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CUR Focus

The Graduate Research Consultant Program: Embedding Undergraduate Research Across the Curriculum

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.” At 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 Office 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. The graduate students are paid for 30 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; Pukkila 2004; Justice et al. 2007; Lee 2011). Each course shares common practices: Students learn and apply disciplinary-specific research methods to questions of interest and present the results of their research; the GRCs serve as research consultants or coaches for the students; and the faculty member teaching the course collaborates with the GRC. Within these general guidelines, however, each course differs based on the research practices of the field and the subject matter and level of the course. The

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 19,000 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

Course Number	Course Name
AMST 277H	Globalization and National Identity
ANTH 089	Public Archaeology in Bronzeville
ANTH 120	Anthropology through Expressive Culture
ANTH 248	Public Anthropology
ART 055H	Art, Gender and Power in Early Modern Europe
ART 089	Druid Culture
ART 150	World Art
ART 270	Early Renaissance Art
ART 79	Meaning and the Visual Arts
ASIA 051	Cultural Encounters: Arabs and the West
BIOL 101H	Principles of Biology
BIOL 065	Pneumonia and Flu
CHEM 190	Special Topics in Chemistry

Course Number	Course Name
CHEM 070	First-Year Seminar: You Don't Have to Be a Rocket Scientist
COMM 082	Globalizing Organizations: Food Politics
COMM 089H	Countercultures
DRAM 089	Ecodrama
ECON 056	Asia and the West
ENGL 084H	Into the West
ENGL 086	The Cities of Modernism
ENGL 087	Jane Austen Then and Now
ENGL 089H	Reading and Writing Women's Lives
ENGL 102	English Composition and Rhetoric (8 sections)
ENGL 102i	Writing for Business (2 sections)
ENGL 143	Film & Culture (2 sections)
ENGL 088	The Legacy of the Japanese American Incarceration from WWII to 9/11
ENST 222	Estuarine and Coastal Marine Science
FREN 260.001	Introduction to French and Francophone Literature
FREN 260.002	L'Argent ne fais pas le Bonheur?
GEOG 056	Local Places in a Globalizing World
GEOL 072H	Field Geology of Eastern California
HIST 083	African History through Popular Music
HIST 176H	The Incas and After
HIST 262	History of the Holocaust
HIST 292H	Magic Prague: Biographies of a Central European City
INLS 089	The Revolution Will Not Be Tweeted: Social Informatics in Popular Culture
KOR 150	History, Memory and Reality in Contemporary Korea
KOR 151	Education and Social Changes in Contemporary Korea
MASC 055	Changes in the Coastal Ocean
MASC 057	From "The Sound of Music" to "The Perfect Storm"
MATH 062H	Combinatorics
MATH 051	Fish gotta swim, birds gotta fly: Mathematics and mechanics of moving things
MATH 060	Simulated life
MUSC 063	Music on Stage and Screen
MUSC 089	Making and Marketing Music in a Digital Age
PHIL 145	Language and Communication
PLAN 053	Race, Sex and Place in America

Course Number	Course Name
PLCY 089	The Character of Place
PLCY 210	Policy Innovation and Analysis (5 sections)
POLI 130	Introduction to Comparative Politics
POLI 209	Analyzing Public Opinion Data
PSYC 058	The Psychology of Mental States and Language Use
PSYC 066	Eating Disorders and Body Image
PSYC 190.001	Eating Disorders and Body Image
PSYC 190.002	Exploring Infancy and the Development of the Mind
PSYC 225H	Sensation and Perception
PSYC 245	Abnormal Psychology
RELI 072	Messianic Movements
RELI 224H	Gender and Sexuality in Western Christianity
ROML 059	Courts, Courtiers, and Court Culture in Early Modern Spain
ROML 061	Language in Autism and Developmental Disabilities
SOCI 064	Equality of Educational Opportunity Then and Now
SOCI 251	Measurement and Data Collection

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 of success 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 for quant 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 thinking 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 simulation, multivariate statistical modeling, probability sampling, and psychometric scaling.

“After much time spent staring 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 through hands-on research.” (Posted in the GRC@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 experiments 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 discussions 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 importance 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 classes.

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 for two hours.” Plans for the 10th-year workshop are currently under way.

Departmental-level adoption: At UNC-Chapel Hill, a large number 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 conversations exploring the possibility of using the GRC model to make scholarly research an essential component of their undergraduate students’ 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 undergraduate 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 experiences report positive changes in psychosocial characteristics, such as increased self-confidence and the ability to work independently (Brownell and Swaner 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 conducted by UNC’s Office of Institutional Research and Assessment through surveys and focus groups. Multiple evaluations 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 understanding 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 together the day before. And there was a lot of emphasis on the research practices, which was valuable. [There was] encouragement to use primary sources and lots of secondary sources.”
- The GRCs themselves report extremely positive experiences. More than 60 percent of them reported influences 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 benefitted from my interactions with students on a pedagogical level—the experiences I’ve had will prepare me for conferences with students in my future composition class—being a GRC has also contributed to my professionalization. I am gaining a sense of how to present myself to students: as a confident, knowledgeable 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 one again, and 84 percent of faculty using the GRC program reported that it had a significant or transformative influence on their students’ learning.
- Faculty report benefits such as being able to implement the “student as scholar” model in their teaching, having 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 learners. Noted one faculty member who had used a GRC, “I cannot speak too highly of the benefits of this program. This was 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.

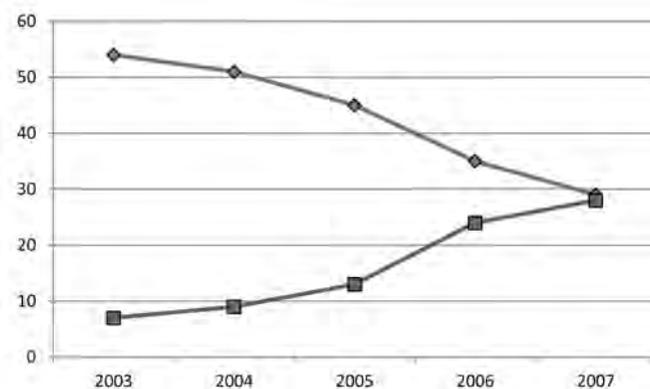
“The GRC for this course was my invaluable co-teacher. She worked one-on-one with the students, helping them define projects and locate interviewees. She also played a central role in guiding the students’ interactions with their interviewees and helping them prepare archival-quality tapes, transcripts, and supporting materials 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) courses. We define research-intensive courses as those in which more than half of the class time is devoted to students conducting 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 corresponding 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 emphases 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 the 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.



*Diamonds indicate percentage of students entering UNC-Chapel Hill in the year shown who received no course credit for research. Squares indicate percentage of students entering UNC-Chapel Hill in the year shown who received course credit for both research-exposure and research-intensive courses.

Funding Sources Expand

The GRC program was new when the campus began conversations 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,” submitted in 2006, included a strong emphasis on research experiences for undergraduates, and expanding the GRC program was one of the key objectives. The resulting benefits to the GRC program included campus-wide attention, 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

Service, and a grant to UNC-Chapel Hill from the Howard Hughes Medical Institute's Undergraduate Science Education Program each fund GRCs for specific courses. In addition, as we noted above, the Department of Romance Languages and Literatures hopes to use the GRC program as a catalyst to transform its curriculum. Also, the Center for the Study of the American South has agreed that faculty who apply for the center's course-enhancement funds may choose to use those funds to fund a GRC.

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 recent 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.

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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 meiotic 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.

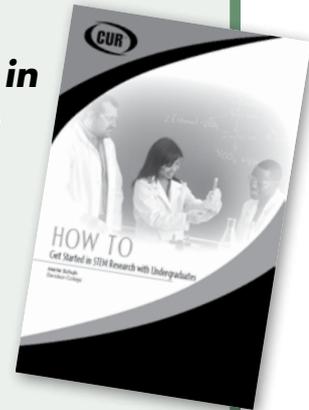
Martha S. Arnold is an independent curriculum consultant. Prior to her retirement from UNC-CH, she served as associate director of the Office for Undergraduate Research for five years, where she coordinated the assessment of the undergraduate research portion of the campus's Quality Enhancement Plan. 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.

Aijun 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.

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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.

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