adult education, gifted education, cognitive psychology, social psychology, and adolescent and adult behavior. Even so, we will inevitably also have to grow our own theory.

To start, we must choose a theory. Choosing an appropriate theory or theories is as crucial as the decision to use a theory. Theory application requires time, commitment, vigilance and follow-through. It is an investment in the future. As such, here are several precautions to keep in mind:

1. *"Just giving words for words doesn't really tell you what anything means"* (Matthews, 1980). Theories tend to generate jargon and this jargon is often used to separate insiders from outsiders. In honors education we need to speak across all disciplines, to make ourselves understood by all. Therefore, the especial point of theory in honors education is not to pontificate, but to articulate; not to establish esoteric laws, but to ask and answer useful questions. We must beware of drowning in our own or others' words.

2. *Not all theories mix well.* Complex issues such as honors education will require, by their nature, several theories to address the full panoply of questions and problems that need resolution. Theories tell us what questions to ask and what kind of responses to anticipate. Theory also works as the point of union between our general beliefs (or philosophy and world view) and our specific ideas and concepts. If multiple theories are combined on an *ad hoc* basis with conflicting philosophies and premises, they will inevitably generate confusing results and claims. On the other hand, our advancement in research, understanding, and practice will also suffer from too narrow a scope of theories being utilized. So, our selection and addition of theories must be done with careful consideration.

3. *Methods-driven teaching and research should not be confused with theory-driven teaching and research.* The easiest way to explain this statement is to provide an example. Active and collaborative learning are becoming quite popular in higher education, but as Hansen and Stephens (2000) noted in a recent article, collaborative learning has been treated more as a method than a mind-set or theory. The theory of collaborative learning says, in part, that students need to learn to become responsible for their own development; practice honesty, courage, care, and justice; be ready to question the shortcomings of their own work; and be held publicly accountable to others for their work. If collaborative learning or group work is assigned without also teaching students this mind-set, it will often devolve into social loafing with one student in the group doing the work for all with no realization of the value of teamwork. In other words, there is no magic in dropping a method into teaching; the method must be accompanied and practiced with the thinking and philosophy behind it to have any hope of working!

Methods-driven education or research is generally viewed as a negative activity from a scholarly perspective because it fails to make intellectual progress. While it may inform us about the particulars of a given process in the short term, it cannot take us beyond that process to higher levels of performance.

4. *Theories must change.* "The value of theories is derived not from their performance, but from their contribution to the generation of new and better concepts and practices" (Novak and Gowin, 1984). Theories should evolve; those that don't must ultimately be discarded as useless. The hope in any theory-driven effort is that first, changes will result and second, those changes produce a keener understanding of the processes and events that occur within and across various contexts or settings of interest, changes that simultaneously improve the theory.

5. *Theories are not good or bad.* Theoretical mistakes are not simply wrong. Theories are constructed. They are more or less powerful, more or less useful, more or less insightful (Kuhn, 1996). When a theory fails, it is like a learner. It is an inadequate attempt to master a problem and improve through constructive self-correction. Having said that, we can leave off a theory that isn't productive.

SUMMARY

To conclude, honors educators should be difference makers. Higher education is entering a period of intense change. Honors programs could play a pivotal and powerful role in this change era, but only to the extent that we become better at, and more knowledgeable about, what we do. I issue a call to action: to use theory to drive our program decisions, designs, and interventions. Let us learn and share our results together to advance us all, just as our colleagues do in other disciplines. It is our challenge to engage in theory-building efforts for the benefit of gifted and talented students everywhere, and ultimately for the benefit of our future and for our society, overall. I shall look forward to sharing the good lessons learned in the future.

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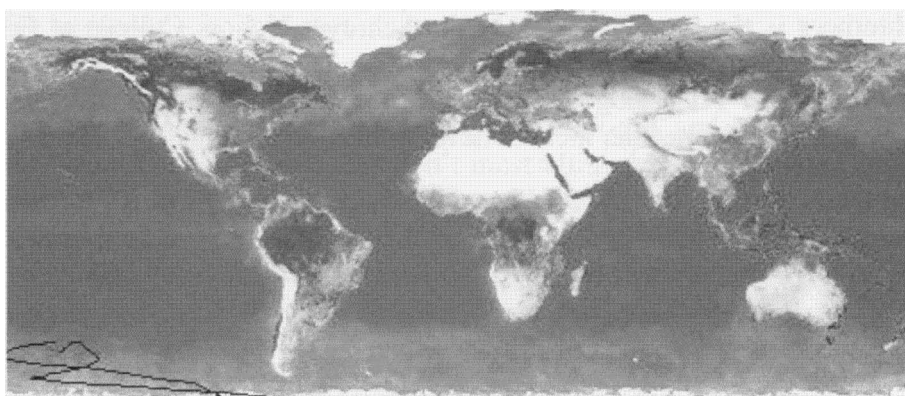
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