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Cover Photo: First-year students at Pepperdine University who are investigating the biological mechanism of plant adaptation to wildfire in the Santa Monica Mountains. Students shown are measuring enhanced photosynthesis and transpiration characteristics of fire-adapted plants after shoot removal by wildfire. (Photo credit: Stephen S. Davis)

www.cur.org
“An ounce of practice is worth more than tons of preaching.” —Mahatma Gandhi

Over the course of the past nine months in my new role at Florida Southern College and as CUR President, I have been engaged in a wide variety of conversations related to the role and purpose of general education. A haphazard survey of college websites indicates institutions vary dramatically with respect to the number of general education courses students complete as part of a degree program. Colleges and universities are less varied, though, with respect to the goals of these requirements. The goals often refer to preparing students for citizenship, providing an appreciation for diversity, helping students integrate ideas from across disciplines to illuminate interdisciplinary themes, and improving thinking, reasoning, and communication skills.

Given the goals of general education and the percentage of these courses that make up a student’s educational experience, it behooves us to find ways to integrate undergraduate research. Weaving undergraduate research/scholarship into and across general education courses is an effective way to achieve educational coherence and provides a framework for intentional scaffolding of intellectual and communication skills. When successful, we will solve two of today’s most vexing challenges—supporting research opportunities for all students and building a specific skill set for student scholars. Many faculty members assign readings for students to complete out of class and then are disappointed when their analysis of the readings is superficial. When was the last time you took time in class to break down a research article (or book or poem) paragraph by paragraph (or stanza by stanza)? When have you spent time improving these skills, as well as general skills related to movement such as balance, flexibility, agility, and speed.

A campus might approach the design of general education as building a specific skill set for student scholars. Many faculty members assign readings for students to complete out of class and then are disappointed when their analysis of the readings is superficial. When was the last time you took time in class to break down a research article (or book or poem) paragraph by paragraph (or stanza by stanza)? When have you spent time improving these skills, as well as general skills related to movement such as balance, flexibility, agility, and speed. A campus might approach the design of general education as building a specific skill set for student scholars. Many faculty members assign readings for students to complete out of class and then are disappointed when their analysis of the readings is superficial. When was the last time you took time in class to break down a research article (or book or poem) paragraph by paragraph (or stanza by stanza)? When have you spent time improving these skills, as well as general skills related to movement such as balance, flexibility, agility, and speed.

An analogy that might help us think of ways to use these courses to create undergraduate researchers is to think about “wicked” problems and how they cannot be solved with the methods of a discipline to answer a question, communication, analysis, and dissemination. By breaking the “research/scholarship/creative work” cycle into distinct stages, one gains a clearer understanding of how general education courses can provide us the means to introduce students to the commonalities and differences among disciplines. For the past five years, my institution has been using a common theme in its general education courses to help students learn how different disciplines approach a given issue (poverty and hunger, environment and sustainability). Students are learning how simple issues can suddenly become complex when disciplines and individuals differ in their value systems. This reminds me of Herb Childress’s address at the 2012 biennial CUR conference about “wicked” problems and how they cannot be solved with the lens of a single academic discipline.

The examples in this issue show that our general education courses offer a ready mechanism for us to provide early and sustained research experiences for all students. We cannot predict in advance who will be the next generation’s greatest humanitarians or thinkers— all we can do is provide time and guidance as they practice in our classroom. I hope the articles inspire you to incorporate undergraduate research into your general education classes.

Mary Crowe
Associate Provost of Experiential Education
Florida Southern College
CUR President
The February 2013 CUR Dialogue conference featured back-to-back plenary presentations by Jane Waldman, executive director of the National Association of System Heads, followed by Rebecca Martin, vice president of the Education Delivery Institute. The first presentation highlighted pressing issues in higher education, including the systematic disinvestment in higher education (for all but a few well-endowed private institutions) that’s taken place over the last few decades, the seemingly inexorable rise in tuitions, and the sickening crunch between students’ expectations for affordable, accessible, and high-quality education, and what many domains of the educatonal marketplace are offering right now. The second presentation focused on strategies to connect high-impact practices such as undergraduate research with the national dialogue on improvements in student success and degree quality, and engaged several hundred CUR Dialogue participants in focus-group discussions on the challenges and opportunities to systematically expand undergraduate research on their campuses.

Both plenaries called for leadership from faculty and administrators to build more connections between research programs and classroom practice, and, quite specifically, to expand undergraduate research into the lower-division curricula and campus-wide general education infrastructure. The Summer CUR Quarterly special issue showcases the vitality and diversity of the faculty and students who are doing just that.

Allied to the expansion of undergraduate research into the general education curriculum, we see growth in other aspects of the undergraduate education experience. The recent emphasis on assessing outcomes of the (re)created general education curriculum. Several of the articles, for example Pukkila et al. and Carr et al., provide examples of new and innovative ways to expand the numbers of mentors engaged in research-based learning environments, through empowerment of near-peer (graduate and/or upper division) students to help lead course-related research projects and processes.

Revitalization of general education to inculcate high-impact practices such as undergraduate research is receiving a lot of attention in higher-education circles, as well it should. CUR is an important force in the movement to expand the liberal arts tradition, and a multiplying sense of despair that the students in my classes seemed to have little interest in the sweeping overview of Earth’s processes and history I presented in prescribed, thrice-weekly, 50-minute lecture doses. From colleagues in the science education department, I did learn to infuse some inquiry-based elements into the large lecture setting, but didn’t have a smidgen of a vision about restructuring the course to emphasize research.

The articles in the Summer 2013 CUR Quarterly provide insights on how to turn general education environments into laboratories of practice for “Students as Scholars.” The five contributions (four print, and one web-based) share common themes: inter (and multi) disciplinarity, creative reconstruction of the standard lecture setting, and a focus on assessing outcomes of the (re)created general education curriculum. Several of the articles, for example Pukkila et al. and Carr et al., provide examples of new and innovative ways to expand the numbers of mentors engaged in research-based learning environments, through empowerment of near-peer (graduate and/or upper division) students to help lead course-related research projects and processes.

Elizabeth Ambos
Executive Editor

The competition has never been fiercer in the delivery of general education courses. MOOCs (Massive Open Online Courses) from the nation’s top universities offer general education courses free of charge to more than 100,000 students in some classes. MOOCs will soon come with academic credit for students who wish to transfer the coursework across the country or globe. For-profit institutions continue to offer a myriad of core curriculum courses, and technical colleges in many states now offer general education courses at significantly cheaper tuition rates. In this increasingly competitive marketplace, many colleges and universities are asking how they can stand out. The focus of our Summer 2013 CUR Quarterly on the integration of undergraduate research experiences into general education courses provides an answer to that question. For institutions of higher education to not only survive but also to prosper in this hyper-competitive environment, the best practices highlighted in the focus articles and vignettes of this issue provide a path forward.

Katy Carr and colleagues from Pepperdine University describe the powerful combination of undergraduate research and first-year seminars. The Keck Scholars Program (one of the Keck Colleges) at the Claremont University System offers general education courses free of charge to more than 140 and 160 first-year students in seminars that span diverse academic disciplines with fellow students serving as peer mentors. The article provides particularly valuable assessment data on student research skills and abilities. Marina Cvetkovic-Cvijle and colleagues at St. Cloud State University illustrate the value of interdisciplinary faculty learning communities. The authors highlight a learning community of faculty in anthropology, chemistry, English, and biology (immunology) that reached across disciplinary silos and engaged undergraduates in research through courses that are part of the university’s general education requirement. The article provides an analysis of the quantitative and qualitative results of a Common Classroom Assessment Tool (CCAT). The CCAT reveals student attitudinal shifts concerning the research process. I also encourage you to explore the insightful print vignettes in the Summer 2013 CUR Quarterly. C. Wesley Walter describes a general education first-year seminar in which students at Denison University perform home energy assessments using the homes of volunteers as a “research lab.” Robert Zeidel and Kate Ritzmacher of the University of Wisconsin-Stout report how students in a general education U.S. history course can access primary sources to investigate their “historical birthday.” Amy Peeler of Wheaton College reveals that undergraduates can engage in Biblical exegesis in a general education course.

Finally, our Summer 2013 CUR Quarterly on the Web provides additional and valuable examples of undergraduate research in general education courses. The article by Ani Kveven and Josh Searie outlines Everett Community College’s Ocean Research College Academy (ORCA). ORCA involves an interdisciplinary learning community that is cohort-based with student-led research at the heart of the initiative. Our web vignettes describe innovative models of incorporating undergraduate research into general education courses ranging from biology to Japanese culture as well as first-year experiences from the Earth sciences to nursing.

The intense competition that will continue to unfold in the delivery of general education courses creates a tremendous challenge for colleges and universities, but it also provides valuable opportunities. The collection of articles and vignettes in this issue, from private to public institutions,
can serve as a clarion call for how to incorporate undergraduate research experiences into general education courses. Institutions of higher education that incorporate these best practices can thrive in a marketplace of growing competition. Fundamentally, our authors teach us that undergraduate research is not reserved for upper-level students but rather should be a key and dynamic element in how we provide the core curriculum.

James T. LaPlant
Valdosta State University
CURQ Issue Editor

Elizabeth (Beth) L. Ambos became CUR’s fourth Executive Officer in May 2012. As an undergraduate student, she found the undergraduate research paradigm one of the best ways to learn, and when she became a professor at California State University, Long Beach, she actively sought ways to establish and expand undergraduate research opportunities. She was attracted to CUR first as a faculty member, because of the opportunity to interact with like-minded faculty who were passionate and practiced undergraduate research mentors. As she transitioned to administrative positions, she deepened her relationship to CUR through connections to CUR’s NSF-funded programs for STEM faculty. Now, as Executive Officer, her deep commitment to and appreciation of CUR has grown substantially. She believes the people involved in CUR, the past accomplishments of the organization, and the opportunity to significantly expand undergraduate research in its manifold forms are amazing and set CUR apart from other organizations.

Prior to becoming CUR’s Executive Officer, from 2006 to 2012 Ambos served as assistant vice chancellor for research initiatives and partnerships in the California State University System office. Before taking that position Ambos held several administrative appointments at California State University, Long Beach, including associate vice president for research and external support, graduate dean, and associate dean of the College of Natural Sciences and Mathematics. She has helped obtain or manage more than $60 million in grant and contract funds over the past two decades. One of the grants she led and managed was the Geosciences Diversity Enhancement Program (GDEP), which supported summer undergraduate research experiences for students and faculty at Long Beach-area community colleges and high schools.

Ambos received her AB in geology from Smith College (magna cum laude), and her master’s and doctoral degrees in marine geology and geophysics from the University of Hawaii at Manoa.
Developing First-Year Students as Scholars

Two of the challenges of increasing undergraduates’ participation in research are supporting research opportunities for students from all disciplines and involving students in research early in their college careers. Pepperdine University’s Seaver College has sought ways to engage first-year students in research with the expectation of tremendous benefits for students’ academic development. Three years ago when we embarked on creating and implementing what is now called the Keck Scholars Program (KSP) in honor of the W. M. Keck Foundation’s support for the program, we pondered, as have others, the question: “What would happen if teachers in all disciplines allowed their students to seize the creative work right from the beginning, trusting that the important fundamentals would emerge? What would change for us, and for our students?” (Blackmer 2008, 10).

KSP introduces undergraduates to research through first-year seminar courses, which are part of the general-education curriculum. The program was built upon our belief, which the program has reaffirmed, that first-year students can make important contributions to research and scholarship, even in the absence of extended exposure to discipline-specific methods. Students are not only learners; they are also developing scholars. Through learner-centered and discovery-based practices; sharing their scholarship with first-year students aligned with best practices in higher education, including liberal arts practices cited in its 2007 report are also key components of the seminars, allowing faculty to spend sufficient time working with each group on their hypotheses, research methods, and presentations. To ensure a sustained impact, programmatic components of KSP extend beyond the first-year seminar course and link students to subsequent research opportunities (McKillop 2009). All participants in KSP write an individual mini-grant proposal as a final academic exercise in their seminars. Within each seminar, the emphasis given to the group and individual projects varies at the faculty member’s discretion and is generally influenced by his or her specific discipline. Regardless, the students are all eligible to receive mini-grant funding to conduct the proposed projects over the following term or the summer if they choose to submit their proposals for review by a faculty committee. Ultimately, students who successfully integrate revisions suggested by the committee into their proposals receive funding for their research projects. Similar to standard grant-acceptance protocol, students are designated as principal investigators (PIs) on their grant awards. KSP alumni may seek additional funding for travel to attend academic conferences and may choose to participate in one of Pepperdine’s other undergraduate research programs. Thus, the program is designed to equip KSP alumni to pursue further research opportunities after their first experience.

Program Components and Populations

Students. Enrollment in first-year seminars occurs during the summer prior to the start of the academic year. At Pepperdine, students rank their top three seminar choices, selected from offerings in three categories: first-year seminars on a variety of topics; colloquia that would extend beyond the first year (e.g., seminars titled Grant Basics, on Social Action and Justice), or KSP seminars. None of the offerings in the first two categories include research as a central component. In the first year of the Keck Scholars Program, 142 students enrolled in KSP first-year seminars, and in the second year 162 students enrolled.

Early in the fall term, faculty form, or allow students to form, research teams of three to four researchers. Content introduced early in the term situates students in a particular sub-discipline in which they are free to explore potential research topics. Students in the seminars learn to investigate a topic of interest, develop research projects, and finally to present results to one another and to a broader university audience. The format for the presentations varies according to the particular disciplines and is intended to replicate what one might find at a national or regional academic conference.

In preparation for their final presentations, students now are required to attend the Southern California Conferences for Undergraduate Research (SCCUR) held annually in November. This one-day, regional conference welcomes all disciplines, is appropriate for entry-level presentations and first-year students.

Curricular Focus

Since the first-year seminar is the only course that is required for all first-year students and it is offered across all disciplines, it provides the perfect platform to integrate intensive research into the general-education curriculum. Designed to connect students from all disciplines to scholarship early in their undergraduate careers, the KSP has already produced a significant change in the first-year seminar landscape. Implementing this change required careful planning and coordination among faculty, administration, and support staff. In its second full year, academic 2012-13, Pepperdine’s KSP enrolled 162 first-year students, roughly one fifth of the incoming class, in research-based courses during their first semester in college. The goal is to transform the beginning of a student’s four-year college experience from a tourist’s gaze (Woodiwiss 2011) to deep learning and personal scholarship (Blackmer 2008). The students in the program also realize the benefits of teamwork and collaboration (Barkey 2006) and have the opportunity to receive funding for continued research as the seminar draws to a close.

The Keck Scholars Program Model

Six key objectives guide the vision for KSP. The program aims to:

1. engage students in research through first-year seminars;
2. encourage faculty development through instructors sharing their scholarship with first-year students through learner-centered and discovery-based practices;
3. create a learning environment in which peers serve as role models of scholarship; 4. empower students by allowing them to take ownership of their creative, original ideas; grant-acceptance protocol, students are designated as principal investigators (PIs) on their grant awards. KSP alumni may seek additional funding for travel to attend academic conferences and may choose to participate in one of Pepperdine’s other undergraduate research programs. Thus, the program is designed to equip KSP alumni to pursue further research opportunities after their first experience.

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In preparation for their final presentations, students now are required to attend the Southern California Conferences for Undergraduate Research (SCCUR) held annually in November. This one-day, regional conference welcomes all disciplines, is appropriate for entry-level presentations and first-year stu-
students, thereby increasing the potential to advance current knowledge. Students benefit from an early introduction to the rigor of academic scholarship; faculty benefit from devising innovative methods that engage first-year students in original, creative research. By working collaboratively and consistently throughout the semester with the undergraduate researchers, faculty members have the opportunity to stay abreast of the current literature in their discipline, which can, in turn, help to advance their own scholarship.

For example, the KSP seminar in plant biology, entitled “Plant Adaptations to Wildfires,” focused on the mechanical adaptations of plants to water stress because water is the factor most restricting plant survival in and landscapes in California. Mechanical resistance of native plants to water stress is an emerging field of investigation and is of particular interest to Stephen Davis, the seminar’s instructor. Another example was the KSP seminar in teacher education entitled “Discovering the Secret to Inspirational Teaching.” In this seminar, one research team chose to investigate an emerging issue in educational technology, titling their project “Teachers’ Perceptions of Integrating iPads into their Middle School and High School Classrooms.” This topic complemented the research efforts and interests of their faculty mentor, Stella Erbes. These two examples, from very different KSP seminars, serve to illustrate the common elements of research and how scholarship can be shaped for faculty.

Up to ten faculty members, drawn from eight divisions, are recruited for KSP each year. Besides broad disciplinary representation, selection of faculty is based on: 1) faculty aptitude and willingness to adapt professional approaches to scholarship for first-year students; 2) faculty willingness to provide guidance while encouraging student ownership of original research ideas; and 3) personal engagement and scholarship activity of faculty within their discipline. Further, faculty participants are expected to exemplify teamwork and interdependence within and across sub-disciplines.

Before the first year of the program, participating faculty attended five teaching seminars organized by the project’s directors. These seminars included discussions on assigned readings about collaborative undergraduate research and development of shared learning outcomes, as well as dialogue on how to organize and facilitate a research course. Since the program was launched, KSP faculty have met regularly to compare notes and to share best practices across disciplines. Participating faculty are also encouraged to share their best practices and pedagogical outcomes with other academics beyond Seaver College, either at educational workshops or in the educational section of academic conferences.

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Peer Mentors. The role played by peer mentors in KSP is also critical to the program’s success. Two peer mentors are selected by each participating faculty member on the basis of the peer mentor’s prior research or teaching experience in the discipline. Mentors receive a modest stipend to attend every class session, provide advice and feedback on research ideas, and help with methods and logistics, and attend SCCR and the seminar’s final poster or oral presentation session. In the second year of the program, peer mentors could be drawn from sophomores who participated in KSP as first-year students. In addition to bringing first-hand familiarity with KSP, they are also able to empathize and provide advice to first-year students newly immersed in research, scholarship, and creative activity. Our experience suggests that an ideal combination of mentors would be one junior or senior and one sophomore who had participated in KSP.

Assessment Overview

KSP students, peer mentors, and faculty complete mid-program and post-program surveys in which they are asked to report on their experiences in the seminar by rating items on Likert scales and responding to ranking and open-ended questions.

The survey questions for students are grounded in the works of Kardash (2000) and Erbes (2008) and ask respondents to report their abilities for planning, analyzing, and communicating research before and after their undergraduate research experience. Assessment data based on survey results after the first year of the program (Table 2) indicate that in eight out of nine sections of the KSP seminar students reported, a significant increase in growth in their abilities to design an original research study (N=124). In six out of nine sections they also reported significant growth in their perceived abilities to locate current research studies relevant to any research topic (N=124). On the other hand, the data did not demonstrate a statistically significant growth in students’ perceptions of their abilities to analyze or communicate research. In eight out of nine sections of the seminar, the results did not show a statistically significant increase in students’ perceived abilities to demonstrate problem-solving or critical thinking skills when carrying out a research project. Similarly, in seven out of nine sections, no statistically significant increase was reported in students’ perceptions of their ability to interpret research findings appropriate to a research topic.

This minimal growth in students’ perceptions of their abilities to analyze research may be attributed to the challenges created from a combination of factors in the first year of the Keck Scholar Program. These challenges included professors learning how to plan and pace the activities effectively for this research-intensive course, the limited time that students have to invest in the research during the semester while managing the responsibilities of their regular course loads, and the students’ inability to dig deep into their research given the time restrictions of one semester.

Eight out of nine sections also did not report statistically significant growth in students’ perceived ability to communicate clearly in oral presentations, and seven out of nine sections did not report statistically significant growth in perceived ability to communicate effectively in written discourse. These findings prompted us to look at how communicating research is formally taught in the KSP seminars and to investigate what prior experiences or training can be attributed to students’ perceptions of their abilities to communicate research. Post-surveys revealed that 90 percent of students found the mini-grant proposal assignment to be somewhat or extremely useful. The number of students who are interested in attending graduate school remains constant in both mid-program and post-program surveys, with 72 percent showing interest in continuing their education.

At the faculty level, three program components were helpful to faculty teaching KSP seminars: participation in faculty workshops, collaboration among KSP faculty members, and the participation of peer mentors (eight of nine faculty members reported that each of these aspects was helpful) after the first year of the program. The Likert-scale questions for faculty asked them to rate how important the research experience was in helping students develop the skills for planning, analyzing, and
Table 2. Self-perceptions of Student Research Abilities (n=124)

<table>
<thead>
<tr>
<th>Planning Research</th>
<th>To what extent do you feel capable of?</th>
<th>Session</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Post-Mean</th>
<th>Post-SD</th>
<th>p value</th>
<th>r value</th>
<th>Statistically Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Designing an original research study?</td>
<td></td>
<td>1</td>
<td>2.59</td>
<td>0.88</td>
<td>3.00</td>
<td>1.00</td>
<td>0.002</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>2.59</td>
<td>0.88</td>
<td>3.00</td>
<td>1.00</td>
<td>0.002</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Locating current research studies relevant to any research topic?</td>
<td></td>
<td>1</td>
<td>2.67</td>
<td>0.74</td>
<td>3.00</td>
<td>1.00</td>
<td>0.001</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>2.67</td>
<td>0.74</td>
<td>3.00</td>
<td>1.00</td>
<td>0.001</td>
<td>*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Peer mentor activities and the corresponding percentages of the 17 mentors’ participation.

<table>
<thead>
<tr>
<th>Activity</th>
<th># Participate</th>
<th>% Participate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met individually with research groups</td>
<td>15</td>
<td>88%</td>
</tr>
<tr>
<td>Assisted groups with formulating a research question</td>
<td>16</td>
<td>94%</td>
</tr>
<tr>
<td>Assisted with finding resources</td>
<td>14</td>
<td>82%</td>
</tr>
<tr>
<td>Assisted groups with research designs</td>
<td>15</td>
<td>88%</td>
</tr>
<tr>
<td>Helped groups with problem-solving as it related to the research process</td>
<td>15</td>
<td>88%</td>
</tr>
<tr>
<td>Assisted groups with oral presentations skills</td>
<td>8</td>
<td>47%</td>
</tr>
<tr>
<td>Assisted with written presentation skills</td>
<td>9</td>
<td>53%</td>
</tr>
<tr>
<td>Reviewed research proposals along with the seminar professor</td>
<td>15</td>
<td>88%</td>
</tr>
<tr>
<td>Taught the whole group</td>
<td>9</td>
<td>53%</td>
</tr>
<tr>
<td>Graded papers</td>
<td>11</td>
<td>65%</td>
</tr>
</tbody>
</table>

Especially helpful during these sessions were collegial discussions about the nature of research within diverse disciplines. Faculty shared their processes for determining what the products of student research should look like in their respective disciplines. For example, this year’s art history students curated museum exhibits, while history students developed outlines of the biographies they hypothetically would write. KSP has deepened mutual respect among faculty across disciplines as they wrestle with pedagogical decisions and share outcomes with one another.

In teaching the seminars, faculty had to learn to balance the research-intensive elements of the course and the generic first-year seminar requirements that orient students to college life. Faculty benefited from sharing syllabs with one another prior to the first year, which allowed them to conceive of how best to incorporate the traditional first-year seminar’s learning outcomes with the desired research learning outcomes. At the beginning of the semester, faculty needed to be organized so that research skills were clearly introduced early in the semester, helping prepare students for the workload ahead.

Faculty initially were unsure of how to include peer mentors effectively in their plans for the seminars. They questioned how they could utilize peer mentors during and outside of class and what responsibilities the mentors should be given. Through trial and error and conversations with one another,

First-year students in a KSP course who are investigating the biological mechanism of plant adaptation to wildfire in the Santa Monica Mountains. Students shown are measuring enhancing photosynthesis and transpiration characteristics of fire-adapted plants after shoot removal by wildfire. (Photo credit: Stephen C. Davis)
Sustainability of KSP, funded in part by a three-year grant from the United States; 95 percent of four-year institutions have established first-year seminar curriculum. Regardless of a student’s discipline, scholarly work requires astute reasoning ability, clarity of oral and written communication, critical thinking and problem-solving skills, quantitative ability, and creative, original expression. This is accomplished by involving participants is an added dimension to their research, scholarly work, or creative activity. This is accomplished by involving inexperienced students who often bring fresh perspectives, without preconceived notions, to pressing needs and emerging issues. The ideas of first-year students are often more compelling, novel, adventurous, and far less constrained than those of professionals.

KSP may or may not have chosen to participate in a research-intensive course as a first choice for their first-year seminar. It might have been their second or third choice. As a result, this may impact the extent of their subsequent engagement in research, and it creates a potential challenge for faculty. Yet even if students do not choose to pursue research opportunities after their first-year seminar, current literature indicates that participating in research helps students become better students (Lopatto 2010). Nonetheless, other institutions may want to consider creating seminars on the basis of demand for the seminars.

Conclusions

KSP both enhances and complements the general-education requirements in the context of a liberal arts education. When students are challenged to engage in personal research, scholarly work, and creative activity, they actively make use of all resources available to them—hypotheses, answers questions, defend theses, and/or create artistic expression. Because students experience this process first-hand in KSP, we are now convinced of the importance of offering first-year research-intensive seminar courses within the general-education curriculum. Regardless of a student’s discipline, scholarly work requires astute reasoning ability, clarity of oral and written communication, critical thinking and problem-solving skills, quantitative ability, and creative, original expression. KSP students quickly realize that these broad skills complement the technical and theoretical training they receive in their specialized majors.

The assistance of KSP faculty, the scholarly contributions of first-year students can eventually lead to transformative ideas, paradigm shifts, and a distinctive advancement of new knowledge. A few students who have made a significant impact in the past are Charles Darwin, Richard Henry Dana, Jr., Bill Gates, and Mark Zuckerberg. Students who have participated in the program reach their senior year. At the time of their graduation, we anticipate that the authors and authorities on their own education.”

References

Kamron King for their editorial contributions and to Valerie Skinner for permission to use this program a success.

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A Multi-disciplinary Analysis of Intensive Undergraduate Research

Undergraduate research as a “high impact practice” has attracted a great deal of attention in the last several years, thanks to the emphasis it has received in recent years by the Association of American Colleges and Universities (AAC&U) within its Liberal Education and America’s Promise (LEAP) initiative. Complementing that emphasis has been the support provided by the Council on Undergraduate Research since 1978 to undergraduate institutions across the large, elite, research universities. These efforts, stimulated by the influential Boyer Commission report of 1998, aimed to reinforce the role of research-oriented universities’ lack of focus on teaching have resulted in the creation and implementation of a number of university-wide undergraduate research programs and the introduction of research and inquiry into individual courses, classified by Seymour et al. (2004) as the “Research-Based-Learning” model. Our present study, which involves pedagogical changes to incorporate research and inquiry processes into a course at any time during the student’s undergraduate education, fits best with the latter model. (The term “research” is unfortunately often used to mean the method of experimental research used primarily in the sciences. In this article we have used both “research” and “inquiry,” to be mindful of the breadth of the processes of inquiry across the disciplines.)

Undergraduate research as a learning process has the potential to be used in general education to help students achieve some of the key outcomes that the LEAP initiative recommends for liberal education. Scholars across the disciplines (Behling 2010; Ishiyama 2002; Lopatto 2004, 2010a) agree that to a greater or lesser degree, benefits occur over four or five broad areas: (1) personal and professional gains such as an increase in students’ confidence in establishing collegial working relationships with faculty and peers; (2) increased knowledge of the various aspects of the research process; (3) gains in research, communication and collaboration skills; and (4) clarification or confirmation of a career or education path.

In recent years, as interdisciplinary studies have begun to take shape, and may be strengthened, the need for implementation of cross-disciplinary approaches to teaching and learning has gained further recognition (Klein 2010). Establishment of “faculty learning communities” (FLC) emerged as an avenue for building cross-disciplinarity (Cox and Richlin 2004) and enhancing student learning (Cox 2009).

Methodology of Our Project

In response to the recognized need for greater cross-disciplinarity and to discuss students’ early involvement in undergraduate research, for the first time at St. Cloud State University (SCSU), a comprehensive university, four faculty (in anthropology, chemistry, English, and immunology) were involved by the division of Research in Teaching and Learning, reached across disciplinary silos and formed a faculty learning community. Below we discuss how the FLC balanced the objectives for involving undergraduates in research with the existing content objectives in courses that were part of the university’s general education requirement (anthropology and chemistry) and those that were program electives (English and immunology).

In August 2011, the faculty members in our FLC each began redesigning one of their courses to include research/inquiry-based learning, to be implemented and evaluated in spring 2012. At our working sessions, held every three weeks, besides based learning, to be implemented and evaluated in spring 2012, besides those in anthropology, biology, and immunology, the instructor adapted the “Process Oriented Guided Inquiry Learning” (POGIL) (Moog and Farrell 2011) and the case study approach in science teaching (Herreid 2006) in the redesigned class, where students worked in groups of four to six throughout the semester. The students spent the class time working collaboratively on inquiry-based learning activities, guided by the instructor and a learning assistant who occasionally helped them along the way. In this class, students had access to pre-recorded lectures through our university’s online course-management system. The inquiry-based collaborative case study exercise required students to perform a literature search, design and conduct simple experiments, collect data and analyze the results, and write a report during the last two laboratory meetings of the course.

English. At SCSU, Modern and Contemporary British Literature is taught as a traditional survey of the 20th-century British literary canon. Approximately 30 students were enrolled in the course during this study—an even mix of juniors and seniors who intended to major in English; a handful intended to major in chemistry or biochemistry.

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rated their learning in each category after course completion but also reflected back to their knowledge and skills at the beginning of the semester, in addition to answering a limited number of open-ended prompts.

What made our assessment tool unique was the differentiated manner in which we formulated the questions on the survey. Unlike the sections on collaborative learning and attitudinal shift toward research in the discipline, in the section of the survey related to research processes and skills, each of us asked questions specific to the discipline using language that best reflected disciplinary approaches, such as the experimental approach in the sciences, the ethnographic approach in anthropology, and theoretical textual analysis in English. The specific questions or prompts used in our surveys, as well as the method of statistical analysis of the data, are briefly described in Figures 1, 2, and 3.

Comparative Analysis and Results

In this section we focus on an analysis of the quantitative (Figures 1, 2, and 3) and qualitative results (Tables 1, 2, and 3) from surveying students’ perceptions about their learning in the three goal areas: research process and skills (Figures 1 and 2, Tables 1 and 2), collaborative learning (Figure 3, Table 3), and attitudinal shift toward the respective disciplines, obtained through our pre-course, RPTP, and post-course surveys. First, we discuss the data obtained from the pre-course and the RPTP surveys, and second, we present a comparative analysis of the post-course and RPTP survey findings.

Figure 1 shows that in some categories students had overrated themselves as we had mentioned in the methodology section, however, the occurrence and extent of overrating were not the same in all four courses. The anthropology instructor opted out of the RPTP survey at the end of the semester as the overrating was not apparent in the pre-survey section evaluating knowledge of the research process. Very few studies exist of the pre-conceptions students bring regarding the research process, the skills needed, and the learning they can expect in a research experience; more studies are needed so as to understand the role of developing student self-efficacy in learning. Adeolokun and Burgess (2013) have attempted to draw a research experience; more studies are needed so as to understand the role of developing student self-efficacy in learning. Adeolokun and Burgess (2013) have attempted to draw a comparative analysis of the post-course and RPTP survey findings.

Figure 1. Student Survey Responses Regarding the Research Process

Table 1. Open-ended Questions on Knowledge of the Research Process

Table 2. Student Survey Responses Regarding Collaborative Learning

Table 3. Student Survey Responses Regarding Research Skills

Figure 2. Student Survey Responses Regarding Collaborative Learning

Figure 3. Student Survey Responses Regarding Research Skills

to embrace undergraduate research (Grobman and Kneeland 2010). Consistent with that idea, we noted that data from the pre-course survey of students in anthropology (average Likert score of 2.5) showed that they did not overrate themselves on “knowledge of the research process” instead of on their initial knowledge of the research process; and yet, there were no differences in chemistry (Figure 1). As mentioned before, the nature and diversity of the student population in the general education chemistry course—that is, the potential presence of overconfidence and low motivation in these students—might have contributed to this anomaly. Since it was also the first time the instructor was implementing the POGIL model and the case study teaching methods in this large general education class, it made the project even more complex. Comparison of the post-course and the RPTP survey data clearly showed the highest statistically significant differences on all questions concerning the research process in English and immunology (Figure 1), indicating that the students felt they had learned a great deal once they reflected upon their initial overratings. Comparison of the pre- and the post-course survey data in anthropology (Figure 1) showed a similar trend, except for the questions on how scientists think and work. Those two questions had been given a high Likert score of 3 in the pre-course survey, suggesting that student overrating may have occurred in this course as well.

Although General Chemistry I and Introduction to Anthropology are both general education courses with a less advanced, non-major student enrollment, they showed markedly different results. We attribute those to a number of factors: the difference in class size, the discipline-specific wording of the survey questions in anthropology, greater student
choice of projects in anthropology versus chemistry, and the differences in the disciplines themselves with STEM (science, technology, engineering, mathematics) courses perhaps being rated as “more difficult” by students. Clearly more research is needed to draw definitive conclusions.

**Findings on research skills.** Similar to our results from students’ assessment of their gains in the process research, students also overrated their research skills in English and immunology (Figure 2). Comparison of pre- and RPTP survey responses showed significant differences in immunology, but not so-significant differences in English, suggesting perhaps that English students, being more experienced juniors and seniors compared to less advanced immunology students, had better judged their initial research skills when entering the class.

In all the categories evaluated of the research skills section of the English post-course survey, the responses were significantly higher compared to RPTP survey responses (Figure 2). Similar results were observed in anthropology and immunology. Yet student perceptions of their knowledge of how to ensure ethical conduct in research showed few or no statistically significant differences in anthropology, English, and immunology (Figure 2). Either the students did not recognize the importance of such ethical conduct in these areas, or across the board felt that they already “knew” everything they needed to know about collaborative skills.

**Findings on collaboration skills.** Compared with knowledge of the research process and research skills, student rankings their collaboration skills the highest (Likert scale score average of 3) across the board in the post-course survey (Figure 3). Even though the RPTP survey “correction” significantly reduced overrating among students in immunology for a majority of the questions in this section of the survey, it did not show significant differences between immunology and English (Figure 3). Post-course survey data showed significant gains in students’ perceived skills in collaboration in the immunology and anthropology classes with effect, in general, in chemistry and English (Figure 3), although in the qualitative data most English students mentioned learning about certain aspects of collaborative learning, including better time management and communication skills.

**Attitudinal shift toward the disciplines.** Attitudinal shift toward research in the respective disciplines was measured by asking questions about students’ interest in conducting future research, and their perception of the importance of research for their careers. While immunology students expressed significantly higher interest (p<0.001) in involvement in future research in the post-course survey compared with the pre-course survey, no differences were observed in the other courses. The students entering all four courses felt that research experience is very important for their future careers (average Likert score ≥3). However, no significant change in that perception was observed in the post-course survey (data not shown).

### Table 1. Students’ Responses to “List the new things you learned in this class about doing research in your discipline.”

<table>
<thead>
<tr>
<th>Course (total number of responses)</th>
<th>% Positive Responses - Most frequent responses</th>
<th>% Neutral/ Negative Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthropology (n=126)</td>
<td>96.8 - Geographic research process (Observation)</td>
<td>0/3.2</td>
</tr>
<tr>
<td>Chemistry (n=71)</td>
<td>98.6 - New techniques</td>
<td>0/1.4</td>
</tr>
<tr>
<td>English (n=75)</td>
<td>91.3 - Use of research databases specifically for English</td>
<td>0/6.7</td>
</tr>
<tr>
<td>Immunology (n=28)</td>
<td>100.0 - Importance of statistics in scientific papers</td>
<td>0/0</td>
</tr>
</tbody>
</table>

### Table 2. Students’ Responses to “List new things that you learned in this class about working in a group for doing research in your discipline.”

<table>
<thead>
<tr>
<th>Course (total number of responses)</th>
<th>% Positive Responses - Most frequent responses</th>
<th>% Neutral/ Negative Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthropology (n=115)</td>
<td>95.7 - Learned to work in a team</td>
<td>2/4.2</td>
</tr>
<tr>
<td>Chemistry (n=74)</td>
<td>88.6 - Contributed to a research project</td>
<td>1/11.4</td>
</tr>
<tr>
<td>English (n=75)</td>
<td>99.9 - Communication skills</td>
<td>0/0.1</td>
</tr>
<tr>
<td>Immunology (n=31)</td>
<td>100.0 - Working very close to your team members</td>
<td>0/0.0</td>
</tr>
</tbody>
</table>

### Qualitative data analysis.

The qualitative data, obtained along with the post-course surveys, included three open-ended prompts asking students to list three new things they had learned in the course regarding the research process (Table 1), working in a group (Table 2), and how the research experience affected their attitude toward the discipline (Table 3).

Analysis showed that the majority of students’ responses regarding the research process (Table 1) and collaborative learning experiences (Table 2) were overwhelmingly positive in all courses (an average of 95 percent positive). Whereas the quantitative survey data had not shown consistent support for a positive attitudinal shift toward the discipline (except for the immunology students), the qualitative data clearly showed that the shift had occurred, with 95 percent, 95 percent, 54 percent, and 100 percent positive responses among students in anthropology, English, chemistry, and immunology, respectively (Table 3). Once again, chemistry was unique; the positive responses were the lowest (54 percent), and yet, 26 percent of the additional responses were neutral, not negative, regarding the discipline.

### Conclusions and Recommendations

In summary, three major conclusions can be drawn from our study on the impact of undergraduate research in two contexts, within courses in a general education curriculum and in two majors. Ten responses were drawn from our students’ perceptions, while the third emerged from reflections on our year-long collaboration through a faculty learning community.

There is little or no doubt that engaging students in discipline-specific research impacts their perceptions of their learning very positively for the most part. It is important to note, however, that quantitative analysis, without qualitative data, may not be sufficient to provide a complete understanding and evaluation of students’ perceptions of their learning. Our quantitative data, while providing us with valuable information regarding student perceptions of their growth, were complex and at times, broadly inconclusive. The qualitative data, on the other hand, captured some of the nuances of the students’ perceptions.

As seen in the summary analysis of our qualitative data (Tables 1-3), students appreciated their learning about the research process, recognized the importance of the methodology, and gained an enhanced sense of their competence in skills such as data collection, analysis, use of primary and secondary sources, and team work. Even in chemistry, where we had obtained the most complex results, students’ comments on open-ended questions were mostly positive or at least neutral. Our most complicated data involved the students’ misconceptions of their own knowledge and abilities, an area that clearly requires further research and perhaps replication of the study to confirm the results before any conclusive recommendations can be made for instruction.

Our second significant conclusion is that incorporating a research project in a general education course requires serious attention to the broad purpose within the entire program. In our study, students in anthropology and chemistry, both general education courses, had difficulties quite different from those in the English and immunology courses, which were electives within the respective programs for majors. Anthropology students, for instance, felt that they did not have enough training in methodology to be able to formulate a research question and gather the data for an ethnographic study. In the chemistry course, in order to include the research skills in the course, the instructor focused classroom time on those and gave students access to lectures online—a strategy that seemed to throw students off who did not immediately understand the advantages. Other issues in these general education courses included large class size, a feature of general education on many campuses, making it more challenging to engage students throughout the process of learning. On the other hand, when the course was an elective and the class size was smaller, as was the case in the English and immunology courses, even if students from other related majors took the course, the overall student attitudes toward research were positive, realistic, and highly appreciative.

Finally, the process of conducting this study, planning the courses, analyzing the results, and reflecting on the whole experience has encouraged the learning of a new member of our group. As members of a learning community, we reap all the benefits described by those who have studied FLCs. As a result, we have learned to appreciate multiple approaches to research-intensive pedagogy in our different disciplines and learned how to engage cross-disciplinary topics in our teaching and learning.

We discovered a mutually supportive community to discuss our teaching and learning experiences, appreciated the commonalities in students’ learning outcomes across disciplines through formulating a common tool for assessment, and broadened our understanding of research design and inquiry in the different disciplines.

For other institutions that are considering incorporating undergraduate research into courses or incorporating research into courses in new ways, we recommend the following. First, create a faculty learning community from a small group of dedicated faculty from several disciplines who can work together over a whole year and learn to trust one another. Second, encourage them to create a collaborative assessment tool that includes both quantitative and qualitative data collection, through which comparisons across disciplines can be made. As we have shown, such a process can enhance faculty engagement and student learning experiences.
Pursuing Research Through Focus Groups: A Capstone Experience Meets Disciplinary, General Education Goals

In four class meetings of a general education capstone course, students at George Mason University’s School for Conflict Analysis and Resolution (S-CAR) learned to design, conduct, analyze, and present focus-group research—all by studying their fellow undergraduates.

This activity simultaneously familiarized students with skills for facilitating focus groups—skills valued in academic and professional settings—while also providing effective, experiential training in a research protocol.

In post-activity evaluations, students and instructors decisively affirmed that the activity had enhanced students’ in-class engagement, as well as achievement of the course’s learning objectives. Three initiatives had sparked the development of this versatile assignment: 1) the university’s learning objectives for general education, which include developing interdisciplinary and critical thinking in the context of a capstone course; 2) a university-wide project to foster a culture of student scholarship that encourages courses in which undergraduates create and present original scholarly projects; and 3) a research project funded by the Fund for the Improvement of Postsecondary Education, titled “Linking Theory to Practice,” through which our project team develops, tests, and seminaries experiential-learning activities designed to enhance teaching of conflict analysis and resolution.

Thus, on one hand, the focus-group experiential learning probed in our article, formally called Engaging Students Through Focus Group Methodology, is a result of a unique confluence of initiatives at George Mason University. On the other hand, however, we are convinced that this research activity can be used in many different upper-level general education courses. Moreover, by involving students in lower-level courses as participants in the focus group, the activity contributes to scaffolding research experiences into either general education or disciplinary courses—or both—and affords advanced students the opportunity to apply theory-driven research to practical issues and problems. This article provides an overview of the activity and some tools for facilitating focus-group research. We offer step-by-step descriptions of the instructional process, preliminary evaluation results, and ideas for adaptation to other courses and disciplines. We hope that this discussion will inspire CUR Quarterly readers to adopt such an activity in a diverse range of fields.

Background

Since the 1990s, the focus group has been a popular method of qualitative research, used by academics, health professionals, evaluators, literacy activists, the military, practitioners working to achieve community control, law enforcement, others in the research professions (Krueger and Casey 2009, Flores and Alonso 1995). Given its widespread use in and outside the academy, focus group research is a valuable skill for students to acquire before they enter the labor market. At George Mason University’s School for Conflict Analysis and Resolution (S-CAR), our newly designed experiential-learning activity is providing undergraduates with a hands-on introduction to this powerful research tool. The activity has achieved promising results in enhancing students’ academic engagement and acquisition of research skills. Since the activity was designed to meet both disciplinary and general education objectives, it is inherently versatile and adaptable for research on almost any topic.

A focus group is an organized, facilitated discussion designed to enable researchers to better understand the range of opinion among target groups of people about an issue, product, or service. The researcher acts as a moderator, listener, observer, and analyst who must pay equal attention to the content of participants’ comments and the dynamics of the conversation (Stewart et al. 2007). The format encourages spontaneous discussion among participants, which allows the researcher to take a less directive role in comparison to one-on-one interviews. In order to identify patterns in participants’ perceptions and opinions, researchers typically conduct multiple focus groups on the topic of interest and examine the data afterward using a variety of quantitative and qualitative techniques. Widely used in many contexts, focus groups are well suited to the field of conflict analysis and resolution because they are an effective method for eliciting diverse and divergent perspectives on potentially controversial topics. As just one example, Mercy Corps, a non-governmental organization, uses focus groups in Pakistan to assess the extent and type of conflict experienced by young people (Mercy Corps 2010).
Our experiential activity introduces students to this research method through readings, class discussion, and a model focus group conducted in class by a veteran facilitator. Once trained, students practice the techniques they have witnessed on one another and then engage with the focus group participants from a different course. Finally, the focus-group leaders jointly analyze the data collected and present findings on their chosen topic. Students in the S-CAR capstone courses and an intensive service-learning course have participated in the activity.

At George Mason, undergraduates can major or minor in conflict analysis and resolution, a growing interdisciplinary field that emphasizes the integrated study of theory, research, and practice. Through coursework and field experience, students learn to take a critical and holistic approach to analyzing complex problems at multiple levels of society. At the same time, they are exposed to a variety of conflict-resolution techniques, such as mediation, dialogue facilitation, and negotiation, and then afforded the opportunity to practice them. The 30 diverse courses offered by the School for Conflict Analysis and Resolution cover topics ranging from organizational conflict to human rights to peace-building and are available not only to its 219 majors and 61 minors but also to the larger student body of more than 20,000 undergraduates. Each semester, dozens of non-majors join S-CAR students in two course offerings—one introductory and one capstone—that fulfill the university’s general education requirements.

Given its practice-based nature, the field of conflict resolution has displayed a commitment to experiential and inquiry-based learning since its inception (Smith 2007). Innovative approaches to teaching, such as student-centered research, role playing, simulations, and community-based course projects, are hallmarks of the curriculum for teaching conflict analysis and resolution. Traditionally grounded in experimen- tation, our activity was conceived of as an opportunity for capstone research that would serve multiple disciplinary and general education objectives.

Capstone Required
At GMU, all upper-level undergraduates must complete a capstone course or project that fulfills the experiential degree gained through their general education courses. Specifically, our focus-group activity was created for “Integration,” the capstone course for students majoring in conflict analysis and resolution. This capstone, which also serves as a capstone for general education, challenges students to synthesize diverse forms of knowledge and to apply theory learned through prior coursework to real-world problems. Given those objectives, S-CAR’s capstone has always included an individual research project to prompt students to draw connections across their studies. Three initiatives sparked the addition of the focus-group activity to “Integration” in the fall of 2011.

First, GMU has recently reinvigorated its general education offerings by creating new learning goals. The new goals for the capstone course in general education emphasize critical thinking and effective oral and written communication. The goals say that by the end of the course, students should be able to “connect issues in a given field to wider intellectual, community or societal concerns using perspectives from multiple disciplines.” (A description of GMU’s general education requirements can be found at: http://provost.gmu.edu.) S-CAR faculty perceived these new goals as inviting innova- tive, interdisciplinary approaches to gathering data, analyzing it from multiple perspectives, and offering conclusions or recommendations tailored to particular audiences and in and beyond the academic community. Most students enrolling in the S-CAR capstone are majors or minors in conflict analysis and resolution, although the course also attracts students from other majors, such as global affairs and psychology, who are seeking a general education capstone. The result is a dynamic interdisciplinary environment for student learning in which a new kind of research experience could be piloted.

Second, as part of regional accreditation requirements, GMU embarked in 2012 on a university-wide initiative to foster a culture of student scholarship. Called “Students as Scholars,” the five-year initiative offers incentives for many forms of curricular innovation, including emphasis on scholarship in introductory general education courses; attention to the tech- niques of knowledge production (e.g., research methods) in each discipline; and opportunities for students to create and present original scholarly projects. (A description of GMU’s “Students as Scholars” initiative can be found at: http://oscar.gmu.edu.) Providing an individual research opportunity for every student can be a tall order for a large state university. For instance, as the S-CAR undergraduate program grows, the supervision of individual research projects in the “Integration” course has become a significant challenge. For the GMU’s “Students as Scholars” initiative thus provided S-CAR faculty with a welcome opportunity to design a group research project that would engage students in an original scholarly creation without straining faculty capacity.

Third, in 2011 S-CAR faculty procured a grant from the United States Department of Education’s Fund for the Improvement of Postsecondary Education (FIPSE) for a three-year curricu- lum-development project titled “Linking Theory to Practice: Conflict Analysis and Resolution Pedagogy.” The project aims to improve students’ ability to apply conflict resolution and other theories to practical situations. The survey of experimen- tal learning activities in the classroom and intensive service-learning courses taken off-campus. Our focus-group activity is one of eight experiential learning activities designed and tested by the project’s team of S-CAR faculty and students. The experiential activities are embedded in the syllabi of existing courses in conflict analysis and resolution as a goal of enhancing the kinds of student learning central to linking theory to practice, including critical thinking, facilitation skills, and analytic techniques. The project team also adapts and disseminates the experiential activities to partners at com- munity colleges and universities.

A Step-By-Step Description of the Activity
The focus group exercise proceeds through a sequence of activities undertaken over four consecutive class periods, as noted above. In preparatory sessions, an experienced instruc- tor introduces students to focus-group methodology and leads a discussion of best practices for each of the primary roles of participants in focus groups: facilitator, note-taker, host, and research subject. The instructor emphasizes that the focus- group activity is actual research, and students work collabora- tively to devise research questions that build on existing scholarship. Students then participate in a mock focus group led by the instructor, who uses “time-outs” to highlight and unpack the challenges characteristic of focus groups, such as what to do if no one speaks up and how to respond to humor- ous or provocative comments.

Working in small groups, students choose topics; brainstorm, design, and pilot questions; assign and practice roles; and cre- ate informed-consent procedures for participants. Colleges and universities vary with respect to policies requiring informed consent for research projects undertaken as part of a course, rather than as a contribution to scholarship. In our case, we acquired students with the institutional review process, including informed-consent procedures, which they followed in conducting the focus-group research. These preparations culminate in the students conducting 45-minute focus groups with undergraduates from other courses.

The first instructors to use the focus-group exercise chose “social media and conflict” as the overarching research topic. Designing a classroom exercise with multiple curricular aims in mind carries the risk that the end product might be overly complicated or could falter short of meeting one or another of the course’s aims. The creators of our focus-group activity therefore sought to keep the activity simple and clearly orga- nized, yet flexible with respect to content. The primary goal is to involve students in an engaging research experience.

Students’ specific research interests were wide-ranging. Some students investigated undergraduates’ perspectives on whether social media should be banned in educational settings and the extent to which students are politically active through social media. For instance, the team of students selected social media as a catalyst for interpersonal conflict asked participants such questions as: “What are some examples of proper social media etiquette?” “Improper social media etiquette?” and “How do social media interactions impact in-person encounters?”

In analyzing their data, student researchers identified themes and trends, they also puzzled over and ultimately made sense of ambiguous remarks and divergent perspectives (e.g., gender differences in approaches to social media) to arrive at tentative answers to their research questions. In instances in which research findings pointed toward a persistent prob- lem, students developed recommendations addressing the issue at the kind of problem. For instance, when they concluded that social media had many negative effects on interpersonal relationships, the students recommended the development of a “new user tutorial” to urge responsible communication. The students’ reporting of findings and recommendations to classmates through brief PowerPoint and oral presentations included opportunities for constructive criticism and reflec- tions on the research process.

Evaluating Students’ Experiences
Every activity produced by S-CAR’s experiential-learning project is thoroughly documented, assessed, and revised. Accordingly, the project team employs multiple methods to gather data on the focus-group activity each time it is used in a classroom setting. Surveys of students and post-activity surveys of students, instructors, and review of student assignments.

Prior to beginning the activity, the project team collected base- line data on students in the capstone course by using a survey to assess students’ familiarity with focus groups, their confi- dence in their skills related to the activity, and their opinions on social media and conflict. A similar survey was adminis- tered after the students conducted the focus groups. The post- survey asked students to rank the activity a learning and skill-building experience, to reflect on their level of engage- ment in comparison to typical class formats, and to offer feedback on the design and impact of the exercise. The results were anonymous; however, a generalized identity market (e.g., date of birth) allowed for before/after comparison.

Students found the activity highly engaging and effective in terms of building practical skills. An overwhelming majority of students (96%) described the focus-group exercise as a “good” or “excellent” learning experience and as an “engag- ing” or “highly engaging” classroom activity. A similar num- ber of respondents also described the activity as enhancing their understanding of the conflict perspectives of people of whose views might differ from their own, and they
reported gaining confidence in their ability to conduct future focus groups. Students’ qualitative responses reinforce these positive impressions. When asked to choose three to five words to describe the activity as a learning experience, the most common responses were “interesting,” “enjoyable,” “engaging,” and “practical.” When asked for open-ended feedback, one student expressed a widely shared sentiment this way: “It was very engaging. I felt very interested the entire time. I enjoyed talking to the [focus group] participants and listening to their views and opinions. I believe that what I learned from the focus group project, I will be able to use in the future many times.” Another student said that the activity enhanced her openness to opinions, her listening skills, and her patience. As she remarked, “We had to use all three while asking follow-up questions and listening to all participants’ opinions.”

Students shared critical feedback as well. They expressed concerns about the amount of course time devoted to the activity and the topical relevance of the activity to the course. Critical feedback centered almost entirely on the secondary aspects of course structure and topical content, rather than the design of the activity. These preliminary findings will be refined through additional data collection and analysis. Based on the initial evaluations, the activity will be implemented again with attention to integrating it more directly into the course’s themes and structure.

Adapting the Focus Group Activity Elsewhere

In June 2012, the project team’s members adapted the focus-group activity for an off-campus, intensive service-learning course. In preparation, eight GMU undergraduates underwent the focus-group training used in the capstone course. Then the students used focus groups in their service-learning work at a federal Job Corps facility in Charleston, West Virginia. The GMU students conducted focus groups with Job Corps student leaders in order to learn about the types of conflict at the facility. Drawing on the focus-group data, they designed training techniques for conflict resolution that they provided to the Job Corps student leaders.

The GMU students were responsible for all aspects of the Job Corps work—from generating research questions, to conducting focus groups with student leaders, to analyzing the results and designing appropriate training. The GMU students skillfully facilitated the focus groups, asking open-ended questions and establishing a rapport with the Job Corps students, who spoke in detail about their experiences of conflict. The rich narratives and diversity of perspectives obtained through the focus-group research allowed the GMU students to choose appropriate topics for the subsequent training sessions. For example, when the Job Corps students reported feeling trapped in repetitive cycles of conflict, the GMU students elected to introduce them to “storyboarding,” which offers

In post-course evaluations, the focus-group activity was rated as “excellent” by the GMU students. In debriefing discussions, Job Corps students said that they found the activity engaging and helpful. The enthusiastic response of the Job Corps students was gratifying to the GMU students, who were surprised to witness the transformative power of the questions that they asked. The students discovered that the focus-group discussion led their Job Corps counterparts to think about ways in which conflicts—at the facility and in their lives—might be resolved more constructively. The Job Corps administrators were so pleased with the experience that they took steps to initiate an ongoing relationship with the project team and GMU.

We are convinced that our focus-group activity can be used in many different contexts, including a variety of upper-level general education courses. The topic we used—social media and conflict—is integral to the contemporary undergraduate experience and directly linked to teaching core ideas in the conflict resolution field. Yet it is also inherently relevant to multiple disciplines. As the experience at Job Corps demonstrated, our focus-group activity can incorporate thematic content of any kind, just as focus groups are used in practice to study perspectives on a vast spectrum of subjects. As a testament to the multiple uses of the focus-group activity, one GMU instructor had students use it to assess their experiences with a course assignment. She then drew on the insights gained to improve the assignment for future courses.

The focus-group research experience affords a wide range of students the opportunity to apply theory-driven research to practical issues and problems. By involving students in lower-level courses as participants in the focus group, the activity also contributes to scaffolding research experiences into general education and/or disciplinary courses. Further implementation information is available in the Instructor Guide on the project website at http://scar.gmu.edu/experiential-learning-project/home.

References


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Susan F. Hirsch, a cultural anthropologist, is a professor in the School for Conflict Analysis and Resolution (S-CAR) at George Mason University. She is the principal investigator for the curricular-development project supported by the U.S. Department of Education’s Fund for the Improvement of Postsecondary Education (FIPSE) described in this article. Hirsch has published, among other topics, on Islam and law in east Africa, sociolinguistic and feminist theory, and law as a response to mass violence. With Frank Dukas, she is the author of Divergent Views of Mountaintop Mining in Appalachia: Changing Stakeholders in Environmental Conflict. Hirsch is currently conducting research on several initiatives related to global justice.

NCUR is a FIPSE-funded postdoctoral research fellow at George Mason University’s School for Conflict Analysis and Resolution. His research focuses on conflict analysis and resolution, evaluation, experiential learning, peace education, and the Israeli-Palestinian conflict. He earned his doctorate at American University’s School of International Service in 2011. His dissertation was a study of the long-term impact of the Seeds of Peace program, inspired by his work as the organization’s program director for the Middle East, based in Jerusalem from 1996 to 2004. Lazarus has served as an advisor, evaluator, and facilitator for numerous Israeli-Palestinian peace-building initiatives, and he is currently leading a developmental evaluation of U.S. Agency for International Development-sponsored “people-to-people” reconciliation projects in the Middle East.

Ned Lazarus is a FIPSE-funded postdoctoral research fellow at George Mason University’s School for Conflict Analysis and Resolution. He is currently the director of the Center for Global Justice at George Mason University. He teaches courses on community, group, and organizational conflict in the school’s undergraduate program. He has developed classroom modules in simulated community conflict and is a member of S-CAR’s Undergraduate Experiential Learning Project (UELIP). In summer 2012, she co-led the GMU service-learning project at a Job Corps site in West Virginia. Her research and practice interests include conflict discourses and positioning, immigration, experiential learning and empathy, and community conflict resolution.

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Julie Minde completed a master’s degree in Peace Education at George Mason University’s School for Conflict Analysis and Resolution (S-CAR) in 2011 and is currently a PhD student and graduate research assistant there. Her master’s thesis examined how asymmetric identity politics affected the environmental crisis in the Aral Sea region. Her doctoral research focuses on how geospatial techniques can be used as part of confidence-building measures between parties to conflicts. She also received a master’s degree in geographic and cartographic sciences from GMU in 2008 and a master of art in Russian language and literature from the University of Iowa in 1997.

Gina M. Cenasam is a PhD candidate in the School for Conflict Analysis and Resolution (S-CAR) at George Mason University. She teaches courses on community, group, and organizational conflict in the school’s undergraduate program. She has developed classroom modules in simulated community conflict and is a member of S-CAR’s Undergraduate Experiential Learning Project (UELIP). In summer 2012, she co-led the GMU service-learning project at a Job Corps site in West Virginia. Her research and practice interests include conflict discourses and positioning, immigration, experiential learning and empathy, and community conflict resolution.

For more information, visit http://www.cur.org/ncur_2014/.
In an editorial in the *New York Times* in 2011, Gary Gutting, a professor of philosophy at the University of Notre Dame, argued that the primary role of universities is to "nourish a world of intellectual culture; that is, a world of ideas, dedicated to what we can know scientifically, understand humanistically, or express artistically." As research universities, faculty members are expected to make substantial contributions to their disciplines, to society, and to educating students. They want to see undergraduate students progress from novice-like behaviors to more expert-like understanding and appreciation of the intrinsic value of their disciplines. However, some faculty members find it difficult to expose students to authentic research and scholarship without support. The GRCs for Undergraduate Research (OUR) at The University of North Carolina-Chapel Hill sought to create a simple and flexible model to support faculty in making incremental changes in their courses so that student inquiry and research could become substantive components of their classes. Accordingly, we created the Graduate Research Consultant (GRC) program in 2003 (Pukkila et al. 2007).

The GRC program provides instructors with advanced graduate students (the GRCs) whose assistance makes it possible to turn course assignments into robust research projects. The primary role of the GRCs is to assist the undergraduates as they plan, carry out, and disseminate the results of their projects. GRCs do not evaluate the students’ work. GRCs help undergraduates frame questions appropriate for the discipline, design and conduct original investigations, and report their findings to the class and sometimes also the broader community in oral or written form. Graduate students are paid for 20 hours of work during the semester at the standard hourly rate for teaching assistants. Faculty members select their own GRCs. Some faculty members have recruited GRCs from outside their home departments to take advantage of GRC expertise in specific research methods or to provide interdisciplinary perspectives for students.

The pedagogical framework for the program is that of inquiry and discovery (Boyer 1998, Alberts 2000). The GRC program is exceptionally flexible, adaptable to any discipline, and embeds research and inquiry-based learning across the undergraduate curriculum. It benefits the undergraduates who are exposed to the research experience, the graduate students eager to further their professional and pedagogical development, and the faculty who are interested in including an inquiry-based research component in their courses. The research projects and products produced by students in GRC-supported courses vary according to the specific course design. Table 1 provides examples of the courses in several disciplines that have used the GRC program. The GRC program has become a very effective strategy for embedding inquiry-based education into the curriculum and has now involved more than 18,000 undergraduates in nearly 650 courses. Further program statistics are available at: http://www.unc.edu/depts/our/pdfs/GRC_statistics.pdf. The GRC program has been used extensively by faculty teaching in our First-Year Seminar Programs, in general education courses, and in upper-level special topics courses. Increasing numbers of students introduced to research through these GRC-supported courses go on to take research-intensive courses in their major (see Assessment below).

### Table 1. 2011-12 GRC Courses: First Year Seminars and 100 & 200 Level Courses

<table>
<thead>
<tr>
<th>Course_number</th>
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<tr>
<td>CHEM 107H</td>
<td>First-Year Seminar: You Don't Have to Be a Rocket Scientist</td>
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<td>COMM 082</td>
<td>Globalizing Organizations: Food Politics</td>
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<td>COMM 089H</td>
<td>Countercultures</td>
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<td>DRAM 089</td>
<td>Ecodrama</td>
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<td>ECON 056</td>
<td>Asia and the West</td>
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<td>ENGL 084H</td>
<td>Into the West</td>
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<td>ENGL 086</td>
<td>The Cities of Modernism</td>
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<td>ENGL 087</td>
<td>Jane Austen Then and Now</td>
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<tr>
<td>ENGL 089H</td>
<td>Reading and Writing Women's Lives</td>
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<tr>
<td>ENGL 102</td>
<td>English Composition and Rhetoric (8 sections)</td>
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<td>ENGL 102i</td>
<td>Writing for Business (2 sections)</td>
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<td>ENGL 143</td>
<td>Film &amp; Culture (2 sections)</td>
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<td>ENGL 088</td>
<td>The Legacy of the Japanese American Incarceration from WWII to 9/11</td>
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<tr>
<td>ENST 222</td>
<td>Estuarine and Coastal Marine Science</td>
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<tr>
<td>FREN 260.001</td>
<td>Introduction to French and Francophone Literature</td>
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<tr>
<td>FREN 260.002</td>
<td>L'Artiste ne fai pas le Bonheur?</td>
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<td>GEOG 056</td>
<td>Local Places in a Globalizing World</td>
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<td>GEOG 072H</td>
<td>Field Geology of Eastern California</td>
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<td>HIST 083</td>
<td>African History through Popular Music</td>
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<td>HIST 174H</td>
<td>The Incas and After</td>
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<td>HIST 262</td>
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<td>HIST 293H</td>
<td>Magic: Paris Biographies of a Central European City</td>
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<td>INLS 089</td>
<td>The Revolution Will Not Be Tweeted: Social Movements in Popular Culture</td>
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<td>KOR 150</td>
<td>History, Memory and Reality in Contemporary Korea</td>
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<td>KOR 151</td>
<td>Education and Social Changes in Contemporary Korea</td>
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<td>MASC 055</td>
<td>Changes in the Coastal Ocean</td>
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<td>MASC 057</td>
<td>From The Sound of Music to The Perfect Storm</td>
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<td>MATH 062H</td>
<td>Combinatorics</td>
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<tr>
<td>MATH 051</td>
<td>Fish gotta swim, birds gotta fly: Mathematics and mechanics of moving Things</td>
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<td>MATH 060</td>
<td>Simulated life</td>
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<td>Music on Stage and Screen</td>
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<td>Making and Marketing Music in a Digital Age</td>
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<td>PHIL 345</td>
<td>Language and Communication</td>
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<td>PLAN 053</td>
<td>Race, Sex and Place in America</td>
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<td>Abnormal Psychology</td>
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<td>RELI 072</td>
<td>Messianic Movements</td>
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<td>RELI 224H</td>
<td>Gender and Sexuality in Western Christianity</td>
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<td>ROML 059</td>
<td>Courts, Courts and Court Culture in Early Modern Spain</td>
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<td>ROML 061</td>
<td>Language in Autism and Developmental Disabilities</td>
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<td>SOCI 064</td>
<td>Equality of Educational Opportunity Then and Now</td>
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<td>SOCI 251</td>
<td>Measurement and Data Collection</td>
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**Faculty Adoption:**

Recommendations from colleagues, a workshop, and possible departmental adoption of the GRC program are three spurs to faculty members’ decisions to introduce research into their pedagogy using the GRC model. Recommendations from colleagues. When faculty members share their experiences with the GRC model, other faculty become interested in exploring this option. When faculty recruit graduate students for their GRC position or when graduate students who have served as GRCs are encouraged to apply for GRCs for their own courses, this pedagogical model becomes part of a broader departmental and institutional conversation and is more visible as an opportunity.

Patrick Curran, a professor in UNC-Chapel Hill's Department of Psychology, found the GRC Program transformative and crucial to his ability to create an undergraduate course in quantitative psychology. He observed that, “Although all of the other specialty areas in psychology offer an upper-level undergraduate introductory course (developmental, clinical, social, etc.), no such class had ever existed forquant psych. Our belief was that, given the required math stats, and computer programming skills needed, quant psych was ‘too advanced,’ for introductory undergraduate study.”

“Over time I came to think that this was actually a rather silly belief, as well as a bit insulting to the remarkable skills of our
undergrads at UNC. I thus decided to design a brand new upper-level course cleverly titled ‘Quantitative Psychology.’ I hit my first major roadblock after about 30 seconds of think-
ing about the course content. It turns out that our prior belief was not entirely misplaced, indeed, there is an extensive level of expertise needed to navigate topics such as computer simu-
lation, multivariate statistical modeling, probability sampling, and psychometric scaling.

"After much time spent starting at my office wall—followed by more time talking with colleagues—I stumbled upon a solution to my problem: the Graduate Research Consultant program. Whereas I was trying to develop a curriculum that focused on teaching students quantitative psychology, the GRC program allowed me to have students learn by doing quantitative psychology. This allowed me to sidestep the very real prerequisite problem entirely and instead approach the problem of talking to my students.” (Posted in the GoR@UNC Blog, March 8, 2012.)

Faculty Workshop. In the fifth year of the GRC program, we hosted a workshop entitled "The Place of Inquiry in the Undergraduate Classroom.” This workshop had several goals, including to:

• Promote a dialogue on inquiry-based teaching methods across the disciplines
• Acknowledge and support continuing faculty experi-

ences with inquiry-based pedagogy
• Reflect on faculty learning in the GRC Program
• Recruit new faculty to the GRC Program
• Offer an opportunity for faculty to talk with faculty in

other disciplines
• Provide opportunities for faculty to continue the discus-

sions started at earlier gatherings.

The workshop was highly interactive and participatory. In addition to faculty and GRCs sharing their experiences in the GRC-supported courses, the provost and the dean of the College of Arts & Sciences spoke briefly about the impor-
tance of increasing inquiry-based learning and undergraduate research opportunities. The majority of the workshop time was devoted to small-group discussions in which faculty discussed how they might incorporate this model into one of their own courses.

One attendee commented: “It was remarkable to have in one place so many faculty members from a wide variety of units discussing issues of pedagogy. Plans for the 10th-year workshop are currently under way.

Departmental-level adoption: At UNC-Chapel Hill, a large num-
ber of faculty and teaching instructors in the Department of Romance Languages and Literatures (ROML) have embraced the GRC model in order to integrate inquiry-based learning and independent research into their courses. Faculty member Lucia Binotti notes that the department is beginning con-
versations exploring the possibility of using the GRC model to make scholarly research an essential component of their undergraduates’ apprenticeship, scaling the program to require all majors in the department to enroll in at least one GRC-supported course.

Assessment of GRC Results

Studies demonstrate that conducting research as an under-
graduate correlates with several positive student outcomes, including increased retention and persistence to graduation/degree completion, increased grade-point-average, increased satisfaction with the undergraduate academic experience, and increased likelihood of enrollment in graduate school (Nagada et al. 1998; Hathaway et al. 2002; Gregerman 2009).

Additionally, undergraduates who engage in research experi-
ences report changes in professional and personal characteristics, such as increased self-confidence and the ability to work independently (Brownell and Swanner 2010; Lopatto 2010).

We hypothesized that participation in courses that exposed students to research would be similarly beneficial, especially if students went on to seek more intensive research experiences.

Our internal assessment of the GRC program has been con-
ducted by UNC’s Office of Institutional Research and Assessment through surveys and focus groups. Multiple evalu-
ations over a number of years indicate that the program has produced a number of desirable results:

• Students report that the extent to which they could engage in research in the course was significant and transformative, with benefits that included understand-
ing the research process, identifying research questions, using a research approach, completing a project, and communicating the results to others. This demonstrates the kinds of deep and significant learning that occur in GRC-supported classes.

• Of the students enrolled in GRC-supported courses between spring 2009 and spring 2011, 71 percent said they found the research experience valuable, very valuable, or extremely valuable. Said one undergraduate: "Of course I’ve done research papers, but it’s never been like this before. This seemed like very serious and not something you could throw in the garbage the day before. And there was a lot of emphasis on the research prac-
tices, which was valuable. [There was] encouragement to use primary sources and lots of secondary sources.”

• The GRCs themselves report extremely positive experi-
ences. More than 60 percent of them reported influ-
ences on their own professional development and expertise in using an inquiry-based teaching/learning model, ranging from “significant” to “transformative.” Almost 80 percent of them regarded the experience as “valuable” or “extremely valuable.”

• Reported one GRC: “My experiences as a GRC have been invaluable to my development as a teacher. Each undergraduate I speak to challenges me to draw from resources within and beyond my own discipline…” While I’ve greatly benefited from my interactions with students on a pedagogical level—the experiences I’ve had will prepare me for conferences with students in my own discipline and outside of it—being a GRC has also contributed to my professionalization. I am gaining a sense of how to present myself to students: as a confi-
dent, well-prepared scholar who is fully interested in and engaged with the student’s work.”

• More than 90 percent of faculty who have used a GRC indicate that they would use it again, and 84 percent of faculty using the GRC program reported that it had a significant or transformative influence on their stu-
ents’ learning.

• Faculty report benefits such as being able to implement the “student as scholar” model in their teaching, hav-
ing students conduct genuine research, and enabling them to have an intensive research experience. They also report improved student papers and improved student writing, and that students became active learn-
ers. Noted one faculty member who had used a GRC, “I cannot speak too highly of the benefits of this program.”

• The best iteration of this course I have ever taught, and it was the highlight of my year. The course is extremely demanding. It asks students to define an original research project, master a new research method, combine that method with more traditional approaches, and produce both a sophisticated written paper and a performance-based public presentation.

“The GRC for this course was my invaluable co-teacher.”

• She worked one-on-one with the students, helping them define projects and locate interviewees. She also played a central role in guiding the students’ interac-
tions with the statistics, helping them prepare archival-quality tapes, transcripts, and supporting mate-
rials for deposit in the permanent archives—and thus to make an original contribution to knowledge.

This personal attention helped the students rise to a level of insight and performance far beyond the norm. The student evaluations were ecstatic, and many cited the GRC specifically for her contribution to what they saw as a unique learning experience.”

We also wanted to know if student enrollment in research-

intensive (RI) courses might be influenced by the increased availability of the GRC-coached research-exposure (RE) cours-
es. We define research-intensive courses as those in which more than half of the class time is devoted to students con-
ducting original research and presenting conclusions. We examined enrollment data for five cohorts of students (those entering UNC in 2003-2007). We observed that the percentage of students receiving neither RE nor RI credit declined from 54 percent for the 2003 cohort to 29 percent for the 2007 cohort (Figure 1). We were interested to observe a nearly correspond-
ing increase in the percentage of students receiving both RE and RI credit (from 7 percent for the 2003 cohort to 28 percent for the 2007 cohort). It appears that students responded to the increased availability of RE courses (and possibly also to other campus emphasis on undergraduate research) by enrolling in both RE and RI courses. The remaining students received only RI credit (33 percent in the 2003 cohort, declining to 25 percent in the 2007 cohort) or only RE credit (6 percent in the 2003 cohort, rising to 17 percent in 2007 cohort). We conclude that the GRC program has contributed positively to the culture of undergraduate involvement in research and scholarship on our campus.

Figure 1. Undergraduate participation in research-

exposure and research-intensive courses.

Funding Sources Expand

The GRC program was new when the campus began con-
versations in 2004 about choosing the focus of our Quality Enhancement Plan (QEP), which is part of the Southern Association of Colleges and Schools’ “Reaffirmation of Accreditation” process. The resulting plan, “Making Critical Connections,” insisted on a strong emphasis on research experiences for undergraduates, and expanding the GRC program was one of the key objectives. The resulting benefits of the GRC program included campus-wide attention to research resources, and access to the university’s Office for Institutional Research and Assessment. Student enrollment in GRC courses increased nearly 10-fold during the five years of the QEP (from 500 in 2005-2006 before the QEP began to 4,980 in 2010-2011).

The value of the GRC program also has been recognized by several campus units that now provide financial support for the research-exposure classes. Currently, the Honors Program, the Department of English and Comparative Literature, the First-Year Seminars Program, the Carolina Center for Public
Next Steps for the GRC Program

UNC-Chapel Hill’s most recent “Academic Plan” (2011, 18) places substantial emphasis on expanding opportunities for undergraduate research, including a recommendation to “fully engage first-year undergraduate students in the academic life of the University by introducing them to unsolved problems, encouraging them to identify their research interests, and connecting them with faculty and graduate students who will inspire and mentor them.” More specifically, the plan calls for increasing the number of GRC-supported courses, as well as including GRCs in new multidisciplinary lecture courses that are being developed. The GRC program’s visibility in the academic plan will be extremely valuable as we continue to make undergraduate research the distinctive feature of a UNC-Chapel Hill undergraduate experience.

In addition to continuing to expand the program, we are also focused on building community among our GRCs and GRC faculty members. As part of this effort, we initiated a GRC blog (http://grc.web.unc.edu/) in early 2012. This virtual site offers space for faculty and GRCs to share experiences, best practices, and challenges. It also creates opportunities for reflection on the pedagogical practices that promote success in a research-exposure course.

In the current CUR publication Characteristics of Excellence in Undergraduate Research (COEUR), Rowlett et al. (2012, 3) note several important factors and best practices that help to “support and sustain highly effective undergraduate research environments,” including “broad disciplinary participation” and “accessible opportunities for undergraduates.” Undergraduate research opportunities need to be available to students at all levels of academic performance and in all disciplines. The research-exposure courses offered through the GRC program help to achieve these goals and provide effective inquiry-based learning for undergraduate students, pedagogical and professional development opportunities for graduate students, and satisfying and successful teaching experiences for faculty. The program has allowed us to leverage the strengths of our research university to provide an excellent liberal arts education for thousands of students.

References


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Donna M. Bickford is associate director of the Office for Undergraduate Research (OUR) at the University of North Carolina at Chapel Hill, as well as an adjunct assistant professor in the Department of English and Comparative Literature. Bickford directed the Carolina Women’s Center at UNC-Ch from 2006 to 2011. Prior to her arrival in Chapel Hill, she taught at the University of Rhode Island and was awarded a Fulbright Scholar Grant to teach at Abo Akademi University in Turku, Finland.

Patricia J. Pukkila is professor of biology at UNC-Chapel Hill and also associate dean and the founding director of the university’s Office for Undergraduate Research. Her laboratory investigates chromatin dynamics during the synchronous mitotic process in the model mushroom Coprinus cinereus. She has received the Bruce Alberts Award for distinguished contributions to science education from the American Society for Cell Biology, and she was named a Fellow of the American Association for the Advancement of Science for work in regulation of meiosis and for leadership in promoting undergraduate education and research. Pukkila has been a CUR Councilor since 2002.

Martha S. Arnold is an independent curriculum consultant. Prior to her retirement from UNC-Ch, she served as associate director of the Office for Undergraduate Research for five years, where she coordinated the assessment of the undergraduate research portion of the campus’s Quality Enhancement Plan. She convened the initial focus group that contributed the basic design of the GRC program, and oversaw its rapid expansion and assessment. She previously served as director of curriculum development in the university’s Center for Teaching and Learning for four years.

Ailun Anna Li is senior research associate in the Office of Institutional Research and Assessment at the University of North Carolina at Chapel Hill where she works with academic and administrative units to develop and conduct effective assessment activities. Prior to her arrival in Chapel Hill, she evaluated various federally funded educational technology projects at the SERVE Center of the University of North Carolina-Greensboro. She received her PhD and master’s in education from the University of Illinois-Champaign-Urbana.

Faculty members face unique challenges and issues in doing successful research with undergraduates in STEM fields. How to Get Started in STEM Research with Undergraduates provides a general discussion of these special issues and discusses ways to deal with them. Examples of such issues include: setting up and managing a research laboratory, designing student research projects, working with administrators, seeking research grants, writing successful grant proposals, integrating research into the classroom, dealing with information management, and making optimal use of the primary literature. Although the monograph is directed toward helping faculty who are in their early years of teaching, it should also be valuable in showing administrators the needs they must address in providing an environment in which new faculty researchers can be successful and what expectations they can have of faculty. The appendix lists some research agencies that fund undergraduate research.

To order this and other CUR publications visit: http://www.cur.org/publications.html.
Home Energy Assessments in a General Education First-Year Seminar

C. Wesley Walter, Denison University, walter@denison.edu

In my course Renewable Energy and Sustainability, a general education first-year seminar at Denison University, the students do a research project in which they perform home energy assessments using volunteers’ houses as their “labs.” In teams of two or three, the students visit a particular house to visually assess the conditions and interview the homeowner about energy usage. Each team develops its own list of five factors that they will analyze in the specific situation at that house. Examples of factors that students have evaluated include lighting, space heating, “vampire electric” power, attic insulation, water heating, and thermostat settings. The students take relevant measurements at the house, such as electric power usage by appliance or hot water temperature. Then, they analyze the information they’ve gathered, together with the household’s utility bills, to evaluate the current energy usage and annual costs for the different aspects of energy usage. The students then develop specific recommendations for possible improvements in energy conservation, including the estimated potential cost savings.

The research project culminates in an energy-assessment report that is transmitted to the homeowner. The report includes discussion of the students’ findings and the current household energy usage and recommended improvements. This research project has worked well for students, helping them to put the course material to use in a meaningful, real-world context. As an added bonus, knowing that their reports will be read and possibly acted upon by the homeowners helps to motivate the students to work hard on their research and to do their best writing.

Bibliical Studies Research in Introduction to the New Testament

Amy Paeler, Wheaton College, amy.paeler@wheaton.edu

My Introduction to the New Testament course includes an assignment to write an essay, an interpretive examination of a text, which is a task normally reserved for upper-level classes. This assignment asks students to engage deeply with a particular biblical passage. Students must consult an ancient source to learn more about the issue they have chosen. In addition, they must also consult secondary literature in order to make their own claims on issues such as authorship, dating, location, and genre. In the next installment of the assignment, the students follow a rubric of questions that encourages them to read the text many times from different perspectives, getting a sense of its grammar, narrative, rhetoric, and theology. Once they have organized their thoughts on the passage, they must seek out the views of other interpreters, including those in academia, from the non-Western world, and from the non-Christian past. Finally, they write a brief thesis paper, the exegesis, arguing a particular point about the passage. At the end of the course, students present their work to their peers, and by articulating their thesis, they convey what they have learned through the entire process and about the text itself. Overall, this assignment equips my students with the basic skills—and confidence—to interpret texts with wisdom, a skill they will all need even if they do not go on to become professionals in the field of Biblical studies.


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Research in the discipline of history necessitates access to primary sources, which complicates integration of such activity into introductory classes. Most students simply do not have access to major depositories of historical material, and those who do typically lack the requisite skills to find and use appropriate documents. Digitalization of historic newspapers and periodicals alleviates this problem, however. Using the databases to investigate the student’s “historical birthday” offers an original research opportunity. In our Modern U.S. History Survey assignment, students can investigate what occurred on the exact day they were born; in the Early U.S. Survey, students can investigate what happened on their birthday during a significant year—not the actual year they were born. They easily can locate materials for both assignments.

This research introduces students to a variety of sources and search strategies. They are taught to use digital databases to find primary sources—a newspaper article by date and a magazine or journal article by relevant topic. For example, in the Modern U.S. History Survey, students enter their birth date into NewsBank, a subscription newspaper index, in order to find a pertinent article published that day. They are encouraged to search for content in areas of national significance. After finding it, students identify key words in the text, including names and events, and then use them to locate a related magazine or journal article in the Academic Search Complete database. Database features allow them to limit the dates to those near their birth. Students then use the sources to write a short interpretive and analytical narrative. Instructors provide guidance to help students understand what makes a particular piece of historical evidence important and show them how to connect it to a larger theme. Each student finds his or her own sources, as opposed to writing a paper based on primary source selections by anth- olology editors or depository archivists, thus actually engaging in original research.

From the International Desk

Undergraduate Research in Scotland: An Enhancement-led Approach

Robert F. Zeadil

Scottish higher education increasingly finds itself, as do sectors elsewhere, having to cope with the complexities of a globalized and uncertain world. This manifests itself in the speed of knowledge generation and transfer, as well as the speed of digital communication. The seemingly ubiquitous intensification of risk, in relation to environment, health, security, finance and technology has only been exacerbated by the onset of economic austerity. At the same time, the pressing scientific, social, and economic problems of our times—climate change, sustainability, security, international debt crises, public health, aging populations—require graduates with appropriate attributes to cope effectively and imaginatively in such environments.

Ideally, graduates are being prepared to view issues through more than one disciplinary lens, in order to bring these urgent issues more clearly into view. They also should be comfortable crossing epistemological, social, and ontological boundaries in pursuit of the solutions that policymakers and employers desire. Barnett (2000a, 257) has characterized the “supercomplex” nature of this environment as follows:

A complex world is one in which we are assailed by more facts, data, evidence, tasks and arguments than we can easily handle within the frameworks in which we have to work. By contrast, a supercomplex world is one in which the very frameworks by which we orient ourselves to the world are themselves contested.

How graduates with such attributes might be developed, and how they can be encouraged to engage in such “re-invention” is a matter of pressing concern to policy-makers for Scottish higher education. The National Survey of Student Engagement in the U.S. (Kuh 2008), probably the largest longitudinal study of student engagement in higher education, found that ten “high-impact activities” correlated with increased student engagement. One such activity was undergraduate participa- tion in scholarly research. Barnett has commented further (2008b, 163) that “being engaged in research of a frame- developing kind and projecting those frames to wide publics is a strong … condition of teaching that is aimed at bringing about supercomplexity in the minds of students.”

Further, Baxter Magolda’s longitudinal study over the last twenty-five years (2009) has identified a process of student development through inquiry that leads to “contextual knowing or self-authorship.” She argues, “Moving away from unthinking acceptance of knowledge to critically constructing one’s own perspective” is “more complex than learning a skill set. It is a transformation of how we think—a change in our assumptions about the certainty, source and limits of knowl- edge” (2006, 50). A s von Humboldt (1797) recognized some 200 years ago in a similar period of social, technological, and conceptual shift, such transformation in students through co-inquiry produces not just sound scholars, but also effective citizens with a critical moral perspective. It is also a reasonable assumption that the acquisition of such skills, attributes, and capacities will equip today’s students to perform many high- level employment roles.

Context and Culture

The fostering of an undergraduate research culture in Scotland can be viewed as part of a current distinctive policy climate. In recent years the Scottish higher-education sector has taken place one of the most concerted policy interventions yet witnessed to establish an approach to enhancing the quality of higher education across the whole university system. This has been characterized as “a push for a new Scottish policy framework” (2009, 91) and certainly, politically and culturally, it arose at a significant juncture in recent Scottish history. The inception of this initiative, the Scottish Enhancement Framework (QEF), took place in 2003, only four years after the establishment of the first Scottish government in nearly three hundred years. This bold move toward constructing a clear identity for the higher-education sector can be seen as part of the building of a broader and distinctive Scottish policy culture at that time. The impe- tus continues into the present as Scotland prepares for a major referendum in 2014 on possible national independence from the United Kingdom.

The Scottish higher-education sector is a close-knit community, but one that contains a high degree of institutional variation. This variability and diversity is present despite the limited size of the sector—nineteen higher-education institu- tions—with short lines of communication with each other and with government departments and agencies. There is a shared culture and a sense of community that fosters both competi- tion and collaboration, and a shared identity that can often give rise to a sense of solidarity.

The QEF is coordinated by the Quality Assurance Agency on behalf of the Scottish Funding Council and is designed to provide cross-sectoral approaches to enhance the undergraduate research experience rather than solely assurance (the latter referring to judge- ments made against defined criteria to ensure the meeting of a standard). Quality enhancement (QE) is defined as “a set of joint- commitments by universities, universities and other relevant bodies to
The enhancement work in Scotland identified a polarization in approaches to the development of undergraduate research. At one end of the spectrum the approach might be characterized as a “junior model of the practitioner,” with the emphasis placed on research outcomes, the acquirals of competence in research methods, and publication. Approaches that focus on research internships, undergraduate research publications, and internships and the faculty-led research might fall into this category. The emphasis is on excellence and selectivity—engaging the best students who probably choose themselves to conduct research. It is an elite (and elitist) model in the positive sense of those terms. Activities in this narrative are often organized by an institution’s office of research.

The alternative approach is similar to what Jenkins and Healey (2009) have termed “mainstreaming.” This approach draws increased attention to the need for and value of undergraduate research. Among the various conceptual tools employed in addressing the themes was the one developed by Jenkins (2009) overview of the research-teaching linkages theme is a valuable gateway into this literature. A number of conceptual tools were employed in addressing the themes. For example, Gunn (2011) helpful dis- cussed the notion of “research-mindedness” as one analytical lens. Another tool was Healey’s (2005) model of potential research-teaching linkages (after Griffiths 2004), shown in Figure 1 below. In terms of the Healey model, a shift from the “research-led” tendency (lower left-hand corner of the diagram) to a “research-based” tendency (upper right-hand corner) was deemed necessary in order to effect an active cul- ture of undergraduate research that develops desired attributes in graduates. All four approaches shown in the model were deemed important, but only the “research-based” approach was considered likely to lead to the capacities neces- sary for dealing with the “supercomplex” society described by Barnett.

Figure 1. Healey’s Model of Undergraduate Research and Inquiry

The steering group studying research-teaching linkages, which included faculty and students, considered how to develop the desirable student attributes through the taught programs. It focused on how, at level of the institution and the academic program, links among research strategies, activities, outputs, and processes could support student learning and enable the development of key research-oriented attributes in graduates. At the undergraduate level, such potential attributes included:

- critical understanding
- awareness of the provisional nature of knowledge
- awareness of how knowledge is created, advanced, and renewed
- ability for effective communication and dissemination of findings
- an ability to analyze problems and issues and to formu- late, evaluate, and apply evidence-based solutions and arguments
- an ability to apply a systematic and critical assessment of complex problems and issues
- an ability to deploy appropriate techniques of analysis and inquiry
- familiarity with advanced techniques and skills
- inventiveness and creativity in formulating, evaluating, and applying evidence-based solutions and arguments
- effective project management of time, resources, opera- tions, and logistics
- an understanding of the need for a high level of ethi- cal, social, cultural, environmental, and professional conduct.

An important emphasis for this steering group was provided by recent Australian work. Krause’s (2007) “knowledge transfer conceptual framework” warns against the dangers of polariza- tion between research and teaching. She argues the need to acknowledge emerging conceptions of knowledge transfer, notions of “public scholarship,” and “third stream” activi- ties i.e., revenue-raising activities undertaken by academics over and above their first two stream activities of teaching and research. These could take the form of collaborations with commercial companies, such as providing professional development programs, one-off consultancies, or knowledge transfer partnerships (KTPs) in which research posts would be funded as a joint enterprise between private companies and universities. This is in line with the influential work by Gibbons et al. (1994) on changing modes of research, including a temporary shift to publicly commissioned, team-based, applied, and shorter duration “mode 2” research, e.g., a university working with a local engineering firm to test the durability of a new material. In contrast, the concept of “public scholarship” has received less debate in the UK. Krause refers to public scholarship as occurring when universities engage “in reciprocally beneficial ways with communities at [the] local, national and international level.” It is more com- monly discussed in the United States, where it has grown out of “service learning” and is related to Boyer’s (1996) concept of “the scholarship of engagement.”

Institutional Collaboration in Enhancement

A further distinctive element of the Scottish framework is the periodic (roughly biennial) identification of an enhancement theme around which selected institutions gather to collabo- rate and share diverse solutions appropriate to their own insti- tutional contexts. This work is coordinated by the Scottish Higher Education Enhancement Committee (SHEEC). Since 2003 a burgeoning repository of resources—publications, presentations, reports, and case studies—has been made freely available on the committee’s website. Two recent enhance- ment themes, titled “Research-Teaching Linkages: Enhancing Graduate Attributes” and “Graduates for the 21st Century,” drew increased attention to the need for and value of under- graduate research in a varied but compact sector.

Both of these themes recognized and subsequently advanced the notion that encouraging students to participate in inquiry- based or “research-minded” activity could deliver a range of benefits. These included increased student academic engage- ment, as well as enhanced capacity of individuals as rigorous scholars, pro-active employees, and ethical and responsible citizens—attributes envisioned by policy-makers as necessary for the successful modern Scottish society and economy. A rich array of valuable scholarship has grown out of the work done in connection with the enhancement themes, which addresses institutional, disciplinary, and pedagogical practices. This work, which merits wider dissemination, includes nine discipline-related national studies of undergraduate research, as well as studies exploring various dimensions of undergradu- ate research. Jenkins (2009) overview of the research-teaching linkages theme is a valuable gateway into this literature.

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In terms of defining attributes desired in graduates, the steering group readily acknowledged that the language used to describe student development is fraught with inconsistencies in terms of use and meanings. Indeed, terms such as attributes, skills, and competencies are often used interchangeably. A fellow Australian, Barrie (2004, 262), defines desirable attributes as being “the skills, knowledge and abilities of university graduates, beyond disciplinary content knowledge, which are applicable to a range of future work.” A significant amount of research has been undertaken, primarily in Australia, to look at how institutions can use the concept of graduates’ attributes to be more transparent and explicit about how students can expect to develop throughout their higher education. An important dimension of defining needed attributes, which arguably is less obvious when talking about skills, is the transformational elements of the higher-education experience. This, in turn, raises more fundamental questions about the role of a university education in today’s society.

**Vignettes of Undergraduate Research**

Comprehensive information on all the Scottish enhancement themes can be obtained from a dedicated website at: http://www.enhancementthemes.ac.uk. A full account of the variety of undergraduate research in Scottish universities is available from Land and Gordon (2008a, 2008b). The following is a brief selection of vignettes from their work (2008b) showing the range of student research.

**University of Aberdeen School of Divinity, History and Philosophy: Temporary Ordination in Second Life**

This initiative is seeking to build a simple “virtual monastery” loosely modelled on one historically associated with the diocese, with appropriate clothing and avatars so that students in the Encountering Buddhism course can experiment with different roles and responsibilities of being members of a religious order dependent on patrons for food, clothing, and other resources. (The monastery is developed using the online virtual world Second Life. http://www.secondlife.com). The outcome is a research-informed teaching environment for second-year and fourth-year students that uses role-playing to convey the ritualization, ethical constraints, internal cohesion, and identity of the Buddhist community. This allows them to understand the ritualization of everyday life that is a part of monastic behaviour; experience the challenges and responsibilities of being members of a religious community, on the charity of the surrounding community; and understand the distinction between the ethics of personal commitment to the development of popular books on Buddhism or in discussions on religious and monastic experience—and the ethics of a vow of behavior.

**University of the Highlands and Islands Marine Science: Fieldwork Abroad Vessels**

One example of good undergraduate research practice with a small group of students is found within the honors program in marine science. Each year a maximum of 15 students embark on a four-year program at the Dunstaffnage Marine Laboratory, where they have unprecedented access to research vessels, a manufacture of shore and coastal habitats, and state-of-the-art laboratories. The labs support work in fields including physical oceanography, marine biology, marine resource exploitation, and sedimentary bio-geochemistry. During all four years, students undertake fieldwork aboard the vessels and work in the specialized laboratories.

Modules are led by experts in the disciplinary fields, so the students are exposed to the latest conceptual and technological developments in a range of pedagogical approaches that are tied directly to students’ acquisition and development of higher-level research skills. These include, for example, techniques used in the first year, e.g., delivering an experimental design in the second year, reviewing of academic papers and writing abstracts in the third year; writing research proposals and undertaking research projects in the third and fourth years; and deconstructing the certainty of science and communicating science in the fourth year. Although not a systematic approach to embedding research-teaching linkages at the core of the curriculum, this occurs because of the nature of the students’ environment at the laboratory.

**Conclusion: A Future Agenda**

A number of issues arise from the foregoing discussion of undergraduate research practice in Scotland. A particular implication of the mainstreaming approach discussed above is the need for appropriate faculty development. Such an approach for all students in undergraduate curricula requires a degree of scaffolding for students. Faculty require an awareness of curriculum design and are obliged to negotiate a learning threshold that places emphasis on student participation and student learning, as opposed to faculty research expertise. An interesting future research agenda also arises from such undergraduate research. How do undergraduates perceive their own development and academic identity through their experiences? How does this relate to shifts in a student’s disciplinary understanding and identity, as well as developments in their practical capacities and perceptions of whether the experience has increased their employability? Given the interdisciplinary nature of many of the intractable issues facing societies in the 21st century, what learning gains have students experienced from intercultural encounters and border crossings? What are the identifiable factors in the design of research-based curricula and co-curricula that are most likely to optimize student engagement? Scottish universities and their institutions continue to explore such issues. One hopes that similar issues might also emerge in the papers at future CUR conferences and issues of the CUR Quarterly.

The Scottish research-teaching linkages works offer much that may be of value to institutions in the United States at departmental, institutional, national, discipline, and accreditation-agency levels. It offers a practical framing tool (Land and Gordon 2008a, 68-72) and an audit tool (ibid 72-73) to analyze current practice, at least as the resources already mentioned above, all freely available online.

**References**


Introduction

As faculty members, our primary instructional responsibilities are to equip and empower our students. By making effective teaching and learning a priority, a faculty member ensures that students will obtain the skills needed to succeed as they move on from the college or university. During a student’s time with us we must be proficient in capturing and then demonstrating the excitement of the sciences and, at the same time, equip that student with the fundamental principles of his or her field, in this case, organic chemistry.

Stice showed in a 1987 study that college-level students retain only 25 percent of what they hear and 30 percent of what they see, compared to 90 percent of what they say (Stice 1987). These remarkable numbers show that learning is not a spectator sport regardless of the instructor’s abilities. The interactive approach to learning is a necessary tool to ensure that students leave a classroom having understood and remembered the material presented to them. This is similar to the Gutenberg method of teaching in which textbook and lecturer together provide the fundamental concepts to the students and involve the students in the classroom on a regular basis (Morrison 1986).

Concurrent with one’s instructional responsibilities is the pursuit of one’s scholarly activities—research. Accordingly, the introduction of research to students in organic chemistry—in the form of direct interaction with the unknown and unexplored—provides a unique and valuable experience rarely available outside the walls of an institution of higher education. Research offers the student an individualized, hands-on experience that, when paired with an effective classroom experience, offers a truly enriched educational environment.

Research provides a unique opportunity for students to define their own scholarly activities. That is, students in the lecture setting are presented on the first day of classes with predetermined dates for their quizzes/exams/final. The lecture material is scheduled and organized on a grid format with little input from the class. Research is open-ended, and the data generated are never predetermined. Using research as a vehicle for learning, the overall experience allows for added benefits. The professor now takes on the role of mentor, in addition to that of teacher, as he or she interacts one-on-one with students, while at the same time assuming an important role in the student’s professional development.

Guidance of Entering Academics in Organic Chemistry

Guidance of Entering Academics in Organic Chemistry

Nothing more effectively demonstrates the value of undergraduate research than the words and stories of the student participants themselves. In spring 2014, the Council on Undergraduate Research (CUR) will host its annual undergraduate poster session on Capitol Hill. This event will help members of Congress understand the importance of undergraduate research by allowing them to talk directly with the students involved in such studies.

CUR invites undergraduates to submit an abstract of their research that represents any of CUR’s divisions (Arts and Humanities, Biology, Chemistry, Geosciences, Health Sciences, Mathematics/Computer Science, Physics/Astronomy, Psychology, and Social Sciences). To ensure proper review of applications, the above are the only disciplines in which students may apply. In the case of research that is interdisciplinary, students should select the division that most closely describes the research.

Directors of undergraduate research, faculty members, and other involved administrators are urged to encourage their students to submit posters. This is a highly competitive program and a very exciting experience for both students and their faculty advisors.

The candidate is responsible for assembling the portfolio used in this evaluation process. Tenure assures job security. Promotion allows one to rise through the academic ranks. If the institution expects the potential faculty member to be visible in research, that institution will supply support to assist in the establishment of a research program. At predominantly undergraduate institutions, these amounts vary (and typically range from $25,000 to $50,000) and are predicated upon size and research expectations of the particular program. To evoke what may be found at research universities, even more highly priced equipment is often shared. If the institution’s mission is primarily teaching, start-up costs may be met with the purchase of computer equipment and teaching aids.

External Support. Even before beginning an academic appointment, a new faculty member should consider writing a proposal for research support (to support personnel, including summer session funding for the first year of the contract). In the case of organic chemistry, the proposal should go to the Petroleum Research Fund of the American Chemical Society (ACS-PRF) Undergraduate New Investigator Award (www.acs.org/prf) or the Research Corporation for Scientific Advancement’s (RCSA) Cottrell College Science Award (http://www.rescorp.org/grants-and-awards). Each has different criteria, but each award is designed to assist a new faculty member in starting a research program. It may be helpful to reach out to current awardees to gain a sense of the proposal-writing process and to solicit advice on the respective websites. Once a research program is established, more funding opportunities arise, which include but are not limited to funding from the National Science Foundation (Elli Reiz – Research in Undergraduate Institutions, and ROA – Research Opportunity Award) and the National Institutes of Health (AREA – Academic Research Enhancement Award). As already described, additional private sponsorship can be obtained from the ACS-PRF and RCSA, as well as the Camille and Henry Dreyfus Foundation.

When beginning the process of proposal preparation, it is important to obtain a good sense of the entire grant review process of the sponsor, as well as the expectations of the program officer and reviewers. It is appropriate for the faculty member to contact the program officer about the possibilities and to apply for funding. The program officer will serve as a guide to the application procedure, as well as provide brief commen
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gues/) or National Science Foundation Days (http://www.nsf.gov/events) will facilitate this grant-writing process.

Curriculum
Many traditional core curriculum for chemistry programs begins with an introduction to chemistry that is normally devoted to chemical principles and their applications. The introductory course serves a broad clientele, from potential chemistry majors to nursing, and a variety of other pre-professional students. It is, in fact, a major “service course” in colleges and universities, one that has politically, at least in the United States, justified a significant portion of the budget for chemistry faculty. Significant changes have taken place in the chemistry curriculum since 1989. Driven in part by the large increases in enrollment over the previous four decades (1953–1996), some chemistry departments now permit students with Advanced Placement or International Baccaulaurate credit to enroll in organic chemistry as their first college chemistry course. Others begin the chemistry curriculum with organic chemistry or start the organic chemistry curriculum after one term of introductory chemistry. The American Chemical Society’s Committee on Professional Training (CPT), which has the responsibility to broadly define programs of study for students who aim to be professionals in the chemical sciences at the baccalaureate level. In the case of organic chemistry, the proposal should go to the Petroleum Research Fund of the American Chemical Society (ACS-PRF) Undergraduate New Investigator Award (www.acs.org/prf) or the Research Corporation for Scientific Advancement’s (RCSA) Cottrell College Science Award (http://www.rescorp.org/grants-and-awards). Each has different criteria, but each award is designed to assist a new faculty member in starting a research program. It may be helpful to reach out to current awardees to gain a sense of the proposal-writing process and to solicit advice on the respective websites. Once a research program is established, more funding opportunities arise, which include but are not limited to funding from the National Science Foundation (Elli Reiz – Research in Undergraduate Institutions, and ROA – Research Opportunity Award) and the National Institutes of Health (AREA – Academic Research Enhancement Award). As already described, additional private sponsorship can be obtained from the ACS-PRF and RCSA, as well as the Camille and Henry Dreyfus Foundation.

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gues/) or National Science Foundation Days (http://www.nsf.gov/events) will facilitate this grant-writing process.

Curriculum
Many traditional core curriculum for chemistry programs begins with an introduction to chemistry that is normally devoted to chemical principles and their applications. The introductory course serves a broad clientele, from potential chemistry majors to nursing, and a variety of other pre-professional students. It is, in fact, a major “service course” in colleges and universities, one that has politically, at least in the United States, justified a significant portion of the budget for chemistry faculty. Significant changes have taken place in the chemistry curriculum since 1989. Driven in part by the large increases in enrollment over the previous four decades (1953–1996), some chemistry departments now permit students with Advanced Placement or International Baccaulaurate credit to enroll in organic chemistry as their first college chemistry course. Others begin the chemistry curriculum with organic chemistry or start the organic chemistry curriculum after one term of introductory chemistry. The American Chemical Society’s Committee on Professional Training (CPT), which has the responsibility to broadly define programs of study for students who aim to be professionals in the chemical sciences at the baccalaureate level. In the case of organic chemistry, the proposal should go to the Petroleum Research Fund of the American Chemical Society (ACS-PRF) Undergraduate New Investigator Award (www.acs.org/prf) or the Research Corporation for Scientific Advancement’s (RCSA) Cottrell College Science Award (http://www.rescorp.org/grants-and-awards). Each has different criteria, but each award is designed to assist a new faculty member in starting a research program. It may be helpful to reach out to current awardees to gain a sense of the proposal-writing process and to solicit advice on the respective websites. Once a research program is established, more funding opportunities arise, which include but are not limited to funding from the National Science Foundation (Elli Reiz – Research in Undergraduate Institutions, and ROA – Research Opportunity Award) and the National Institutes of Health (AREA – Academic Research Enhancement Award). As already described, additional private sponsorship can be obtained from the ACS-PRF and RCSA, as well as the Camille and Henry Dreyfus Foundation.
These are, of course, minimum standards, and they do not infer requirements for the total chemistry curriculum for undergraduates who may pursue specific emphases in chemistry when selecting their advanced course requirements. They do, however, make a profound statement that core of knowledge exists within every student recognized as a chemical scientist.

Course and Laboratory Teaching Resources
In the organic chemistry laboratory, micro-scale organic methods and “green” chemistry practices are integrated into many programs. Micro-scale techniques have the advantage of minimizing waste and costs associated with waste disposal, without compromising the learning environment (Singh, Szafar, and Pike 1999). With a microwave reactor, it is possible to start the methods to extend solvent-free or aqueous-based techniques (Lebadores 2005; Ward and Lyons 2006; Zovinka and Stock 2010; Candeias et al. 2012). In many situations, students employ one or more spectroscopic tools for additional structural identification, such as gas chromatograph/mass spectrometry (GC/MS), infrared (IR) and nuclear magnetic resonance (NMR) spectrometry. As a result of the analysis, individual laboratory experiments rely on simple organic compounds and instead employ more complex, naturally occurring compounds and stereoselective reactions (Leslie, Lee, and Smith 2012; Wong, Sultana, and Vosburgh 2010).

Student Recruitment and Mentoring
Recent pedagogical changes that offer research experiences as part of the instructional laboratory experience may, interest- ingly, alter the career path of those considering a minor or even a major in chemistry. The objective of the lab experience is to offer students the opportunity to identify and contribute to the scholarly work in their field of interest. Mentoring students in the research laboratory gives them significant opportunity to the scholarly work in their field of interest. Mentoring students in the research laboratory gives them significant opportunity to the scholarly work in their field of interest. Mentoring students in the research laboratory gives them significant opportunity to the scholarly work in their field of interest. Mentoring students in the research laboratory gives them significant opportunity to the scholarly work in their field of interest.

Fifth course is quantitative analysis. The minor keeps open the sequence and so, as rising juniors, many have satisfied 80 percent of chemistry when selecting their advanced course requirements. These are, of course, minimum standards, and they do not infer requirements for the total chemistry curriculum for undergraduates who may pursue specific emphases in chemistry when selecting their advanced course requirements. They do, however, make a profound statement that core of knowledge exists within every student recognized as a chemical scientist.

Minor. The minor in any discipline is designed to offer a choice of courses within a specific field. For chemistry, this option for minimimizing waste and costs associated with waste disposal, without compromising the learning environment (Singh, Szafar, and Pike 1999). With a microwave reactor, it is possible to start the methods to extend solvent-free or aqueous-based techniques (Lebadores 2005; Ward and Lyons 2006; Zovinka and Stock 2010; Candeias et al. 2012). In many situations, students employ one or more spectroscopic tools for additional structural identification, such as gas chromatograph/mass spectrometry (GC/MS), infrared (IR) and nuclear magnetic resonance (NMR) spectrometry. As a result of the analysis, individual laboratory experiments rely on simple organic compounds and instead employ more complex, naturally occurring compounds and stereoselective reactions (Leslie, Lee, and Smith 2012; Wong, Sultana, and Vosburgh 2010).

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date can be very difficult, especially without sufficient direction from faculty. Each of us should be honored to participate in the advancement of any young chemist’s career. The relationship between student and mentor is invaluable and extends far beyond the confines of the undergraduate institutions. We believe that our roles as educators are not only to teach the disciplinary subject matter but also to become true mentors to students and junior faculty as they work on their own careers. The topics and skills detailed above regarding both teaching and research are intended to assist all those entering the field of academic research.

Sustaining an Active Research Program
Undergraduate education needs to be meaningful when it contains a consistent and engaging research component. As outlined above, students build skills in problem solving, organizing and communicating information, and working in a team environment. In this team environment, often the experienced or senior students in the laboratory take initiative to teach their junior counterparts the techniques and skills mentioned above, including searching the chemical literature and preparing a poster or short presentation. For faculty members, the mentoring experience with undergraduates is immensely beneficial to furthering the faculty member’s research project, but also more importantly to the development of the students as scholars in the field.

The key to success in maintaining a thriving undergraduate research program includes dissemination of data (both publications and presentations, with student co-authors), and sustaining an active network of collaborators and colleagues, which ultimately leads to visibility in the field of chemical research. Visibility leads to external funding. Far too often research is given a back seat amidst the daily demands of an academic career, but with careful planning and wise use of start-up funds (internal and external), a faculty member can quickly create momentum. Constant communication on what has been done, what is in the research pipeline, and what is anticipated will provide the greatest dividends. Other productive activities for a new faculty member can include organizing a regular seminar series at the institution, inviting outside scholars to speak, and participation in professional workshops. These activities can also add to the experience of students in addition to contributing to institutional visibility.

Professional Ethics
The relationship between mentor and student is sacrosanct. A mechanism must be in place whereby an open dialogue can occur at any time between the two parties. Because research and frustration can go hand-in-hand, timely reminders are needed of the ethical responsibilities of both mentor and student on how best to act and make the decisions necessary to maintain a healthy and productive research environment. While not listed as a requirement for most programs, a separate course on professional ethics should be part of the curriculum of every chemistry major. Currently, many programs include discussions of professional ethics as part of coursework and also on an individual basis through meetings and group discussions. Guidelines on academic professionalism are available through the web site of the American Chemical Society (http://portal.acs.org).

Conclusion
Bruce Alberts, before becoming president of the National Academy of Sciences, described a scientific career as one that encounters a number of obstacles, which succeeds only upon achieving the status of a doctorate in philosophy (Alberts 1994). The trajectory from freshman scientist to PhD candidate can be very difficult, especially without sufficient direction from faculty. Each of us should be honored to participate in the advancement of any young chemist’s career. The relationship between student and mentor is invaluable and extends far beyond the confines of the undergraduate institutions. We believe that our roles as educators are not only to teach the disciplinary subject matter but also to become true mentors to students and junior faculty as they work on their own careers. The topics and skills detailed above regarding both teaching and research are intended to assist all those entering the field of academic research.

Helpful Resources
American Association of University Professors (AAUP), http://www.aauap.org
American Chemical Society’s Committee on Professional Training (ACS-CPT), http://portal.acs.org/portal/PublicWebSite/about/governance/committees/training/acspapprovals/CPT_00891

Funding opportunities
American Chemical Society – Petroleum Research Fund. http://portal.acs.org/acs/coc/content?ntfp-track=pagelabel=p+SUPERARTICLE&node_id=1231&suces=services_int=asregions_uaadl=050524h1d1-4634-9532-54ad6b1d86c7
National Institutes of Health.
http://grants.nih.gov/grants/funding/funding_program.htm
Hibernia

Laboratory Techniques and Resources

Literature Review and Dissemination of Data
ACS Style-Guide. http://pubs.acs.org/publishing/authors/styleguide/index.html

References

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Emily C. McLaughlin is an assistant professor of chemistry at Bard College in Annandale-on-Hudson, NY. She completed her PhD dissertation in total synthesis under Professor Jeffrey Winkler at the University of Pennsylvania in 2006. Soon thereafter, she commenced her post-doctoral training at the University of Maryland with Professor Michael Doyle. McLaughlin is currently teaching and mentoring undergraduate students in the pursuit of new methodologies designed for the preparation of non-natural amino acids


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and heterocyclic scaffolds. Her work is supported by Bard College, the ACS-PBF (UNI) and the Research Corporation for Scientific Advancement (Gottlieb College Science Award).

David C. Forbes

David Forbes is a professor of chemistry at the University of South Alabama. His training both as a graduate student in the labs of Professor Scott Denmark at the University of Illinois Urbana-Champaign and as a post-doctoral research associate with Professor Michael Doyle, which started at Trinity University and continued at the University of Arizona, was in the area of synthetic organic chemistry. David has mentored over 50 undergraduate research students since his academic appointment in 1998 and has maintained an externally funded research program which centers on the development and application of new synthetic methodologies. David currently serves as chair of the chemistry department. In 2006 he was honored with a Henry Dreyfus Teacher-Scholar Award, and he currently serves on the Executive Committee of the Arnold and Mabel Beckman Foundation Beckman Scholars Program.

Michael P. Doyle

Michael (Mike) Doyle is internationally regarded in the field of organometallic chemistry and is a major driving force in the development of dithiolium complexes for relevant synthetic organic transformations. In addition, Doyle is equally celebrated for his efforts and leadership in the promotion of undergraduate research. He completed his graduate studies at Iowa State University as an NIH fellow and continued on to his postdoctoral training at the University of Illinois, Chicago. Shortly thereafter, he joined the faculty at Hope College and rose to the rank of full professor by 1974. Doyle is currently the chair of the Department of Chemistry and Biochemistry at the University of Maryland where he continues to mentor undergraduates, graduate students, and postdoctoral scholars. He has been the recipient of numerous awards and accolades throughout his career, including the Camille and Henry Dreyfus Teacher-Scholar Award (1973) and the Arthur C. Cope Scholar Award (2001). He has authored over 250 publications, 10 books, and 20 book chapters. Most notably, his publications feature more than 130 undergraduate coauthors.

The Registry of Undergraduate Researchers

The registry of undergraduate researchers has nearly 10,000 student registrants and is actively growing as juniors and rising seniors submit and update their profiles. Access to the Registry costs $1,500 for a full subscription. CUR Institutional Members are offered a discounted rate of $1,200, and Enhanced Institutional Members receive complimentary access. The full subscription includes all academic departments, and will grant access to anthropology/archaeology, art/ humanities, biology/biochemistry, business, chemistry/biochemistry, economics, education, engineering, English and linguistics, environmental studies, geosciences, health professions, history, journalism and communications, mathematics/computer science, physics/astronomy, political science, psychology, social work and sociology disciplines. Departments can subscribe to their discipline-specific registry for $300 (about the cost of a single recruiting trip). For more information, please visit http://www.cur.org/projects_and_services/registry/.

The students themselves submit the profiles contained within the registry. They include disciplinary interests, geographic preference, research experience, and transcript information. The database allows targeted recruiting efforts of students who plan to pursue an advanced degree, and who have research experience. Students interested in creating a profile can visit http://www.cur.org/projects_and_services/registry/student_register/. Students interested in creating a profile can visit http://www.cur.org/projects_and_services/registry/student_register/.

CUR Quarterly

The CUR Quarterly publishes articles relating to all aspects of undergraduate research that are of interest to a broad readership. Articles regarding the effects of the research experience on the development and subsequent endeavors of students, and how to initiate, support, or sustain undergraduate research programs are appropriate for this journal. The CUR Quarterly is not the appropriate venue for publishing results of undergraduate research.

Editorial Policies —

The CUR Quarterly is the voice of members of the Council on Undergraduate Research. All articles are peer-reviewed. Editorial judgment regarding publication of manuscripts and letters rests with the Editors. Concerns about editorial policies and decisions should be addressed to the Editors.

Manuscripts

Prepare to Submit —

• Copy of article (MS Word or compatible format, Times font, 12-point, double spaced, 1-inch margins, and single-spacing between sentences).
• 2000-3500 words is the typical length of an article, but longer or shorter articles may be appropriate for certain topics.
• Key words for indexing (up to 10).
• Personal information — Institutional title, mailing, and email addresses for the corresponding author.
• Biographical sketch for each author (4-6 sentences).

Proper Citations — Refer to the Chicago Manual of Style citation guidelines-author-date style (http://www.chicago Manualofstyle.org/tools_citationguide.html).

How to Submit —

Authors are encouraged to discuss disciplinary articles with the appropriate Division Editor prior to submission. Contact information for all Editors is listed at the front of every issue of the CUR Quarterly. Once you are ready to submit you will need to visit http://curq.msubmit.net and complete the online submission process.

Book Reviews

The CUR Quarterly publishes short reviews of books and other new publications that editors deem of interest to the undergraduate research community. Books or other publications will be reviewed within 12 months of publication. The Book Review Editor will select appropriate titles for review and solicit reviewers. In order to ensure that the reviews are as timely as possible, the Book Review Editor will expect to receive finished reviews within two months of assignment. Each printed issue of the CUR Quarterly will include one review.