

BEYOND GRANTS: CREATIVE FUNDING SOURCES FOR UNDERGRADUATE RESEARCH



Subtheme in this issue:

Undergraduate Research and Graduation Rates

Editor-in-Chief

James T. LaPlant, College of Arts and Sciences
Valdosta State University
jlaplant@valdosta.edu

Issue Editors

Janice DeCosmo, Associate Dean
Undergraduate Academic Affairs
University of Washington
jdecosmo@uw.edu

Laurie Gould, Department of Criminal Justice
and Criminology
Georgia Southern University
lgould@georgiasouthern.edu

Copy Editor

Cheryl Fields
cheryl.fields@verizon.net

Feature Editors

Book Review

Susan Berry Brill de Ramirez, Department of English
Bradley University
brill@fsmail.bradley.edu

International Desk

Mick Healey
Professor Emeritus
University of Gloucestershire
Healey HE Consultants
MHealey@glos.ac.uk

Alan Jenkins

Professor Emeritus
Oxford Brookes University
alanjenkins@brookes.ac.uk

Undergraduate Research Highlights

Marie Graf

School of Nursing
Georgia Southern University
annennis@georgiasouthern.edu

2014-2015 Divisional Editors

Arts and Humanities

Soledad Caballero, Department of English
Allegheny College
msoledad.caballero@allegheny.edu

At-Large

Lisa Gates, Associate Dean for Fellowships
and Research
Middlebury College
lgates@middlebury.edu

Biology

Lonnie Guralnick, Department
of Mathematics & Natural Sciences
Roger Williams University
lguralnick@rwu.edu

Chemistry

Alex Norquist, Department of Chemistry
Haverford College
anorquis@haverford.edu

Engineering

Binod Tiwari, Civil and Environmental
Engineering Department
California State University, Fullerton
btiwari@fullerton.edu

Geosciences

Laura A. Guertin, Department of Earth Science
Penn State-Brandywine
uxg3@psu.edu

Health Science

Niharika Nath, Life Sciences Department
New York Institute of Technology-
Manhattan Campus
nnath@nyit.edu

Mathematics and Computer Sciences

Kathryn Leonard, Department of
Mathematics
California State University Channel Islands
kathryn.leonard@csuci.edu

Physics and Astronomy

Sorinel Oprisan, Department of Physics
and Astronomy
College of Charleston
oprisans@cofc.edu

Psychology

Scott Bates, Department of Psychology
Utah State University
scott.bates@usu.edu

Social Sciences

Ishuan Li, Department of Economics
Minnesota State University Mankato
ishuan.li@mnsu.edu

Undergraduate Research Program Directors

Sumana Datta, Department of Biology
Texas A&M University
sumana@tamu.edu

Teacher Education

Kymberly Harris, Department of Teaching
and Learning
Georgia Southern University
kharris@georgiasouthern.edu

Graduate Assistant

Kristian Roberts
Valdosta State University

Publisher

CUR National Office
Council on Undergraduate Research
734 15th Street NW, Suite 550
Washington, DC 20005-1013
Phone: 202-783-4810
Fax: 202-783-4811
www.cur.org

Design

Design and Prepress Production
Slice-Works
Gaithersburg, MD
www.slice-works.com

Production and Mailing

The Sheridan Press
Hanover, PA
www.sheridan.com

The *Council on Undergraduate Research Quarterly* is published in the Fall, Winter, Spring, and Summer by the Council on Undergraduate Research.

The mission of the Council on Undergraduate Research is to support and promote high-quality undergraduate student-faculty collaborative research and scholarship.

The *Council on Undergraduate Research Quarterly* and *CURQ on the Web* serve as the official public "voice" of CUR to both its members and to a broader community. Their purpose is to provide useful and inspiring information about student-faculty collaborative research and scholarship from all disciplines at all types of institutions. The goal and function is to advance the mission of CUR. To this end, the operation and editorial policies are flexible so that its content and deadlines meet the immediate needs of the communities that it serves. The *CURQ on the Web* can be found at www.cur.org/publications/curquarterly/.

CUR Advertising Policy

The Council on Undergraduate Research accepts advertising from organizations and individuals if such ads are in line with our tax-exempt educational purpose, which is to promote undergraduate research and education. We retain the right to refuse any advertising that we feel does not fall within our guidelines.

For more information, contact the National Office at cur@cur.org or 202-783-4810.

Subscriptions

For CUR members, the *CUR Quarterly* is delivered as a benefit of membership. For other individuals, the annual subscription rate is \$42. For libraries, the subscription rate is \$87 annually.

To order a subscription, visit:
www.cur.org/publications.html.

ISSN 1072-5830

Council on Undergraduate Research
734 15th Street NW, Suite 550
Washington, DC, 20005-1013

Cover Photo:

Biology major Lauren Schultz reconstructs dinosaur biomechanics with Dr. Eric Snively, an Eagle Apprenticeship mentor at the University of Wisconsin-La Crosse. The arm is from the giant predator Acrocanthosaurus. Photo courtesy of UW-La Crosse University Communications Office.

CONTENTS *Winter Focus:*

Beyond Grants: Creative Funding Sources for Undergraduate Research

Focus Articles

Creative Funding Strategies for Undergraduate Research at a Primarily Undergraduate Liberal Arts Institution	5
<i>—Martina Ramirez, Joseph McNicholas, Brianne Gilbert, Jose Saez, Matthew Siniawski</i>	
Leveraging Federal Work-Study to Support Undergraduate Research	9
<i>—Denise Nazaire, Bethany Usher</i>	
Crowdfunding Undergraduate Research Projects	18
<i>— Neil Fitzgerald</i>	

Other Articles

From the International Desk: The Evolution of the Roskilde Model in Denmark	22
<i>—Anders Siig Andersen, Trine Wulf-Andersen, Simon B. Heilesen</i>	

Undergraduate Research and Graduation Rates

Undergraduate Research Experience Aids Progression, Graduation Rates at Texas Southern University, an HBCU	28
<i>—David Owerbach, Adebayo Oyekan</i>	
Assessing the Impact of Undergraduate Research on Graduation Rates at the University of Georgia	33
<i>—Martin Rogers, William McDowell</i>	

Departments

From CUR’s Executive Officer and Past President — Elizabeth Ambos, Julio Rivera	2
Issue Editor Column — Janice DeCosmo	4
CURQ Vignettes	39
Book Review — Christopher Galvan, Jessica Wallace Szmania	40

From CUR's Executive Officer

From CUR's Executive Officer and Past President



Elizabeth L. Ambros
Executive Officer



Julio Rivera
President, 2013-14

The theme of this issue of the *CUR Quarterly*, "Beyond Grants: Creative Funding Sources for Undergraduate Research," caused us to reflect on the significant impact that funding from one particular source — the Alice and Leslie E. Lancy Foundation — has had on CUR's development as an organization. The investments made by the Lancy Foundation in a variety of undergraduate research endeavors have had a transformational effect on CUR and more broadly on undergraduate research as a movement in higher education. These investments serve as a signal lesson on how to leverage internal institutional resources with external resources, build networks of sustained relationships, and achieve lasting change in and beyond an institution.

The Lancy Foundation has a long history of supporting and catalyzing the activities of the Council on Undergraduate Research (CUR), as well as the National Conference on Undergraduate Research (NCUR). Three separate grant phases have acted to galvanize the undergraduate research community and stimulate rapid change in CUR and NCUR.

Phase 1: Expansion of the summer intensive research model to multi- and interdisciplinary research teams. From 1999 to 2008 NCUR sponsored a grant program with Lancy Foundation support that funded summer interdisciplinary undergraduate research at 26 campuses across the United States, which in turn led to hundreds of presentations by undergraduates at NCUR and professional-society meetings. Many of the investments made through NCUR/Lancy grants seeded multi- and interdisciplinary summer undergraduate research programs that are still supported by academic institutions more than a decade later. More importantly, these grants helped institutions create a range of effective models of undergraduate research that are employed by colleges and universities throughout the United States and emulated

by colleges in other countries.

The successes of the NCUR/Lancy grant programs are summarized by Stocks and Gregerman (2009) and are commonly remembered for their transformational impact. As evidence of the long-term persistence of the NCUR/Lancy vision, CUR anticipates bringing back the NCUR/Lancy grant concept with funding from its endowment, and intends to launch its own "seed grant" competition in 2016 to stimulate innovation in undergraduate research.


Phase 2: CUR and NCUR join forces. From 2007 through 2010, CUR and NCUR received funds from the Lancy Foundation, first, to explore opportunities for enhanced collaboration between the two organizations and, later, to implement the unification of the two organizations, which was successfully accomplished in 2011 (Campbell 2011). With the union of CUR and NCUR formally achieved, the energy of the membership focused more deeply on building programming for faculty and students conducting undergraduate research. Creation of a task force on student programs, hiring of a staff member to manage CUR's portfolio of student programs, and expansion of the numbers of students participating in NCUR, Posters on the Hill, and the NSF REU Symposium are all outcomes that can be traced to the Lancy Foundation's catalytic funding.

Phase 3: CUR governance revitalization. With the CUR-NCUR unification accomplished, the attention of the combined organization turned to raising the professionalism and scope of CUR to meet the challenges and opportunities afforded by its rapid growth and the diversification of programs and services. Beginning in 2011, Lancy supported a thorough reexamination of CUR's governance and strategic priorities. CUR retained the services of BoardSource, a consulting agency with expertise in corporate board efficacy, to examine CUR's health as an organization, including its governance structure, and produce a set of recommendations for consideration by CUR. The resulting changes in CUR's constitution and bylaws, while incremental, have resulted in increased organizational flexibility and focus.

On a larger scale, the organization has now endorsed five strategic pillars, including diversity and inclusion, integration of research into the curriculum, assessment, internationalization, and innovation and collaboration. CUR not only adopted the pillars but also has integrated them at all levels of the organization, forming task forces associated with each pillar to drive further innovation in CUR's programs and services. The conversations within the executive board, divisions, committees, and task forces now focus on completing work that reflects the organization's

intended direction, and prioritizes future efforts by preparing a strategic plan.

Some recent accomplishments include the adoption of a formal diversity and inclusion statement, professional-development initiatives related to scaffolding undergraduate research through curricula, assessment of the impact of undergraduate research on student success, and new projects with international partners. The strategic pillars have clearly resulted in a more dynamic and engaged Council: Former CUR President Mary Crowe estimated in her plenary address at the 2013 Annual Business Meeting that the engagement of the CUR volunteer base increased by more than 25 percent in the first two years of the Lancy Foundation's funding for governance revitalization.

The long-term positive effects of the Lancy Foundation's investments in CUR and NCUR cannot be overstated. They have helped build a range of undergraduate research programs at diverse institutions, facilitated the union of CUR and NCUR, and developed a robust set of strategic pillars that reflect our values and act as a platform to launch new initiatives and more fully engage CUR's vibrant volunteer corps. 

References

Campbell, William. 2011. "From the CUR President." *CUR Quarterly* 32(1): 2-3.

Stocks, Janet and Sandy Gregerman. 2009. "Interdisciplinary Research Projects Supported by the NCUR/Lancy Program." *CUR Quarterly* 30(2): 21-25.

Acknowledgments

The Council on Undergraduate Research gratefully acknowledges the support of the Alice and Leslie E. Lancy Foundation in funding seminal efforts that have helped shape the formation and evolution of undergraduate research in the United States. The work described in this column was undertaken by several generations of leaders within the Council on Undergraduate Research and the National Conference on Undergraduate Research, including Nancy Hensel, former CUR Executive Officer; emeriti Presidents Bill Campbell, Michael Nelson, Jeffrey Osborn, Elizabeth Paul, Mary Crowe, and Amelia Ahern-Rindell; current President Roger Rowlett; and President-elect Susan Larson.

CUR Calendar

FEBRUARY 2016

18-20	CUR Dialogues, Hyatt Regency Capitol Hill, Washington D.C.
-------	--

APRIL 2016

7-9	National Conference on Undergraduate Research (NCUR), Asheville, NC
-----	---

11-15	Undergraduate Research Week
-------	-----------------------------

JUNE 2016

26-28	CUR Biennial Conference, University of South Florida, Tampa, FL
-------	---

Be sure to check www.cur.org for the most up-to-date news and the Event Calendar.

From the *CURQ* Issue Editor



Beyond Grants: Creative Funding Strategies for Undergraduate Research

In today's higher education environment of rising tuition and decreasing state funding for colleges and universities, as well as shifting priorities on the federal level, faculty and administrators must


be increasingly creative in raising funds for undergraduate research. Rising tuition means that students need research support more than ever if they are to take advantage of the opportunities we have all worked so hard to create. While finding efficiencies and cutting nonessential expenditures can help ease budgets, those savings are generally not enough to sustain robust programs. As in other realms of life, necessity can compel us to create new strategies to fill critical gaps. The Winter 2015 *CUR Quarterly* presents several articles and vignettes that explore alternative strategies for funding student awards, infrastructure, and research support that we hope will be a helpful resource for readers seeking to expand their funding base.

"Leveraging Federal Work-Study to Support Undergraduate Research," by Denise Nazaire and Bethany Usher, describes how George Mason University students eligible for Federal Work-Study use those funds to support their undergraduate research experiences, thereby gaining help with educational expenses and a valuable research opportunity at the same time. Neil Fitzgerald takes us into the strange new world of fundraising on the internet in "Crowdfunding Undergraduate Research Projects." He shares his own experiences with a site devoted to undergraduate research funding, as well as offering some very useful tips for avoiding common pitfalls associated with the myriad choices available to us. Many of us may be at institutions that are participating in similar fundraising efforts specific to higher education. My institution, for example, participates in <http://useed.org/>. This type of fundraising is changing so quickly it is both exciting and intimidating to new users; Fitzgerald's article offers great advice for those new to this approach.

Candace Rypisi and Michael Bergren provide a thorough description of establishing a privately endowed fund to support undergraduate research, outlining a pathway to what is probably the ultimate goal for all of us in "Endowing

Undergraduate Research to Ensure Growth and Stability," featured in this issue of *CUR Quarterly on the Web*. In addition, Martina Giselle Ramirez and colleagues at Loyola Marymount University outline several approaches they have used that build on partnerships and co-funding across and beyond the university's boundaries in "Creative Funding Strategies for Undergraduate Research at Loyola Marymount University."

Shorter pieces in the print edition and in *CUR Quarterly on the Web*—presented by Catherine Jean Batsche of the University of South Florida, Scott Cooper of the University of Wisconsin-La Crosse, Herbert Hill of Virginia Commonwealth University, and Kristi L. Haik of Northern Kentucky University—share strategies for raising funds and leveraging partnerships that have been proven to strengthen campus undergraduate research opportunities while also building alumni networks, relationships with community supporters, and collaborations with other campus units such as admissions and financial aid.

We hope that you will find this issue of value as you strengthen your campus's efforts to build robust and sustainable undergraduate research opportunities accessible to all students. 

Janice DeCosmo

University of Washington
CURQ Issue Editor

Martina Ramirez, Joseph McNicholas, Brianne Gilbert, Jose Saez, Matthew Siniawski, *Loyola Marymount University*

CUR Focus

Creative Funding Strategies for Undergraduate Research at a Primarily Undergraduate Liberal Arts Institution

As peer-reviewed research has shown (Elrod et al. 2010), involvement in a faculty-mentored culture of inquiry concerned with authentic, real-world questions, issues, or ideas can be a transformative experience for students. Given this fact, since 2009, students at Loyola Marymount University have had access to a range of programs to facilitate their engagement in scholarly research and creative activities. These include the Undergraduate Research Opportunities Program, the Summer Undergraduate Research Program, and the Undergraduate Research Symposium. Especially since the establishment of the Office of Undergraduate Research in 2012, participation in these programs has grown substantially, with approximately 10 percent of all undergraduates participating in these programs during academic 2013-2014.

As on any campus, scholarly research and creative work at LMU encompass an array of academic activities, the mix of which varies by disciplinary area. In the biological sciences, where understanding the natural world is the focus, undergraduates work in the laboratory and/or in the field, and generally conduct experiments or other data-gathering activities, followed by statistical analysis of results and the preparation of research results and conclusions for public presentation. In contrast, in engineering, where the primary goal is creation of “cost-effective solutions to practical problems by applying scientific knowledge to building things” (Shaw 1990), student work will often involve the development and prototyping of a solution, with the laboratory being used as a locale to gather experimental data needed for the validation and improvement of the solution, prior to communicating project outcomes to relevant stakeholders. Finally, in the social sciences, where understanding the human experience is the focus, students are likely to engage in a wide range of qualitative and quantitative methods of data gathering, from conducting surveys to performing database searches, prior to the analysis of research findings and the formulation of potential societal implications/recommendations for dissemination.

To support the extensive work underway across disciplines, LMU faculty members have been exploring a number of non-traditional mechanisms for gaining external support. Here we will explore how individuals cultivated partnerships with industry to support labs, leveraged interest in special events to raise funds, and engaged in contract work to provide students with practical experience.

Cultivating Industry Partners

In 2011, LMU renovated a fluid mechanics laboratory with support from federal funding and donors. The new James E. Foxworthy Fluid Dynamics Laboratory consists of 2,000 square feet devoted to experiments in fluid mechanics and hydraulics, and includes additional laboratories in materials science, thermodynamics, rapid prototyping, engineering design, hydrology, and a computer station for numerical modeling in computational fluid dynamics. The new laboratory has offered faculty members, industry representatives, donors, and students a chance to interact with each other in the new space while discussing the laboratory courses and applied research that both faculty members and undergraduate students can conduct. For example, a local firm that manufactures sensors that measure water levels in tanks became interested in using the laboratory’s open channel facilities to test new sensors it was developing to measure flow in open channel weirs and flumes.

Working with a faculty member in mechanical engineering, a partnership developed that involved testing the prototype sensors under different hydraulic conditions by following carefully designed testing protocols that satisfied the company’s specifications. Five undergraduates were involved in the effort, and a report summarizing the results was submitted to the company. Funding was made possible through a \$10,000 in-kind gift from the company, which was later increased by approximately \$3,000, plus donations of equipment (estimated at \$5,000). A new undergraduate team is currently preparing for a new phase of testing, which may result in additional long-term opportunities with the company.

This project not only helped undergraduate engineering students learn the techniques and methods used in testing protocols, it also exposed them to the role of engineering within a competitive business environment, which will be an invaluable experience for our job-seeking graduates. The real-world learning opportunity for our students significantly enhanced their skills, understanding, and confidence, leading to the production of considerable undergraduate research. Within the past two years, the same weir and flume facilities have been used to generate one conference paper, two conference presentations, and four conference posters with undergraduates, and one conference paper and poster with graduate students. A paper for a top research journal also is currently being completed.

Leveraging Special Events

The Thomas and Dorothy Leavey Center for the Study of Los Angeles, led by a faculty member in political science, has been extremely successful in fostering donations, contracts, and other forms of support through hosting an annual event that attracts a great deal of attention in the region. The center has long relied on funding from multiple sources, including university support, private donors, contracts, and sponsorships for its signature public events.

The center has successfully employed traditional funding strategies such as applying for grant funds by responding to funders' requests for proposals (RFPs). In addition, many other opportunities for funding have been explored using non-traditional methods. For example, the center at one time engaged in contract work, though it ultimately decided that this model did not work well for the kind of research staff members wished to conduct. Staff members felt that maintaining academic integrity was essential to fulfill the center's public-spirited mission, but found that difficulties arose in doing so. First, sponsors asked the center to modify the phrasing of survey questions in ways that would have led to longitudinal inconsistency and/or misleading results. Second, the center was asked to withhold publication of unflattering results. Although troubling, these experiences were extremely important for staff members and students because they provided real-world insights into some of the methodological and ethical challenges of social science research.

As a result, the center sought alternative funding methods to maintain control over the entire scope of its work. In the last decade the center successfully applied for several grants, bringing in over \$350,000. In addition, over the last five years the center has solicited funds from a variety of companies and individuals, securing nearly \$500,000 more to support its programs.

One of the signature events hosted by the center is Forecast LA, an annual conference that explores the civic and economic concerns, cultural identities, and levels of satisfaction of residents and leaders in the Los Angeles region. As part of the center's approach to forecasting, it conducts two outlook surveys: a telephone survey of adult residents in Los Angeles County and face-to-face interviews with a set of LA County leaders. Forecast LA is sponsored by dozens of corporations, municipal agencies, and other organizations, and it places LMU at the center of a vibrant community committed to a better future for Los Angeles.

At Forecast LA, joint presentations by both seasoned researchers at the center and undergraduates provide a compelling way for the funders to see what their money is supporting. This connection is also beneficial for the students because

not only do they get valuable research experience and public speaking practice, but they also build up a network of connections that have proven valuable when they look for internships and jobs. After several cycles in which the center reached out to funders and then conducted and disseminated accurate and well-respected research, many companies have begun to put line items in their budgets to provide annual funding for Forecast LA, allowing center staff members to focus their efforts on securing new funding while continuing to maintain relationships with past funders.

Contracts and Service-Learning Opportunities

In addition to partnerships and event-based sponsorships, a third non-traditional approach employed at LMU involves securing contracts grounded in work by undergraduates. The renovation of the Foxworthy Labs described above provided an opportunity to partner with local industry, but it also heightened the capacity to conduct contracted research work for local municipalities as well. Two faculty members in civil and mechanical engineering combined their expertise in computational fluid dynamics (CFD) and in wastewater treatment to approach a major local agency seeking to perform CFD research on disinfection reactors at two major treatment plants that the agency operates. Funding for the project was possible through a two-phase contract totaling \$42,000. Though the agency could have hired a consulting firm at a much greater cost, it chose to build a partnership with LMU and expand its long-term relationship with one of LMU's faculty members. The contract specified that the project was to be treated as a research project in which the agency obtains the results, with LMU retaining the rights to conduct research and disseminate the results while working closely with the agency to accommodate its needs.

Contracts for student work have been particularly helpful in supporting senior capstone projects in mechanical engineering. Since the 2011-2012 academic year, industry-sponsored projects based on the Harvey Mudd Clinic Program, which has student teams complete industry-sponsored engineering projects (Bright 1994), have been offered on a scale that matches the resources and learning outcomes of LMU's mechanical engineering program. The mechanical engineering department worked with LMU's Office for Research and Sponsored Projects to create a sponsorship package; industry sponsors provide a \$2,500 donation to cover the costs of prototype fabrication. Industry-sponsored projects are primarily obtained through faculty members' relationships with alumni and with individual companies.

During academic 2012-2013, service-learning projects were also offered. The benefit of service-learning in engineering has been well documented (see Barrington and Duffy

2010), and many programs are exploring ways to offer such experiences for their students. The projects at LMU involve designing assistive devices for children with disabilities in partnership with Westside Innovative School House, a public K-8 charter school dedicated to providing an inclusive educational environment for all children (Siniawski et al. 2014). The student engineering teams submit their projects to the Rehabilitation Engineering and Assistive Technology Society of North America’s annual Student Design Competition. Funding support for these projects comes from the mechanical engineering department and through alumni and industry donations.

The ideal mixture of projects from the student design competition, industry-sponsored projects, and service-learning opportunities for LMU’s mechanical engineering program is best represented by the 2012-2013 academic year (see Figure 1). The majority of the funds available are spent to fabricate the design prototypes. In addition to departmental support, industry donations are mostly obtained through ongoing personal relationships between individual faculty members and alumni and contacts with local companies. Sponsors of current projects and alumni are invited to attend the design-project reviews in order to foster relationships with these partners.

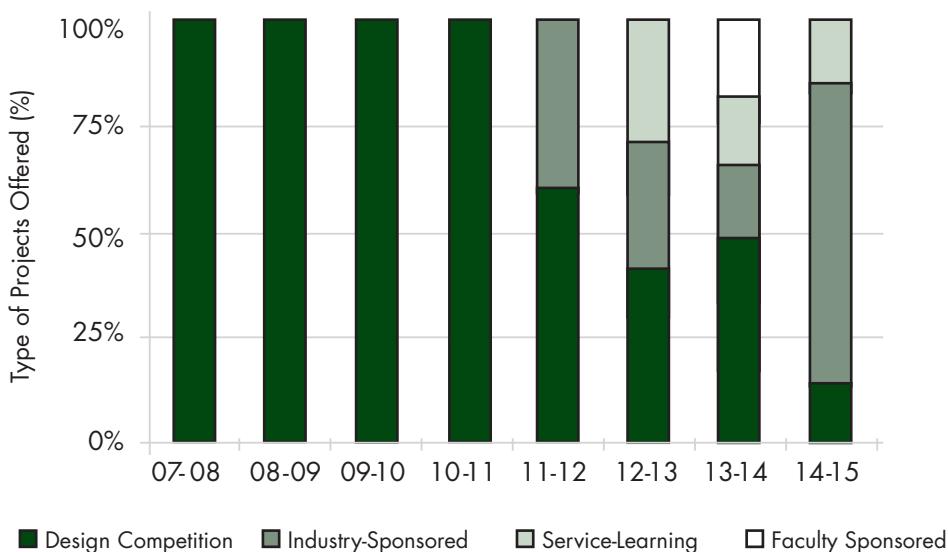
Lessons Learned

Our interest in developing outstanding undergraduate research projects has made us more aware of the needs of our


funders, and that in turn, benefits our students. For students and faculty members alike, there’s a tremendous benefit in generating new knowledge within a context that involves multiple partners, perspectives, and team dynamics. In these ways, in addition to supporting the research itself, the less-traditional sources of funding help our students to discern the social, ethical, political, and personal value of their intellectual labors. And we have found our partners very willing to understand the needs of our educational institution. Involving students in defining a course of work that embodies scientific integrity while meeting specific real world needs is a tremendous learning opportunity for everyone concerned.

As faculty members’ funding needs move beyond a standard grant proposal, the Office for Research and Sponsored Projects has worked with the university’s risk manager to draft new kinds of contracts that help create a legal framework for our partners. Our contracts with external agencies and funders include all the standard clauses one would expect to see regarding insurance, liability, and scope of work and period of performance. In addition, our communications with external sponsors make it clear that the contract is for both educational and business purposes. We clarify all parties’ expectations about intellectual property in our contracts, and where appropriate, include nondisclosure agreements. It is also important to clarify circumstances under which external sponsors may have access to use our facilities, as well as when and how our faculty members and students will have access to theirs. In short, the contracts attempt to spell out as clearly as possible the rights and responsibilities of all parties to promote a productive partnership.

Figure 1. Types of Senior Capstone Design Projects Offered Annually, Mechanical Engineering Program



Similarly, the university’s Office of Corporate and Foundation Relations has often contributed to non-traditional fundraising efforts. The office encourages wide-ranging collaborations that include traditional philanthropic giving opportunities (such as for scholarships and capital improvements) and also assist with research alliances. Personnel have been helpful in identifying partnership opportunities and introducing corporate and foundation personnel to university faculty members and leaders. Knowledge gained through these partnerships enhances the LMU community’s understanding of corporations’ and foundations’ strategic goals and missions and has been invaluable.

Finally, we have learned that nothing replaces the personal knowledge and networks of faculty members. Their engagement with alumni, with business firms and agencies, with trends in their fields, and with the kinds of learning projects that would benefit their students are the factors that most guarantee successful support for students. 

References

- Barrington, Linda, and John Duffy. 2010. "Maximizing Benefits of Service-Learning in Engineering." American Society for Engineering Education (ASEE) Annual Conference and Exposition. Louisville, Kentucky.
- Bright, Anthony. 1994. "Teaching and Learning in the Engineering Clinic Program at Harvey Mudd College." *Journal of Engineering Education* 83(2): 113-116.
- Elrod, Susan, Diane Husic, and Jillian Kinzie. 2010. "Research and Discovery Across the Curriculum." *Peer Review* 12(2): 4-8.
- Shaw, Mary. 1990. "Prospects for an Engineering Discipline of Software." *IEEE Software* 7(6): 15-24.
- Siniawski, Matthew T., Jose A. Saez, Jeremy S. Pal, and Sandra G. Luca. 2014. "Creating Learning through Service Opportunities for Engineering Students: Lessons Learned from a Primarily Undergraduate Liberal Arts University." *International Journal for Service Learning in Engineering* Special Issue on University Engineering Programs That Impact Communities: Critical Analyses and Reflection: 240-255.

Martina Giselle Ramirez

Loyola Marymount University, martina.ramirez@lmu.edu

Martina Giselle Ramirez is special assistant to the provost for technology-enhanced learning and professor of biology at Loyola Marymount University (LMU), Los Angeles, CA. She received her BS in biology from LMU and her PhD in biology from the University of California, Santa Cruz. Prior to LMU, Ramirez taught at Pomona College, Bucknell University, Denison University, and East Stroudsburg University. Ramirez received the Rudinica Award for Student-Faculty Research from LMU's Seaver College of Science and Engineering (2012), as well as a Biology Mentor Award from the Council on Undergraduate Research (2013).

Joseph McNicholas is director of the Office for Research and Sponsored Projects at Loyola Marymount University. He holds a doctorate and an MBA and presents at conferences and publishes regularly on research administration at predominantly undergraduate institutions. His most recent, co-authored work providing guidance for administrators is Establishing and Managing an Office for Sponsored Programs at Non-Research Intensive Colleges and Universities (NCURA 2014).

Brianne Gilbert is the associate director of the Center for the Study of Los Angeles at Loyola Marymount University. Since joining the center, Gilbert has worked on dozens of studies involving voter polls, public-opinion research, and surveys of leaders/elites. Although her specialty is quantitative methodology and analysis, she oversees all phases of the research process and has been a principal investigator on a number of projects. She has presented at regional and national conferences in sociology, anthropology, GIS (geographic information systems), education, and public-opinion research and has served as a consultant in those areas, as well as in international affairs, geology, and medicine. In addition to her work at the center, Gilbert currently teaches the Introduction to GIS course at LMU. She received her BA from Wittenberg University and her MA from Florida International University, both in sociology with emphases on methodology and statistics.

Jose A. Saez is an associate professor in the Department of Civil Engineering and Environmental Science at Loyola Marymount University. He teaches engineering courses in fluid mechanics, open channel hydraulics, water resources, water and wastewater treatment, and introduction to engineering. Saez conducts applied research in open channel hydraulics, hydrology, contaminant transport, and water and wastewater treatment. He also emphasizes the importance of engineering education and the application of engineering concepts in community service projects. Saez has BS and MS degrees in civil engineering from LMU, and a PhD from UCLA in civil engineering with emphasis on environmental engineering. Prior to joining LMU, Saez worked for sixteen years as a civil engineer with the Los Angeles County Sanitation Districts. Saez received the 2013 Rudinica Award for Teaching and Mentoring. He is also a registered civil engineer in California and consults on a part-time basis.

Matthew T. Siniawski played an instrumental role in the revitalization of the senior capstone design program for mechanical-engineering students at Loyola Marymount University, and has advised more than 40 different student capstone project teams since 2004. He has served as a principal investigator on four grants and contracts and published a total of 19 technical journal articles and proceedings and 11 industry reports and magazine articles. He has won more than \$360,000 in grants, contracts, and capstone project sponsorships. He is an active proponent of reform of engineering education and data-driven pedagogical innovation, including service learning and project-based learning and how they impact the technical and professional development of engineering undergraduates. Siniawski received his BSME from Illinois Institute of Technology and his PhD from Northwestern University in mechanical engineering.

CUR Focus

Leveraging Federal Work-Study to Support Undergraduate Research

The “Students as Scholars” initiative at George Mason University is designed to give undergraduate students an opportunity to participate in research and creative activities within and beyond the classroom. Traditionally, students apply for funding through the Office of Student Scholarship, Creative Activities and Research (OSCAR), which runs a competitive grant-proposal process for independent projects and supports a limited number of students with advanced projects each semester. To expand support to more students, we became more innovative in seeking funding sources for undergraduate research. Based on our assessment, we found that Federal Work-Study funding was being underutilized at Mason and that students who work to pay for college are more likely to work off-campus and are thus less likely to be engaged in enriching academic experiences. Given this, we collaborated with the Office of Financial Aid in spring 2013 on a pilot program using Federal Work-Study funds to support undergraduate research assistantships.

This program expanded opportunities for students to be introduced to the concept of scholarship and to learn the research or scholarly methods in their fields while keeping them engaged on campus. Faculty members were given “free” research assistance, with the understanding that they would involve students in research discussions and regularly evaluate them. In the past two years, we have offered 149 positions and placed 95 students in OSCAR Federal Work-Study Research Assistantships (OSCAR RAs). Here we explain the complexities of utilizing this funding source, discuss the development of a strategic partnership, demonstrate how to overcome some of the challenges that are inherent in creating a program such as this, and discuss the lessons learned from two years of implementation.

George Mason University is a public university with high research activity located in Fairfax, Virginia, less than 10 miles from Washington, D.C. More than 198 degree programs (81 of them undergraduate) serve a population of more than 33,700 students (21,672 of them undergraduates), including a significant number of transfer students. Reflecting the diversity of the capital region, fewer than half of our undergraduates identify themselves as white; 14 percent identify themselves as Asian, 9 percent as African American, 10 percent as Hispanic, and 12 percent as other or from two or more backgrounds (or unknown). Despite the location in an affluent region, 57 percent of Mason students receive financial aid (Office of Institutional Research and Reporting, George Mason University 2014).

In 2010, Mason developed a quality-enhancement plan (QEP), titled *Fostering a Culture of Student Scholarship*, for its reaccreditation by the Southern Association of Colleges and Schools (SACS). It outlined a new university-wide initiative, also known as Students as Scholars, to give undergraduates an opportunity to participate in research and creative activities. Student scholarship is specifically defined as the process of generating and sharing knowledge or creative works, and it includes undergraduate research and creative activities. The three major goals of the Students as Scholars QEP are to develop the infrastructure to support student scholarship, increase opportunities for scholarly inquiry, and enhance the awareness and visibility of scholarship at Mason (Eby and Usher 2014).

OSCAR supports student scholarship and is the home to Mason’s Students as Scholars initiative. OSCAR transforms the undergraduate experience by connecting students to the research and creative mission of the university and to faculty members. The initiative supports individual research opportunities, supports student travel to report on their research, promotes curricular integration of research projects, and sponsors celebrations of undergraduate research. Our core values include inclusiveness, collaboration, innovation, and an orientation toward supporting the student and faculty experience. Students are exposed to increasing levels of engagement, beginning with the discovery of scholarship, moving through scholarly inquiry, and culminating with the creation of a scholarly or creative project (Figure 1).

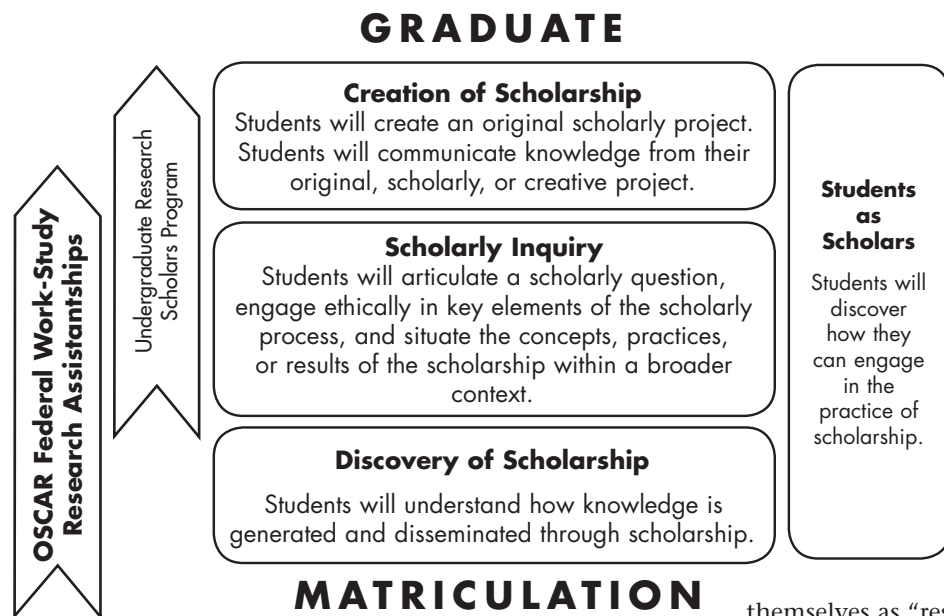
Since December 2011, more than 10,000 undergraduates have participated in at least one OSCAR activity, and more than 1,000 have conducted original scholarly work. Due in part to the success of our programs, scholarship is valued as a core characteristic of the university’s vision for “The Mason Graduate” (George Mason University 2014). Student scholarship is certainly on track to become pervasive across campus.

The Students as Scholars initiative scaffolds students’ learning outcomes related to undergraduate research. The OSCAR Federal Work-Study Research Assistantships are intended to meet the “discovery” and “scholarly inquiry” levels shown in Figure 1.

The Problem

In their report, *Developing Undergraduate Research and Inquiry*, Healey and Jenkins (2009) suggest that some form of research exposure should be made available to all undergraduate

Figure 1. Scaffolding of Students as Scholars Initiative



students who would typically participate in research or creative activities because they have been prepared for this top level of engagement through past coursework and direct experience.

However, despite an increase in the number of applications, the URSP has not made significant impacts on students who did not already see themselves as positively inclined toward participating in research. Our assessment showed that Mason needed to find creative ways to give students who had, because of their academic and economic backgrounds, few opportunities to engage in research and who did not enter Mason envisioning

themselves as “researchers.” Students as Scholars is committed to the value of the undergraduate research experience for all students, especially because research indicates that the greatest gains from involvement in research or creative activities develop among those students who are ill-prepared (Gregerman 2009).

We knew from the results of our administration of the National Survey of Student Engagement that students who work to pay for college are more likely to work off-campus and are thus less likely to be engaged in enriching academic experiences (Office of Institutional Assessment, George Mason University 2010, 2013). Thus it has been a priority over the past five years to find additional ways to get economically at-risk students jobs on campus. OSCAR wanted to give these students an opportunity to learn about research at the discovery and inquiry levels without expecting that they would necessarily conduct independent research at the level of creation of scholarship.



Jose Aguiamatang, OSCAR RA, presents his research on music and memory at the Summer Celebration for Student Scholarship, August 7, 2015.

students and that special experiential opportunities be offered to select students. Research demonstrates that involving undergraduates in scholarship better prepares them for their career goals and advanced study (Association of American Colleges and Universities 2007; Russell, Hancock, and McCullough 2006; Hart Research Associates 2015; Osborn and Karukstis 2009).

The Students as Scholars initiative adopted this thinking in our student-learning outcomes, where it is expected that a modest number of students will actually be involved in conducting original scholarly work (the “creation of scholarship” level in Figure 1); that a substantial number will be impacted by curricular innovations in terms of “scholarly inquiry”; but that the majority of students will acquire an awareness of scholarship (“discovery of scholarship”). All students will have an understanding of the opportunities that are available to them at Mason as outlined in Figure 1 (Usher, Eby, and QEP Planning Committee 2011). The intention of our tiered learning outcomes is that we introduce all students to research, and offer all interested students the opportunity to participate in a research or creative activity while at Mason.

In our original plan, we used university resources (state funding) to establish our competitive Undergraduate Research Scholars Program (URSP), designed to give select undergraduates an opportunity to conduct independent research and/or undertake creative activities under the guidance of a mentor. The goal has been to support a limited number of students (currently 140 to 160 annually) who are at the “creation of scholarship” level, targeting students who are capable of creating and communicating knowledge from an original, scholarly, or creative project. We have found that the undergraduates who win funding through our office are

The number of faculty members mentoring students at Mason was also a concern, as only a portion of faculty members worked regularly with undergraduates. Mason's departmental survey revealed that some on the faculty were not confident that undergraduates had the ability to "do research" at the highest level. Limited funding meant that new faculty, term instructors, and faculty in non-STEM (science, technology, engineering, and mathematics) fields did not have the funds to support undergraduates' research, especially for pilot projects (Hazel and Usher 2014). Yet our commitment to creating a culture of undergraduate student scholarship cannot be realized without faculty members' involvement; they are essential to our ability to carry out the goals of the Students as Scholars initiative.

The Solution

To address the concerns about inclusiveness and faculty mentoring, OSCAR looked for additional ways to support undergraduate research and discovered, as noted above, the opportunity to utilize Federal Work-Study (FWS) to pay students as research assistants (Troppe 2000; Kinkead 2003b; Danovitch, Greif, and Mills 2010). The purpose of the FWS program is to promote part-time employment of undergraduates who need earnings to pursue postsecondary education. The positions are to "complement and reinforce the educational program or vocational goals of each student receiving assistance," and research assistantships are specifically included (Grants for Federal Work-Study Programs 2010). Programs at the University of Michigan and University of Delaware have shown positive retention and academic achievement for students participating in undergraduate research for either academic credit or for work-study pay (Gregerman 1999; Hathaway, Nagda, and Gregerman 2002, Henry and C&EN Washington 2005). Other universities (including Harvard University, Northwestern University, the University of Virginia, and the University of Southern Florida) offer students the opportunity to use work-study to support research projects, but none have created a specific program to recruit, support, and assess a research-focused work-study program. Given the mission of this federal program and evidence of its success when used for undergraduate research assistants, OSCAR decided to design a FWS program aligned with the mission of the Students as Scholars initiative at Mason.

Students' eligibility for work-study funds is determined using the Federal Application for Federal Student Aid and is based on a federally mandated formula used to calculate "demonstrated financial need"—defined as the difference between the cost of attendance (tuition, books, living expenses) and

expected family contribution (Information for Financial Aid Professionals 2013; Perna, Cooper and Li 2006). FWS is one element of a financial aid package, which may also include grants, scholarships, and loans.

With scholarship valued as a core characteristic of the university's vision for "The Mason Graduate" (George Mason University 2014), OSCAR staff met with the Office of Financial Aid to see if this program could be used to create an innovative OSCAR research-assistantship program. Our request was met with enthusiasm. Mason was underutilizing our federally allocated FWS funding, and the financial aid office was eager to develop new programs that aligned with students' academic goals. OSCAR and the Office of Financial Aid piloted the OSCAR Federal Work-Study Research Assistantship (OSCAR RA) program in spring 2013.

The research assistantships expanded opportunities for students to be introduced to the concept of scholarship at lower levels of engagement (discovery and inquiry); to learn the research or scholarly methods in their fields; and to keep them engaged on campus. This program is intended to benefit both students and faculty members in that (1) students are given the opportunity to be involved in the research environment at Mason and gain insight into the process of research while learning skills that make them more successful as students, and later as professionals, and (2) at no cost to the faculty member or department, faculty are given "free" research assistance, with the understanding that they fully involve students in their research teams and regularly evaluate them.

Details of the Research Assistantships

Students eligible for work-study are allotted an award in their financial aid packet for the academic year that may only be earned through employment on campus or in approved positions off-campus (Information for Financial Professionals 2013). Mason students are typically allocated \$2,500 for the academic year. In the OSCAR positions, students earn \$8.00 an hour, equivalent to working 312 hours an academic year or about 10 hours a week. The financial aid office contributes the federally allotted share, which is 75 percent of the student's award, and OSCAR covers the remaining 25 percent. As the goal was to encourage new students and faculty members to participate, OSCAR decided to reallocate funding that could potentially have been used to expand the Undergraduate Research Scholars Program (URSP), shifting it to the work-study research assistantship program to make the program free for faculty. Thus, OSCAR budgets approximately \$625 per student per year, which means that we can fund three work-study research assistants in place of one

URSP student.

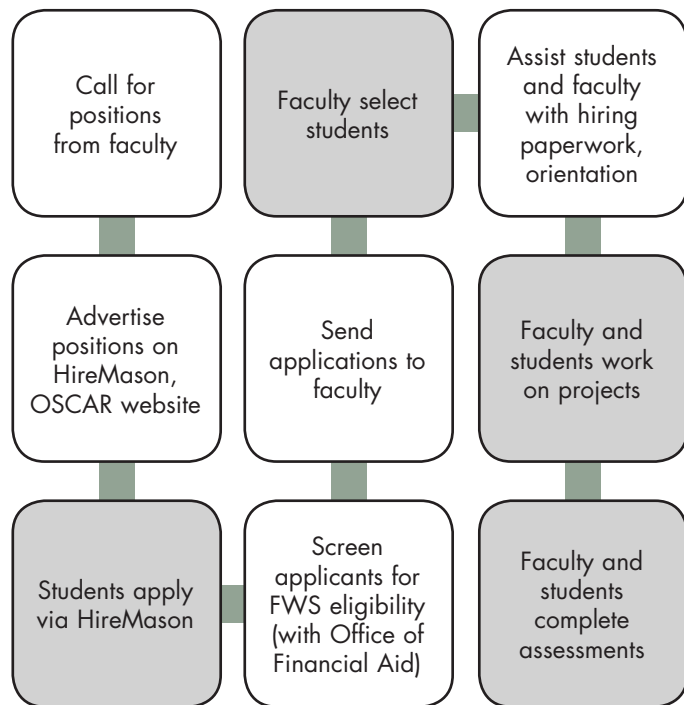
For our pilot program in spring 2013, author Nazaire, then OSCAR's graduate assistant, was charged with creating the procedural model and coordinating the research-assistantship program (Figure 2). The first step was to create a broad selection of research assistantships. OSCAR created a webpage to publicize the program and recruited mentors through OSCAR newsletters, department chairs, and word-of-mouth. Faculty members interested in offering positions were asked to write easily understood descriptions of their research projects and to identify suitable student characteristics (majors, skills, etc.). After receiving requests for the assistantship positions, the coordinator posted the available positions on Mason's career- services platform, HireMason, to reach interested students.

The next step in this model was hiring the students. After applicants were screened by the financial aid office to establish their eligibility for work-study funds, OSCAR forwarded the applications of eligible candidates to faculty members to be considered for employment. Faculty members had com-

plete autonomy to review eligible applications, interview students, and choose their assistants. Once those decisions were made, the faculty members informed the OSCAR office. OSCAR then coordinated with human resources personnel to streamline the hiring procedures; students met individually with our work-study coordinator for assistance in filing the required paperwork and securing appropriate personal identification.

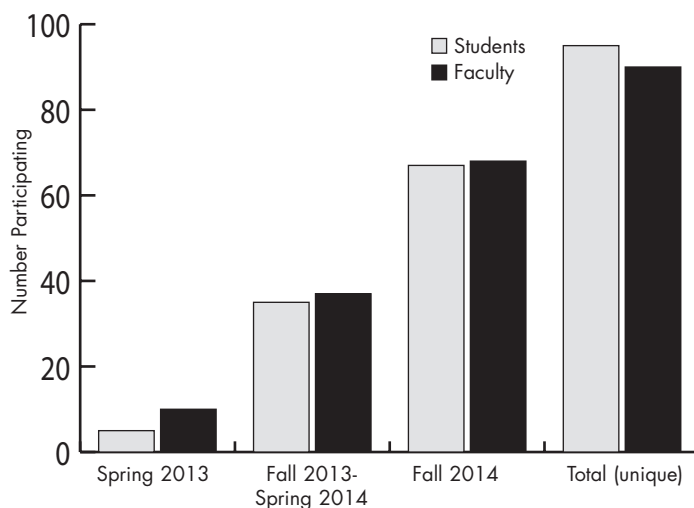
Assessment of the program happens every semester. OSCAR research assistants complete the OSCAR Student Survey (Hazel and Usher 2012) at the end of each semester. The goal of the survey is to track student participation and experiences in undergraduate research and creative activities, and to measure program and student outcomes over time as part of a longitudinal study of student learning. Students also answer a series of practical questions (administered through SurveyMonkey) about their experience and their plans for the future, including their intention to either graduate, continue with the OSCAR research assistantship, seek another work-study position, or not continue with work-study. Faculty mentors are similarly polled at the end of each semester to find out their interest in continuing in the program and with their OSCAR research assistant. Mentors also assess their students on the Students as Scholars student-learning outcomes using the initiative's program rubric (George Mason University 2013). These data are used to determine the research assistants' placements for the following semes-

Figure 2. Processes for Federal Work-Study Research Assistantships Program*



*White boxes indicate actions of undergraduate research office; gray boxes indicate student/faculty activities.

Figure 3. Number of Participating Students and Faculty in Research Assistantship Program*



*Note: The total counts each individual once, even if some participated over multiple semesters; it is not a sum of the annual numbers.

ters, as well as to evaluate the program as a whole and make adjustments as needed.

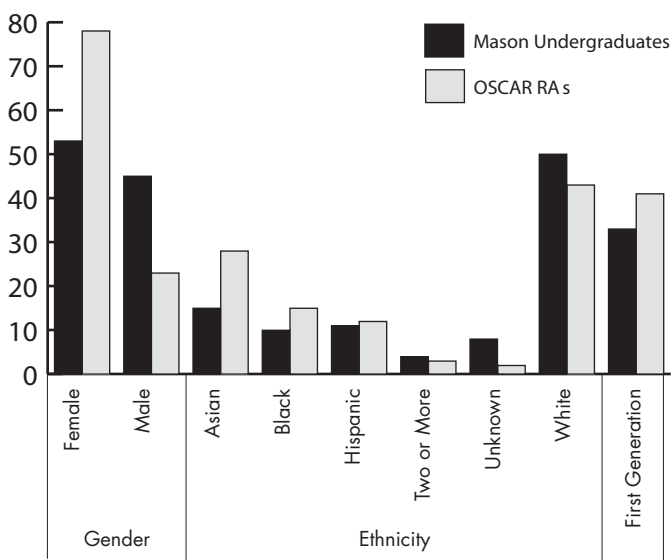
Outcomes

Since our pilot in spring 2013, the OSCAR RA program, as noted above, has offered 149 positions and successfully placed 95 students in research assistant positions. Our program has grown from five students in the pilot semester to 36 students in the second academic year to approximately 66 students participating in fall 2014 (Figure 3).

Of the 95 students who have participated in this program, 81 (85 percent) had never before participated in a research project or creative activity at Mason.

The participation of economically disadvantaged students in undergraduate research has been associated with increased student retention (Nnadozie, Ishiyama and Chon 2001). At Mason, first-year freshman cohorts have an annual retention rate of 87.5 percent and full-time undergraduate transfer cohorts have a retention rate of 85.3 percent (Brown Leonard and Smith 2013). As the RA program is young, we can only measure semester over semester persistence. Across three academic years, OSCAR data indicate a 98 percent combined retention/graduation rate (students who either continued enrollment or graduated with bachelor's degree the semester following their research assistantship). Additionally, 21 (50 percent) of the first two years' OSCAR RAs continued in their positions for two or more semesters and/or persisted to

Figure 4. Demographic Comparison of Research Assistants and All Mason Undergraduates*



*Note: Office of Institutional Research and Reporting, George Mason University, fall 2014 student cohort.

Table 1. Factors Cited as Motivating Participation in Research Assistantships, By Percentages of Respondents

Moderate, 25-74 percent	Highest (>75 percent)
Meeting other students who have similar interests or goals	Being excited by or loving the work
Working on a project that might contribute to individual or community well-being	Gaining experience for career or graduate school
Being required by my academic major or program	Receiving compensation or pay
Earning RS (Research and Scholarship Intensive) designation on my Mason transcript	Working on a specific project of interest
	Working with a specific faculty member

graduation. It appears that OSCAR RAs have a higher retention rate than their peers, although at this point we do not have enough data to determine if this is due to the characteristics of the students who choose to participate or because of the program itself. Over time, we will track the research assistants to see if they continue to re-enroll and graduate at a higher rate than their peers and to better understand the role of the program in their success.

Our data show that even though we are exclusively targeting financially needy students, we are offering opportunities disproportionately to women, first-generation, and minority-group students (Figure 4). Undergraduate research can benefit not only economically disadvantaged students but also those who have other diverse backgrounds (Kinkead 2003a), by increasing their awareness of academic and career options and their understanding of the research process (Russell, Hancock, and McCullough 2006). OSCAR RAs closely reflect the proportions of students at various levels (freshman, sophomore, junior, senior) and the majors of Mason undergraduates over all. However, when compared to Mason undergraduates, Asians, blacks, and females are overrepresented in the OSCAR RA program, while white and male students are underrepresented. Forty percent of the OSCAR RAs are first-generation college students, while these students are only 33 percent of the overall Mason undergraduate population. OSCAR RAs are economically disadvantaged and a very diverse group.

Many students work to pay for the cost of a college education (Perna, Cooper, and Li 2006; King 2002), and assessment of our students shows that receiving compensation was a factor motivating them to apply for the research assistantships. However, students were motivated by many factors. (Table

1). OSCAR RAs also exhibited positive attitudes about their experiences. Most students felt that participating in a research or creative activity not only improved their academic experience and could help them become better professionals but also that the creation or discovery of knowledge was personally rewarding (Table 2).

In the survey above, students were asked to check all factors that motivated them to apply and participate in a research assistantship. No factor was cited by fewer than 25 percent of respondents.

OSCAR RAs perceive their experience in the program as contributing to their ability to understand the research or creative process in their field (cited by 71 percent), to understand how research is relevant to what they are learning in

Table 2. Research Assistants' Attitudes Toward Research*

Attitudes	Strongly Agree/ Agree	Disagree/ Strongly Disagree
Participating in research or creative activities improves the academic experience	100	0
Participating in the creation or discovery of new knowledge is personally rewarding	97.4	2.6
I take pleasure in learning about a subject in-depth	97.4	2.6
Being involved in research or creative activities can help me become a better professional in my field	97.4	2.6
I enjoy learning about people and experiences that are different from my own	97.3	2.7
Learning about research or creative works makes me more curious about the world	94.8	5.2
Advances in research can solve real-life problems	94.7	5.3
Learning about proper research methods and techniques is a valuable use of time	94.7	5.3
It is fun to work on problems that cannot be easily solved, or that take a long time to solve	94.7	5.3
Laws and policy decisions should be based on research findings	92.1	7.9
Professors who do their own research or creative works make better teachers	86.8	13.2
Most research focuses on problems that are too insignificant to really mean anything	15.8	84.2
Helping a professor with her/his research would be a waste of my time	7.9	92.1

*Student responses to selected questions from the OSCAR Student Survey after the first semester of participation (N=40).

their classes (71 percent), and to understand the difference between personal beliefs and evidence in supporting a position or drawing conclusions (79 percent). This correlates with faculty members' assessment of students' learning in their research assistantships. Seventy-nine percent of OSCAR RAs were rated as proficient or better by their faculty mentors in competencies associated with the discovery of scholarship, and 77 percent were rated similarly in competencies related to scholarly inquiry.

These findings highlight the ability of the OSCAR RA program to serve as a form of disciplinary socialization (Healey and Jenkins 2009). The most unexpected outcome, however, was that 34 percent of students were rated by their mentors as being able to "take responsibility for executing a project" at an advanced level normally associated with the creation of scholarship, and fully 53 percent were considered as at least proficient on this measure. This finding suggests that although the program was aimed at lower levels of engagement, students are developing skills that indicate they are able to understand the scholarly process and make significant contributions to research.

Faculty involvement in the OSCAR RA program has increased from 9 faculty members in spring 2013 to 67 faculty members offering research assistantships in fall 2014. Of the 90 individual faculty members participating, 25 had previously mentored undergraduates; the remainder (72 percent) were new to OSCAR. Most faculty members represented disciplines within the College of Humanities and Social Science and the College of Science, Mason's largest colleges, but mentors represent seven of the eight units with undergraduate programs, and also come from research institutes, university-life units, and administrative areas. Our data also show that faculty at all levels (assistant, associate, and full professors, as well as administrative and research faculty) have hired OSCAR RAs, and the majority of these faculty members are in tenured or tenure-track lines.

While the reasons for mentoring undergraduates vary (Temple, Sibley, and Orr 2010), faculty participating in this program indicated that students are thoughtful members of their research teams and have made important contributions to their research. They were impressed with students' abilities to understand the research process, ask relevant questions, and interpret data.

Lessons Learned

After two years of implementation and responses to assessment, including student and faculty feedback, OSCAR personnel offer the following advice that may be useful to any

undergraduate research office in implementing similar research assistantships.

1. Work-study programs are implemented locally, vary by university, and can be more flexible than first assumed. Establish a positive working relationship with the financial aid office and use their expertise in implementing your program.
2. Faculty and students will be more inclined to be involved (and recruit others) when the process is easy. Identify a single point-of-contact in the undergraduate research office who can handle the administrative aspects and mediate among other campus units, including those dealing with financial aid and human resources.
3. Faculty members appreciate being able to hire students they believe fit their positions. Pre-screen applications for students' eligibility for work-study and other basic qualifications, and then allow faculty to interview and select their own research assistants.
4. The program will sometimes draw students who are not qualified for federal work-study funds. Encourage these students to contact mentors to see if other grant funding, volunteer, or credit opportunities are available on the project.
5. For some students, their RA position serves as their first work experience, and while they may be intellectually well-prepared for the work itself, they may be unprepared for the "work culture." Provide instruction on professionalism in both an academic and work environment, which can come in the form of one-on-one meetings with the work-study coordinator, an orientation session, and/or a handbook. We use these as opportunities to discuss professional attire, timeliness (commuting does not count as work hours), and communication with colleagues and faculty.
6. RAs will need some training and support before they can be productive. Help faculty find or provide the training needed (on health and safety issues, work with human subjects, software and hardware, etc.). Remind them that students should be paid for the hours they devote to this training.
7. Although it happens infrequently, as with any other job, occasionally a research assistant will have to be terminated. Student feedback indicates that even those students who were fired or not rehired still felt the experience was valuable. Enforce expectations for students to maintain the professionalism of the program.

8. After the initial exposure to research at an introductory level, students begin to look for additional opportunities to participate in projects. Communicate with them about other on-campus research programs, and encourage them to apply for off-campus summer research opportunities.

Success with such research assistantships ultimately relies on the relationship between the student and the faculty mentor. Faculty members need guidance about their roles in the endeavor, so OSCAR staff members work one-on-one with faculty in writing a position description that is accessible to undergraduate students and descriptive of the activities expected. Writing a student-focused description helps faculty define the student research activities and the capacity of students to do the work, and helps ensure that the experience will be valuable for both the student and mentor. We provide a faculty-orientation session each semester to set expectations about the roles of the research assistants and their mentors, including important but not entirely obvious advice about incorporating their RAs into their research teams (including paying them for attending lab/team meetings and training), regular meetings with RAs, communicating goals for the research project, and setting clear expectations about work hours and locations. All new mentors are given the handbook *How to Mentor Undergraduate Researchers* (Temple, Sibley, and Orr, 2010). Finally, OSCAR has also developed a faculty handbook specifically for our RA program, which is updated and shared with faculty mentors each semester.

Conclusion

Given the success of the OSCAR Federal Work-Study Research Assistantships, OSCAR has hired the former graduate assistant as a full-time program coordinator (Nazaire) with a half-time responsibility for the FWS program. Working in collaboration with the Office of Financial Aid and Career Services, we plan to expand the program to at least 120 positions per year over the next two years. The program coordinator also will be offering additional orientation and programming for new OSCAR RAs and their mentors, to improve their experiences and increase their understanding of the additional research opportunities offered at Mason.

The program has met our goals of broadening participation in undergraduate research for interested students at lower levels of engagement and also had some unexpected outcomes. Undergraduates, even at introductory levels, are capable of engaging in research. In fact, students are academically well prepared to work, learn professional skills quickly, and they value the opportunity for a real research experience.

The program has allowed us to introduce three economically disadvantaged students to research opportunities for every one student that the undergraduate research office would have been able to fund in our competitive Undergraduate Research Scholars Program. Students who participate are more likely than other Mason cohorts to enroll or graduate each semester and meet or exceed our expectations for their learning outcomes. The program encourages underrepresented students (first-generation, minority, and female) to engage in research. It also encourages new faculty to mentor undergraduate students and become impressed by the students' abilities. Unexpectedly, we found that the students were very highly rated by their mentors for their responsibility in executing projects. 📄

References

- Association of American Colleges and Universities. 2007. "College Learning for the New Global Century: A Report from the National Leadership Council for Liberal Education and America's Promise." Washington, DC: Association of American Colleges and Universities.
- Brown Leonard, Jeannie, and Kris Smith. 2013. *Learning from the Past to Create the Future: A White Paper on Student Retention and Graduation*. Fairfax, VA: George Mason University. Accessed July 17, 2015. [https://irr2.gmu.edu/New/N_Persistence/PDFReport/Four-year percent20graduation percent20report percent20Final percent209_10_13.pdf](https://irr2.gmu.edu/New/N_Persistence/PDFReport/Four-year%20graduation%20report%20Final%20percent209_10_13.pdf).
- Danovitch, Judith H., Marissa L. Greif, and Candice M. Mills. 2010. "Working with Undergraduate Research Assistants: Setting-up and Maintaining a Research Lab." *Association for Psychological Science Observer* 23(8): 23-32.
- Eby, Kimberly K., and Bethany M. Usher. 2014. "Leveraging Your QEP for Curricular Innovation in Times of Transition." Presented at the Southern Association of Colleges and Schools Annual Meeting – Sounding the Right Notes: Relevance in a Time of Transition on December 8, 2014.
- George Mason University. 2013. *Students as Scholars Initiative. Students as Scholars Master Rubric*. Accessed March 9, 2015. [https://assessment.gmu.edu/student-as-scholars/outcomes rubrics/](https://assessment.gmu.edu/student-as-scholars/outcomes%20rubrics/).
- George Mason University. 2014. "Our Goal: Mason Vision." George Mason University. Accessed March 9, 2015. <http://vision.gmu.edu/the-mason-vision/our-goal/>.
- Grants for Federal Work-Study Programs. 2010. 42 U. S. Code 2753. Accessed March 9, 2015. <https://www.law.cornell.edu/uscode/text/42/2753>.
- Gregerman, Sandra R. 1999. "Improving the Academic Success of Diverse Students Through Undergraduate Research." *Council on Undergraduate Research Quarterly* 20(2): 54-59.
- Gregerman, Sandra R. 2009. "Filling the Gap: The Role of Undergraduate Research in Student Retention and Academic Success." *Broadening Participation in Undergraduate Research: Fostering Excellence and Enhancing the Impact*. Washington, DC: Council on Undergraduate Research: 245-256.
- Hart Research Associates. 2015. *Falling Short? College Learning and Career Success*. Washington, DC: Association of American Colleges and Universities. Accessed March 9, 2015. <https://www.aacu.org/leap/public-opinion-research/2015-survey-falling-short>.
- Hathaway, Russel S., Biren A. Nagda, and Sandra R. Gregerman. 2002. "The Relationship of Undergraduate Research Participation to Graduate and Professional Education Pursuit: An Empirical Study." *Journal of College Student Development* 43(5): 614-631.
- Hazel, Stephanie L., and Bethany M. Usher. 2012. *OSCAR Student Survey* [Measurement instrument]. Fairfax, VA: George Mason University.
- Hazel, Stephanie L., and Bethany M. Usher. 2014. "Assessment Report: Academic Department Survey on Student Scholarship." Fairfax, VA: George Mason University. Accessed March 9, 2015. <https://assessment.gmu.edu/student-as-scholars/reports-findings/>.
- Healey, Mick, and Alan Jenkins. 2009. *Developing Undergraduate Research and Inquiry*. New York: Higher Education Academy.
- Henry, Celia M. 2005. "Undergrad Research Makes a Difference." *Chemical and Engineering News* 83(17): 37-38. Accessed July 17, 2015. <http://pubs.acs.org/email/cen/html042605103445.html>.
- Information for Financial Aid Professionals. 2013. "Volume 6 - The Campus-Based Programs [2013-2014 Federal Student Aid Handbook]." Accessed March 1, 2015. <http://ifap.ed.gov/ifap/byAwardYear.jsp?type=fsahandbook>.
- King, Jacqueline E. 2002. "Crucial Choices: How Students' Financial Decisions Affect Their Academic Success." *American Council on Education*, Washington, DC: Center for Policy Analysis.
- Kinthead, Joyce A. 2003a. *Valuing and Supporting Undergraduate Research*. San Francisco: Jossey-Bass.
- Kinthead, Joyce A. 2003b. "Learning Through Inquiry: An Overview of Undergraduate Research." *New Directions for Teaching and Learning* (93): 5-18.
- Nnadozie, Emmanuel, John Ishiyama, and Jane Chon. 2001. "Undergraduate Research Internships and Graduate School Success." *Journal of College Student Development* 42(2): 145-156.
- Office of Institutional Assessment, George Mason University. 2010. *BCSSE 2008-NSSE 2009 Combined Report: Longitudinal Results*. Fairfax, VA: Office of Institutional Assessment, George Mason University.
- Office of Institutional Assessment, George Mason University. 2013. *NSSE 2012 Self and Peer Comparison Report*. Fairfax, VA: Office of Institutional Assessment, George Mason University.
- Office of Institutional Research and Reporting, George Mason University. 2014. "2014-2015 Facts and Figures." Mason Visitors Center. Accessed March 9, 2015. <https://irr.gmu.edu/FastFacts/>.
- Osborn, Jeffrey M., and Kerry K. Karukstis. 2009. "The Benefits of Undergraduate Research, Scholarship, and Creative Activity." In *Broadening Participation in Undergraduate Research: Fostering Excellence and Enhancing the Impact*, edited by Mary K. Boyd and Jodi L. Wesemann, 41-53. Washington, DC: Council on Undergraduate Research.
- Perna, Laura W., Michelle Asha Cooper, and Chunyan Li. 2006. "Improving Educational Opportunities for College Students Who Work." *Readings on Equal Education* 22: 109-160.
- Russell, Susan H., Mary P. Hancock, and James McCullough. 2006. "Evaluation of NSF Support for Undergraduate Research Opportunities: Draft Synthesis Report Executive Summary." Menlo Park, CA: SRI International.

Temple, Louise, Thomas Q. Sibley, and Amy J. Orr. 2010. *How to Mentor Undergraduate Researchers*. Washington, DC: Council on Undergraduate Research.

Troppe, Patricia. 2000. "The National Study of the Operation of the Federal Work-Study Program: Summary Findings from the Student and Institutional Surveys." U.S. Department of Education. Accessed July 17, 2015. <http://files.eric.ed.gov/fulltext/ED445270.pdf>.

Usher, Bethany M., Kimberly K. Eby, and QEP Planning Committee. 2011. "Quality Enhancement Plan: *Students as Scholars*, Fostering a Culture of Student Scholarship." Presented to Southern Association of Colleges and Schools, Commission on Colleges, in partial fulfillment of requirements for Reaffirmation of Reaccreditation at George Mason University, Fairfax, Virginia.

Denise W. Nazaire

George Mason University, dnazaire@gmu.edu

Denise W. Nazaire is a PhD student in the Criminology, Law, and Society Department at George Mason University. Her research interests in police-community relations focus specifically on examining macro and micro community differences that influence public perceptions of the police as well as the impact of those perceptions on public partnerships with law enforcement. She has a master's of science in forensic psychology from American International College and a bachelor of arts in psychology and criminal justice from Rutgers University. Nazaire joined the Office of Student Scholarship, Creative Activities, and Research (OSCAR) as a graduate professional assistant in September 2012 and, more recently, worked as a program coordinator. During her time at OSCAR, she has established and maintained the OSCAR Federal Work-Study Research Assistantships program.

*Bethany M. Usher spends as much time as possible in graveyards, as a biological anthropologist who studies cemeteries to understand the social structure and health of past communities. She directs the Students as Scholars initiative through the Office of Student Scholarship, Creative Activities, and Research (OSCAR) at George Mason University, and serves as associate director of the Center for Teaching and Faculty Excellence (CTFE). She is Councilor and Chair-Elect for the Undergraduate Research Program Division of the Council on Undergraduate Research (CUR) and co-chaired the CUR 2014 National Meeting, titled *Creating the Citizens of Tomorrow: Undergraduate Research for All*. Prior to joining Mason in January 2010, she was on the faculty at the State University of New York at Potsdam, where she established the Center for Undergraduate Research and served as its director. At SUNY Potsdam, she was an associate professor of biological anthropology and at one time chaired the Department of Anthropology. She has a long history of collaborating with undergraduate researchers.*

CUR Focus

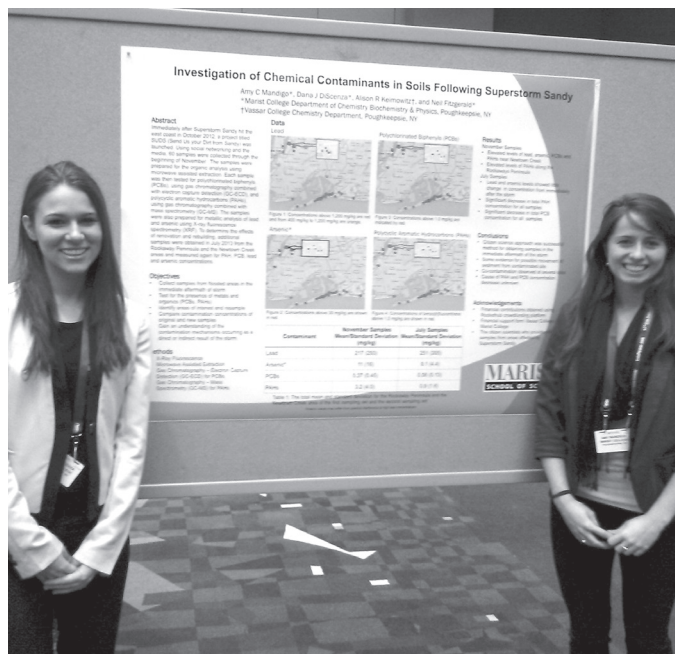
Neil Fitzgerald, *Marist College*

Crowdfunding Undergraduate Research Projects

Undergraduate research costs money. Supplies, travel, conference presentations, and student stipends have to be paid for somehow. If you are lucky enough to work at a wealthy and generous institution, there may be internal funds that can cover the bulk of the costs. Alternatively, there are grants. Anyone who has been involved with grant writing, however, knows the long, hard, and too-often fruitless process grant writing entails. Perhaps, then, it is no surprise that the alternative funding mechanism of “crowdfunding” has been gaining in popularity. According to Wikipedia, crowdfunding “is the practice of funding a project or venture by raising monetary contributions from a large number of people, typically via the internet.” Made popular by sites such as Kickstarter and Indegogo, crowdfunding has raised millions of dollars for start-up companies, charities, artists, scientists, and a host of others—even including college students raising funds for college tuition. With limitations on institutional funds and increasing competition for funding dollars, crowdfunding has become an attractive mechanism for funding academic research, particularly for projects requiring small amounts quickly.

In the interest of transparency, I want to disclose that I am the founding president of the crowdfunding platform called CREU (Crowdfunding Research Experiences for Undergraduates). CREU seeks to combine the advantages of crowdfunding with some of the checks and balances associated with grants. It is specifically designed for undergraduate projects in any discipline that are conducted at U.S. two- or four-year institutions. Based on my experience, I want to provide some information about crowdfunding in general and to offer some advice based on lessons learned from crowdfunding my own research and from running a crowdfunding platform.

So what do you need to know? First and foremost, remember that crowdfunding is a type of fundraising. And just like any fundraising, asking people to part with their hard-earned money is not going to be easy. The first step is to pick an appropriate electronic platform. Platforms appropriate for undergraduate research tend to operate on two basic models: all-or-nothing (AON) or keep-it-all (KIA). AON campaigns require a stated financial target. If the target is reached, all the money donated (including any excess amount) is collected. If the target is not reached, however, no money is collected, and credit cards are not charged. For these types of campaigns, it is advisable to set the fund-raising target as low as possible.



Marist College chemistry students Dana DiScenza and Amy Mandigo present results of crowd-funded research at PITTCON 2014 in Chicago, IL.

KIA campaigns, as the name implies, allow you to keep any money donated regardless of the amount eventually raised. A disadvantage of KIA platforms is that donors are likely to question what will happen to the funds raised if they are not adequate to complete the project. Also, be aware that platforms typically charge a fee of from three to nine percent of the amount raised for successful campaigns, in addition to a credit card processing fee (usually 2.9 percent, plus 30 cents per transaction).

There are numerous platforms available for crowdfunding. Those appropriate for undergraduate research can be divided into four groups:

- **Big-name sites.** Some of the larger sites include Kickstarter (www.kickstarter.com), Indegogo (www.indegogo.com), GoFundMe (www.gofundme.com), and RocketHub (www.rockethub.com). The main advantage of posting to a larger site is greater site traffic and the potential to attract a larger number of donors. With sites continually popping up and disappearing, there is an incentive to use a well-established site. While these sites contain campaigns involving a wide diversity of topics,

they can have definite flavors. For example, Kickstarter has gained a reputation as a site for launching new products and businesses, while GoFundMe is used more for charitable causes.

- Targeted sites. In addition to the big-name sites, there are some that are targeted at specific topics. For example, Experiment (www.experiment.com) and Petridish (www.petridish.org) are both well-established sites focusing on scientific research. Crowd4art (crowd4art.com) is dedicated to the arts, and WorthWild (www.worthwild.com) concentrates on environmental projects. There are many other targeted sites. Their advantage is in attracting a like-minded audience, but be careful of the less well-established sites with a poor track record of successful campaigns. They may not exist for long (see my iamscientist experience below). Some sites may post statistics to help you make a decision. For example, at the time of writing Experiment claims nearly 800 launched projects since 2012 with a success rate of close to 45 percent.
- Institutional sites. A number of colleges and universities have set up their own crowdfunding platforms, typically to solicit funds for projects originating in their own institutions. For example, the Marquette University (<http://www.marquette.edu/crowdfunding/>), the University of Virginia (<https://uva.useed.net/>), and the Georgia Institute of Technology (<https://starter.gatech.edu/>) have such platforms. Oklahoma State University is in the process of launching a site specifically for undergraduate projects (www.philanthoPete.org). Binghamton University attempted to raise funds for undergraduates in its Summer Scholars and Artists Program. Janice McDonald, director of Binghamton's Undergraduate Research Center, explained that the page "was receiving hits, but these didn't translate into donations." With lessons learned, the campus hopes to try the approach again. If institutions find success in developing their own platforms, others are likely to follow suit. The success of these platforms seems to vary widely, but if an institution has its own site, it may well be the best option for its faculty members.
- CREU (creu.tilt.com). I categorize this site separately as to my knowledge it is the only independent site dedicated to undergraduate research. It also has some other significant differences. Unlike most other crowdfunding sites, CREU has specific deadlines for proposal submission and a set donation period. The site is run by an independent nonprofit organization consisting of college professors and industry professionals. All projects

are approved by the host institution, reviewed by independent experts, and assigned a recommendation level (recommended, highly recommended, or most highly recommended), which is posted on the campaign site with selected reviewers' comments.

Some Crowdfunding Experiences

In 2012, Hurricane Sandy struck the East Coast, causing significant damage and flooding. My colleague Alison Keimowitz at Vassar College and I discussed the possibility of sediment moving from known contamination sites to residential areas. It was evident that traveling to the flooded areas during the cleanup operation was going to be very difficult. And so SUDS (Send Us Your Dirt from Sandy) was born. SUDS was a citizen-science project. We asked citizens living or working in affected areas to send us soil samples to analyze. As samples started to arrive, we recognized that our next challenge was to raise enough funds to analyze the samples appropriately. We initially approached our institutions and funding agencies that offered expedited grants. Unfortunately, appropriate grants were not available, and it became obvious that institutional funds were not going to be adequate. That's when we turned to crowdfunding.

Initially the project was launched on iamscientist. No longer in existence, iamscientist was a new AON platform that was attractive due to its focus on science and its backing from eminent chemist George Whitesides. We asked for the full amount we needed, about \$5,000, but unfortunately failed to make the target by the deadline and received nothing. With lessons learned, we requested a smaller amount on a KIA platform, RocketHub, and raised enough money, when combined with institutional funds, to allow two undergraduate students to complete the project. Their work provided valuable insight into the environmental effects of the storm, and the students obtained quality research experiences, which helped them achieve their goals of entering PhD programs.

Our motivation was to raise funds quickly for a time-sensitive project. In another instance, Danielle Solano, an assistant professor of chemistry at California State University Bakersfield, had a different reason for looking to crowdfunding. She chose crowdfunding because her start-up funding ran out and attempts to obtain external grants were unsuccessful. She recently was successful in raising almost \$2,500 to support undergraduates working on the synthesis of LOX inhibitors, with possible application to cancer treatment. "Not only will the money keep my research group operating until I can obtain a more substantial research grant, but

I also hope that it will help me be more successful in doing so," Solano said. Indeed, raising small amounts of money to allow faculty to obtain preliminary data for the basis of a grant proposal may be an attractive reason to turn to crowdfunding. Successful campaigns may also be beneficial for applicants in the tenure and promotion process. How beneficial will depend on the institution.

Crowdfunding: Pros and Cons

My personal experience has taught me a few things that may be useful to others considering this alternative funding mechanism for undergraduate research.

Positive Lessons

Crowdfunding campaigns are quick and easy to set up and can bridge the financial gap between institutional funds and grants, as I have noted. Grant applications can be extremely time-consuming and complex to produce, and crowdfunding campaigns are significantly easier to put together. Crowdfunding does not replace the need for grants, but sometimes seeking grants just doesn't make sense. If you are looking for a relatively small amount of money for a particular project in the short-term (as is typical for undergraduate research), spending a lot of time writing a complex application that may take months to go through the review process and then have a low chance of success is not a sensible approach. Further, institutional funds may well be insufficient or unavailable. Thus in many situations, crowdfunding may be the only viable method to fund an undergraduate research project.

Negative Lessons

I was shocked by the complete lack of oversight of our crowdfunding campaign. No one was checking to see if my project was legitimate, and no one evaluated it for quality or checked to see if I had the credentials or facilities to perform the work. I wasn't even required to submit a budget. When I got a call from the crowdfunding company asking who the check should be made out to, I realized the system is completely open to abuse. While I'm sure the vast majority of campaigns are legitimate and honest, it is understandable that potential donors are suspicious. Another drawback is the fee. In addition to taking valuable funds away from your project, institutions may be reluctant to use a service that is making a profit for research conducted at their nonprofit organization. The institution may well have other concerns, depending on whether it treats the funds as a grant or as a series of donations. In my case, the college treated the campaign as a small grant and took a percentage for indirect costs. Alternatively, if crowdfunding revenue is treated as a series of donations,

institutions are likely to insist on receiving contact information for donors and to be able to state that donations are tax exempt. Not all platforms are set up to allow tax-exempt donations. The institution may also want to check that the platform is legitimate and has a good track record. I would suggest contacting the relevant institutional office or offices early to give their personnel time to address any concerns.

Some Advice for a Successful Campaign

Many campaigns are launched on crowdfunding sites with the expectation that money will just start flowing in. Unfortunately, it isn't that simple, and the majority of campaigns are unsuccessful. The advantage compared to grants, though, is that you have more control over whether your project receives funding after your proposal has been posted on a crowdfunding site. So what can you do to push the balance in your favor? The following strategies may help:

Develop an engaging idea

Just like a grant proposal, your idea needs to be worthwhile, achievable, and planned well. Perhaps unlike a grant, it should also be understandable and attractive to the general public. It is no coincidence that successful campaigns often concentrate on accessible topics. Anything involving animals seems to be particularly appealing. If you want members of the general public to donate, they need to easily understand what you want to do and what the benefits might be.

Be prepared to work hard

In my experience, most funds came from family, friends, colleagues, and other people whom I personally contacted. This is fundraising, and fundraising is hard work. After all, why would a complete stranger give his or her hard-earned money to your campaign? Email friends and family. Contact organizations with which you are involved. Send a mass email to people throughout your institution. Promote the project repeatedly on your social media accounts and make sure your students are also doing so.

Don't be greedy

An all-or-nothing crowdfunding platform means just that: If you don't reach your target, you get nothing. You do, however, keep additional funds raised beyond your targeted amount. Thus, I would suggest setting your sights low. What is the minimum amount that will allow you to do the research? Alternatively, use a platform with a keep-it-all model, although donors could legitimately question what you plan to do with the money if you don't raise enough to perform the project.

Develop a community

Ideally, before your campaign is even accepting donations, you should have started raising public awareness through publicizing your project. Set up and regularly update a Facebook page, website, twitter account, blog, etc. You typically need a large following to raise even a small amount of money. Our SUDS project's Facebook page had nearly 300 likes but very few of those individuals donated to the campaign.

Think about timing

Starting a campaign that includes a holiday period is probably not the best idea. Similarly, if you expect most of your donations to come from students, faculty, and staff at your institution, it may be wise to avoid the summer months.

Make a video

Human beings are visually oriented. To attract people who may be viewing dozens of proposals, you will need to have visually appealing photos and videos. Videos are particularly effective but keep them short (a couple of minutes), informative, and attractive. Five minutes of watching a professor talking in front of a blackboard will probably not attract many donors. If you have access to professional photographers and videographers, make use of them.

Offer rewards

Many sites have a reward system, such as "Donate \$50 and get a t-shirt." Think about what would be attractive to your audience and at what funding level. T-shirts and other gifts are popular, but they cost money, leaving less for your project. For research projects, maybe a copy of any previous publication or report on the general topic, a personal tour of your facilities, or a presentation by the PI might attract funds from potential donors.


Donate to your own campaign

If you don't, why should anyone else?

Summary

My personal experiences have demonstrated the advantages and potential for crowdfunding as a mechanism to support undergraduate research, but they also have highlighted the significant issues I've noted. The idea behind CREU, the platform I maintain, is to develop an independent platform

dedicated to undergraduate research that maintains the advantages of crowdfunding while incorporating some aspects of traditional grants. My experience has demonstrated a demand for this type of funding model. I have noticed some faculty having difficulty explaining crowdfunding to their institutions, but most institutions were happy to endorse it once their questions were satisfactorily answered. Our first CREU competition resulted in four of eleven campaigns reaching their goals. In general, campaigns involving active and enthusiastic students with a goal of \$1,000 to \$2,000 were the most successful.

As a new platform, it remains to be seen how successful CREU will be. However, the continued success of other sites and the explosion in institutional platforms are likely to spike an interest in crowdfunding as a means to fund small academic research projects. Crowdfunding appears to be here to stay as an alternative funding mechanism. It's not for everyone or every situation. It certainly doesn't replace the need for grants or institutional support, but it is an option that undergraduate research advisors should be aware of and consider. 

References

Wikipedia contributors, "Crowdfunding," *Wikipedia, The Free Encyclopedia*, <https://en.wikipedia.org/w/index.php?title=Crowdfunding&oldid=684491000>.

Neil Fitzgerald

Marist College, neil.fitzgerald@marist.edu

Neil Fitzgerald is an associate professor of chemistry and the assistant dean of science at Marist College in Poughkeepsie, NY. He teaches courses in analytical chemistry, research methods in chemistry, environmental chemistry, and general chemistry. Trained as an analytical chemist, Fitzgerald has published in the areas of atomic spectrometry, environmental analysis, and chemical education. He is also the founding president of the crowdfunding platform CREU (Crowdfunding Research Experiences for Undergraduates). He received his bachelor of science from the University of Kent (UK) and master's of science from Loughborough University (UK) before relocating to the U.S., where he earned a PhD from UMass Amherst.

From the International Desk

The Evolution of the Roskilde Model in Denmark

In academic 2013-14 Roskilde University in Denmark had approximately 9,000 Danish students, 1,000 international students, 700 faculty members, and 250 technical and administrative employees. About 1,000 students live on or adjacent to the campus, while most commute from the nearby Roskilde or Copenhagen.

For four decades, teaching at Roskilde University has been based on a research-active curriculum (Healey and Jenkins 2009, 122) mainstreaming research-based learning for all undergraduates and graduates. Problem-oriented project learning (PPL) is the cornerstone of a university-wide system that pervades the formal curriculum from day one. Students' orientation toward research is standard and is a central part of the university's vision and strategy (see also Andersen and Heilesen 2015). This contrasts with the dominant situation in the U.S., as well as in Europe, where research-based undergraduate learning is achieved primarily through the construction of special tracks for small groups of students (comp. Kinkead 2003, 7; Katkin 2003, 19; Healey and Jenkins 2009, 33).

In 1972 when Roskilde University was founded, Danish universities were being transformed into institutions of mass education. The concept for the new university evolved from the late 1960s political debate about universities generally being averse to reconsidering existing disciplinary boundaries so as to adjust to a labor market characterized, on the one hand, by increasing specialization and, on the other, a demand for an interdisciplinary approach to the challenges of modernization and of developing the welfare state. The actual design of a university with a focus on interdisciplinary studies, organized into broad basic study programs, was inspired mainly by the student movement that in the wake of the 1968 student rebellion called for student-centered, collaborative, and interdisciplinary study programs; for hands-on social and political engagement; and for a participatory democracy equally representing students, faculty, and administrators.

Roskilde University's approach to education, radical and controversial at its inception, has undergone revisions over four decades, but it still retains many of its original features. At the same time, some of the ideas developed by its pedagogy have become broadly accepted in Danish higher education, notably project work, interdisciplinarity, and problem-orientation. Briefly summarized:

- In the early days, problem-oriented project work reigned supreme. Later, conventional formats such as seminars and lectures were added, so that today project work constitutes only 50 percent of the student's workload, meaning that across all years half of the grades are awarded for project work. In many cases, however, courses are designed to inform and support project work. In nine of the ten semesters of a master's program, all students are required to participate in semester-long project work (see Figure 1). In the beginning, there were evaluations, but no formal exams. Later, group exams were introduced. The format is an oral exam in which all group members participate in a discussion of their project report. Originally, all students undertook a five-year master's degree made up of two years of basic studies and three years of "superstructure" programs. Today, the curricula have been redesigned in accordance with European Union standards and therefore consist of three-year bachelor's programs and two-year master's programs.
- Interdisciplinary basic studies originally lasted two years. Now they have been reduced to three semesters. The remaining three semesters of the bachelor's programs are dedicated to two disciplines, and a bachelor's thesis that is based on either or both disciplines.
- Originally, "superstructure" students (third-year students and beyond) were allowed to integrate various disciplines into a given project, and they might even integrate projects across semesters. Now, at the master's level a project is limited to one discipline at a time, although the thesis that may be interdisciplinary.
- In the early days, the curriculum would stipulate a timeframe of one semester for a project, but interdisciplinary projects on the "superstructure" level might extend over three semesters. Today, the one-semester timeframe is strictly enforced; students are registered automatically for all required exams, courses, and projects; and non-appearance counts as failure.

Figure 1 presents a generic model of an entire program. The bachelor's program is based on the social science program, although minor variations occur within the four bachelor programs (humanities, humanistic technological sciences, natural sciences, and social sciences). Each semester consists of project work and two or three courses. The courses are either subject-oriented (e.g., sociology, political science,

Figure 1. Model of a Roskilde University program

Structure of a bachelor's-program (social sciences)					
semester 1	semester 2	semester 3	semester 4	semester 5	semester 6
Basic project 1	Basic project 2	Basic project 3	Subject A project	Subject B project	Bachelor project subject A and/or B
Basic course A	Basic course B	Subject A course 1	Subject A course 2	Subject B course 2	Subject A course 3
		Elective course	Subject B course 1	Subject B course 3	Elective course
Method course a	Method course b	Method course c	Method course d	Subject B workshop	Method course e

Structure of a master's program			
semester 7	semester 8	semester 9	semester 10
Subject A project	Subject B project	Interdisciplinary semester, Subject A courses Subject B courses	Thesis (project) Subject A or Subject A and B combined
Subject A courses	Subject B courses		

Problem-oriented project learning (PPL) is oriented toward students' active and collaborative learning of content as well as research methodology (comp. Healey and Jenkins 2009, 7). Through project work and courses, students learn about current research in their discipline(s).

political institutions) or method-oriented (qualitative methods, quantitative methods, strategies for analysis), but all of them are meant to prepare for and support project work within the particular theme chosen for the semester. Two elective courses allow the students either to delve deeper into a subject (A or B in the model) or to take up a third subject. On the master's level, one semester is reserved for each of two subjects, a third semester emphasizes an interdisciplinary approach, and the thesis is written focused on one subject or a combination of the two master's-level subjects.

They engage in research discussions, undertake research and inquiry, and develop skills and techniques for research and inquiry.

The Roskilde Model

The Roskilde model of education combines three components:

- A distinctive way of organizing undergraduate studies into four broad bachelor's programs, and offering master's programs that are either double major or interdisciplinary single major. Usually double-major students combine the two subjects introduced in the bachelor's program, but students may take up a new subject within a framework of eight combinations, defined by the study boards for Roskilde University's graduate programs (220 combinations in all).
- A distinctive academic profile allowing students to develop their individual academic profile by combining subjects (within limits) so as to develop an interdisciplinary approach to real world problems.
- Consistent emphasis on problem-oriented, interdisciplinary, participant-directed project work carried out by students working in groups of between two and eight members (PPL) (Andersen and Heilesen 2015, ix ff).

In students' project work, teachers act as supervisors, fulfilling their task as "well rounded scholars" combining the discovery of new knowledge, the integration of new knowledge into the body of existing knowledge, and the application of knowledge for practice and enlightenment, as well as teaching students how to become scholars themselves, able to integrate scholarly knowledge with their personal experience as a resource for personal, academic, and professional development (comp. Healey, Jenkins and Lea 2014, 51).

The theoretical basis for the PPL approach is that people learn when they are part of engaging and meaningful communities. Learning is furthered by balancing institutional frameworks or goals and the goals of individuals and communities, their timing and rhythms of production, their perspectives of the future, and their needs for orientation. In order to strengthen conditions for learning, curricula are designed to facilitate processes of inquiry, for research-like courses of study, for participant direction, and for supporting communities of practice both within and across groups of learners.

Example of a Problem-oriented Project

Before embarking on a general discussion of problem-oriented project learning, it may be useful to illustrate the scope of project work with a concrete example.

"A Shared View," a 143-page manuscript, reports on project work carried out in Spring 2013 by a group of eight fourth-semester students in the Humanistic Technological Bachelor Program. The project was inspired by a wish to contribute to

social change by developing a concept for inclusion of visually impaired citizens.

Using methods from ethnography, participatory design, and action research, within a framework of phenomenological understanding and hermeneutic interpretation, the group first carefully mapped its understanding of the problem. Then it met with representatives from the Danish Institute for the Blind and Visually Impaired, and finally conducted three qualitative interviews with representatives from the target group. The outcome was a realization that visually impaired people are neither helpless nor victims, but indeed seem to be quite frustrated that most people fail to recognize their individual skills and willingness to contribute to society.

Thus the group had to reconsider the research design and proceeded by conducting a focus-group interview with representatives and clients of the institute in order to discuss some issues identified in the interviews (cooking, getting around, shopping, and sports). The outcome, however, was not a demand for yet another assistive tool, but an entirely new concept for creating a task force of spokesmen for the visually impaired, charged with disseminating knowledge about the capabilities of the visually impaired. A prototype was created and then tested in another focus group, and consequently a revised prototype was developed for a K-9 course (including teaching materials) to be taught by visually impaired persons. Finally, the concept was tested in interviews with two K-9 teachers.

The report concludes by reviewing the project using relevant theories and also attempting to relate the project's findings to general social, cultural, and educational conditions.

PPL in Practice

Problem-oriented programs involve several of the distinctive elements of research-based education since in these programs students work together on research-like projects. In addition, the learning approach is that of knowledge building and inquiry-driven learning. Groups of students make a collective inquiry into a specific topic, arriving at a deeper understanding through interactive questioning and dialogue, and continuously improving on ideas. In this methodological approach, students must be thoroughly aware of research questions, methods, and analyses, emphasizing the consistent use of methods and academic rules. Here, the ideal relation between teachers and students is that of a collaborative community. The teacher allows students to take over a significant portion of the responsibility for their own learning, including planning, execution, and evaluation.

Projects are carried out by groups formed by the students themselves, in a complex process of identifying research themes, as well as potential collaborators. Supervisors sup-

port the students during the process, and once it has been completed, each group is allocated a supervisor. Having designated a theme of study within a broader field of interest, the student group agrees to work upon a problem within the theme. The theme defines the framework for the chosen problem, a context that makes it possible to examine the problem with respect to its broader societal, academic, and subject relevance. The supervisor supports the student group in exploring its theme and in sharpening and clarifying the research question.

Project work must meet academic criteria. This means that students complete systematic literature searches, produce an overview of relevant research, choose the scientific theory and other theories that will serve as the basis of their project work, decide on relevant analytical methods, and reflect upon criteria for inclusion or exclusion of theories and methods.

Supervisors may help with specific proposals, but their main task is to support the students' activities and their self-directed learning. The students reflect critically on their choice of empirical field and then produce and analyze empirical data. Supervisors enter into a dialogue with the students on these issues, and contribute by discussing their own professional experiences in empirical research. Finally, the students draw conclusions based on the project findings, critically reflect on different aspects of their project work, and put the project into perspective. At this stage, the supervisors act as discussion partners who help to both close the project and open it in relation to broader theoretical or societal issues.

Project work is evaluated continuously both in-group, in dialogue with the supervisor, and at seminars where pairs of student groups and their supervisors engage in peer assessment. Final assessment takes place at an exam focusing both on collective (project report) and individual performance (in the oral exam). Grades are given individually according to the student's performance at the exam and based on the quality of the project report.

Curriculum planning includes considerations of ways in which project work and courses at the same academic level can be mutually supportive, as well as how each year's projects and courses can progressively support the next year of study (comp. Healey, Jenkins and Lea 2014, 54)—recognizing that students' own choices of problems, theories, and methodologies constitute an important aspect of the coherence and progression within the study programs.

Project Work and Employability

Aimed at integrating academic standards and social relevance, problem-oriented project work at Roskilde University maintains the academic production of knowledge and skills at a high level while at the same time being open to the

world. Hence, a key prerequisite for project work is to ensure that the educational programs continue to be research-based and that students' work maintains its character of a self-directed research process. However, the university also has a key role in preparing students to function in existing jobs in society, and to understand the broader economic, political, social, and cultural contexts that define the limits and potential for the development of academic and professional work.

Collaborative problem- and inquiry-oriented project work is clearly linked to students' employability in the job market and in society in general. Most often, graduates from problem-oriented programs adapt well to employment. The likely reason is that learning that is student-centered and problem-oriented to some extent meets society's demands for flexible and adaptive education and may foster independent, critical thinkers and creative graduates. For a university that specializes in project work, it is particularly important that students have the skills and competencies demanded by the labor market, not just those relevant to academic study projects (Olesen and Andersen 2015, 278).

In order to strengthen students' employability, Roskilde University continuously seeks to develop exchanges between academic and practice-related professional education, to encourage internships in companies and organizations, and to enable access to research-based education through constant development of student-centered education and collaborative project work.

It is a general tendency, however, that Roskilde graduates are more in demand in times of prosperity than during recession. A likely reason is that faced with a financial slump, companies favor safe solutions, that is, traditional qualifications, while they may be more willing to take risks on individuals during a financial boom by hiring staff with innovative competencies.

Quality Assurance and Impact

All Danish university programs are accredited based on guidelines drawn up by the European Association for Quality Assurance in Higher Education (ENQA), which has received European support to develop a common paradigm based on explicit standards and guidelines for quality assurance in higher education. Accreditation is based on predetermined criteria, called criteria pillars. They include: (1) need for the programs, (2) research-based teaching, (3) competence profile and educational objectives, (4) structure and organization of the programs, and (5) ongoing quality assurance. Accreditation is granted both for existing programs and in the approval of new ones. The accreditation procedure means that all educational programs offered at Roskilde are obliged to meet high standards of quality.

When it comes to examinations in Denmark, there is a long tradition of using external examiners at both the high school and the university levels. The external examiners are respon-

sible for using the same standards for all examinations at the national level, and thus for their quality. One third of all exams must be assessed jointly by external and internal examiners. For the rest of the exams, it is common to use only internal co-examiners. Bodies of external examiners are important partners in quality assurance, as they are required to give feedback to the study boards concerning the quality not only of students' knowledge but also of the exams—that is, how well they are adapted to the skills and competencies that are stipulated for a specific program (Andersen 2015, 199).

Furthermore, all educational programs at Roskilde collaborate with prospective employers. Representatives from business and public and private organizations serve on advisory boards that meet regularly with heads of departments and study boards.

Educational programs at Danish universities are compared on a number of parameters, including the number of applicants, minimum marks for admission, completion time for undergraduates and graduates, dropout rates, employment rates, and levels of income after graduation. However, most comparisons are made among academic main areas or within single educational programs. This information is made publicly available through the Education Zoom, the national web guide to education (www.ug.dk/vaerktoej/uddannelseszoom, in Danish).

Without going into too many subject-specific details, a few comparisons may be made at the university level. At the bachelor's level, Roskilde students' completion times and completion rates are the best, when compared to those of students at the four other multi-faculty universities in Denmark. At the master's level, the figures are average or below. There are, however, harsh administrative and economic pressures on students, as well as on universities, to speed up completion times. This probably will reduce the differences among the universities significantly during the next four to five years.

In general terms, over four decades the PPL-model has had a huge impact on inspiring new ways of teaching at all levels in the Danish educational system.

New Models of Research-based Learning in PPL

Problem-oriented project work that is interdisciplinary and participant-directed involves a hybridization of teaching, research, and experiential learning (Nielsen and Webb 1999; Olesen and Jensen 1999), as well as several of the distinctive elements of research-based education. As described above, for a long time it has been standard practice at Roskilde for students to work together in research-like projects under the supervision of researchers. However, among both students and faculty members there is a desire to further develop the PPL format of research-based learning. Below we outline two different approaches to innovate using the Roskilde model of PPL. The two examples focus on a fundamental issue in problem-oriented project work: how to establish broader

professional communities that engage researchers and students in a common enterprise that exceeds the individual project groups as a framework for the students' work. In the students' normal project work, this objective is not very easily achieved, because project groups tend to be occupied with their own challenges.

One experiment involved the students in faculty members' research, exploring a relationship based on shared practice and collaborative learning processes between students as research learners and teachers assuming the roles of researchers, project managers, and supervisors (Wulf-Andersen, Hjort-Madsen, and Mogensen 2015). The research project used a collaborative research design to study vulnerable young people's participation in secondary and postsecondary education, and the ways in which educational practices and contexts interact with young people's everyday lives, processes of forming identity, and their experience of life's possibilities. Various physical arenas of young people's lives constituted sites for field work and for learning more about the expressions, understandings and (re)productions of different kinds of youth, gender and vulnerability in different contexts by different actors. The involvement of students in their teachers'/supervisors' research provided expanded learning possibilities for both students and researchers.

Groups of undergraduate and graduate students (41 in fall 2012, 18 in spring 2013) worked on subprojects within the research project. The semester began with a seminar for all students involved, followed by students refining their research questions, methodology, and theoretical approaches before going into the field to conduct empirical work. Later, when students had completed most of their empirical work, an analytic workshop was held in order to create common ground for collective reflections and analysis. Throughout the semester, researchers/supervisors monitored, supported, and challenged each group's work.

From the point of view of education, the experiment gave students first-hand research experience and organized their learning processes through interaction with empirical and theoretical fields, informants, research colleagues, etc. It included experience with the delicacy of navigating and reflecting on the multiple contexts and among the many different stakeholders of an actual research project. And it provided supplementary workshops focused on presenting and discussing analyses and interpretations. The shared, collaborative practice changed social relations among students within the project group, among different project groups, and—as students emphasized—changed relations with the supervisors as part of a research community. Students felt they were being “let in” to the research community. This led them to become more committed to learning content and working hard to meet “real research standards” and to be acknowledged and cited for work of value to the larger project.

A very different approach, Anthology Learning, was first introduced in the Working Life Studies Program (Dupont

2015). In this new format, a class of 52 seventh-semester students was divided into four clusters of 14, 17, 14 and 7 participants, each cluster focusing on a theme within the overall subject of the semester. A cluster was made up of supervisors and students organized in case-groups. The cluster functioned as an academic and a social unit, while the students also participated in shared activities such as courses, lectures, reading groups, and field trips. The objective of the cluster was to create an anthology (200 pages) consisting of case-studies from the case-groups, as well as shared chapters introducing the subject, the theoretical and methodological framework, a framework for the case-studies, a conclusion, and a reflection on the work and learning processes.

Distinguishing features of the anthology format are comprehensiveness and complexity. Regarding the former, once they have organized themselves into a cluster during the process of identifying a relevant theme, the students individually and working in groups have to maintain an overview of the theme so as to contribute to the shared chapters of the anthology and put their case-projects into perspective. This is achieved in part by weekly meetings at which cases are discussed across students' groups and with all the supervisors in the cluster. In addition, an editorial board is established, charged with delegating responsibilities and with achieving consistency in the body of the anthology. Thus peer learning, peer assessment, and discussions with several supervisors all contributed to a broader understanding of the theme than would have been achieved in conventional project work.

Having to work collaboratively in a case-group, as well as in a cluster of case-groups, requires skills in organization, communication, and documentation. Thus, a spinoff of the new format is hands-on experience in managing and documenting complex projects. Moreover, evaluations indicate that the organization of clusters has a positive effect on the social environment of the class. Students feel commitment to both case-group and the cluster as a whole, and they establish interest-driven relationships with other students across case-groups in the cluster.

Final assessment of students in Anthology Learning took place at an oral exam based on the anthology as a whole and used a brief synopsis produced by each student as the basis for the individual examination and assessment.


Looking Ahead

Looking ahead, three important trends may be distinguished in the endeavors to strengthen Roskilde University research-based learning:

1. Increasing student participation in faculty members' research. This may involve project work, as illustrated by the example above. But this can also be done in courses in which, for instance, teachers use their own research as a point of departure, with students contributing such

items as literature reviews and analyses of empirical data.

2. Introducing alternative output formats, as illustrated by the Anthology Learning example. In that framework students combine work on their own projects with collaboration across project groups, and the presentation format changes from the conventional report to an academic anthology. Another solution may be to give students the opportunity to write scientific papers instead of project reports.
3. Strengthening students' critical self-reflection concerning the coherence of their educational activities. How can they consolidate their academic interests and use them in the processes of developing research questions for the nine semester-long projects that they have to complete in the course of their bachelor's and master's education.

To sum up briefly, strengthening research-based learning is a question of integrating students' project work and the research of their supervisors, of collaboration across the projects of the student groups, and of longitudinal reflection on the orientation of all the projects that the student has to complete during the course of his or her studies. 

References

Andersen, Anders Siig, and Simon B. Heilesen, eds. 2015. *The Roskilde Model: Problem-Oriented Learning and Project Work*. Cham, Heidelberg, New York, Dordrecht, London: Springer.

Andersen, Hanne Leth. 2015. "External Relations: Bridging Academia and Practice." In *The Roskilde Model: Problem-Oriented Learning and Project Work. Innovation and Change in Professional Education*, edited by Anders Siig Andersen and Simon B. Heilesen, 199-208. Cham, Heidelberg, New York, Dordrecht, London: Springer.

Dupont, Søren. 2015. "Restructuring the Project Work Format: The Anthology Experiment." In *The Roskilde Model: Problem-Oriented Learning and Project Work*, edited by Anders Siig Andersen and Simon B. Heilesen, 233-244. Cham, Heidelberg, New York, Dordrecht, London: Springer.

Healey, Mick, and Alan Jenkins. 2009. *Developing Undergraduate Research and Inquiry*. York: The Higher Education Academy.

Healey, Mick, Alan Jenkins, and John Lea. 2014. *Developing Research-based Curricula in College-based Higher Education*. York: The Higher Education Academy.

Katkin, Wendy. 2003. "The Boyer Commission Report and its Impact on Undergraduate Research." *New Directions for Teaching and Learning* 2003(93): 19-38.

Kinthead, Joyce. 2003. "Learning Trough Inquiry: An Overview of Undergraduate Research." *New Directions for Teaching and Learning* 2003(93): 5-18.

Nielsen, Jørgen Lerche, and Thomas W. Webb. 1999. "Project Work at the New Reform University at Roskilde." In *Project Studies — A Late Modern University Reform?*, edited by Henning Salling Olesen and Jens Højgaard Jensen, 105-120. Roskilde: Roskilde University Press.

Olesen, Henning Salling and Anders Siig Andersen. 2015. "The Roskilde Model and the Challenges for Universities in the Future." In *The Roskilde Model: Problem-Oriented Learning and Project Work*, edited by Anders Siig Andersen and Simon B. Heilesen, 263-280. Cham, Heidelberg, New York, Dordrecht, London: Springer.

Olesen, Henning Salling, and Jens Højgaard Jensen. 1999. "Can 'the University' be Revived in 'Late Modernity'?" In *Project Studies—A Late Modern University Reform?*, edited by Henning Salling Olesen and Jens Højgaard Jensen, 9-24. Roskilde: Roskilde University Press.

Wulf-Andersen, Trine, Peder Hjort-Madsen, and Kevin Holger Mogensen. 2015. "Research Learning: How Students and Researchers Learn from Collaborative Research." In *The Roskilde Model: Problem-Oriented Learning and Project Work*, edited by Anders Siig Andersen and Simon B. Heilesen, 211-231. Cham, Heidelberg, New York, Dordrecht, London: Springer.

Anders Siig Andersen

Roskilde University, siig@ruc.dk

Anders Siig Andersen has headed the Department of Psychology and Educational Studies at Roskilde University since 2008 and is a member of executive university management. His main research interests are in educational planning, higher education, problem-oriented project work, learning in working life, adult and vocational education, learning theories, qualitative methodology, and participatory research. He is the author and editor of a number of books and articles in these areas and has conducted large educational projects in Denmark and Greenland. In 2010 and 2011 he was in charge of the development of a new model for the bachelor's degree at Roskilde University. Together with Simon Heilesen, he has just published The Roskilde Model: Problem-oriented Learning and Project Work (Springer International Publishing).

Trine Wulf-Andersen is an associate professor in the Department of Psychology and Educational Studies at Roskilde University. Her main research interests are in ethnographic and collaborative methods in research, education and social work; theoretical concepts of inclusion, belonging, and learning; young people in difficult life situations and their everyday life across institutions, social networks, and local communities. Her research also includes work with different groups of professionals and volunteers from different sectors and researching and developing their practices concerning young people. Currently, she is engaged in developing and teaching in the bachelor's program in social science and the master's program in social interventions studies at Roskilde University.

Simon B. Heilesen is an associate professor of Net Media and Information Technology in Education in the Department of Psychology and Educational Studies at Roskilde University. He is currently managing the Academic IT Unit, which carries out research, development, and training in effective uses of new media for teaching, researching, and communicating professionally. His main research focus is on the intersection of human-computer interaction, communication studies, and educational studies.

David Owerbach, Adebayo Oyekan, *Texas Southern University*

Undergraduate Research Experience Aids Progression, Graduation Rates at Texas Southern University, an HBCU

Undergraduate research experience has become a widely embraced practice at colleges and universities for enhancing student development and success (Lopatto 2010), and this trend has been widely supported by institutions such as the National Science Foundation (NSF) and the Howard Hughes Medical Institute (HHMI). The Survey of Undergraduate Research Experiences (SURE) has collected quantitative data on the benefits of undergraduate research since the first administration of SURE (Lopatto 2004). Based on the available data, SURE reported gains in student independence, intrinsic motivation to learn, and increased active participation in courses taken after a summer research experience (Lopatto 2007). Mentored undergraduate research has also been reported to provide students with many other advantages, including greater retention and graduation rates (Pascarella and Terenzini 1979; Jonides 1995; Nagda et al. 1998; Jones, Barlow and Villarejo 2010), higher grades (Kinkel and Henke 2006; Junge et al. 2010), and benefits in influencing career choices, including higher chances of pursuing graduate careers (Nnadozie, Ishiyama, and Chon 2001; Crowe and Brakke 2008; Taraban and Logue 2012).

Mentored undergraduate research appears to have even greater benefits for retention and graduation rates of minority populations than for non-minority students (Pascarella and Terenzini 1979; Nagda et al. 1998; Jones, Barlow and Villarejo 2010). However, most of the data on undergraduate research for African-American students were derived from student experiences at off-campus research sites (Beninson et al. 2011), and few are from research programs at Historically Black College and Universities (HBCUs). Fakayode et al. (2014) reported increased retention and graduation rates of students who participated in the undergraduate research program at Winston-Salem State University, an HBCU. However, it is unclear in their study which variables contributed to the increased retention and graduation rates.

Texas Southern University (TSU), an HBCU with approximately 6,000 undergraduate students, has an active undergraduate research program (Owerbach, Ohia and Oyekan 2013). Retention, progression, and graduation rates are low at TSU, with only 55 percent of entering freshmen persisting past the first year. Further, only 18 percent of entering freshmen progress to sophomore status in one year, and only 16.3 percent of entering freshmen graduate in six or fewer

years. The current study addresses the relationship between undergraduate research and progression/graduation rates at TSU, factoring in multiple variables including GPA, race, gender, and students' majors—variables that can affect interpretation of primary data on academic progression and the benefits of undergraduate research.

Study Population and Methods

This study involved 34 undergraduates; 17 students in 2012 and 17 in 2013 participated in the summer undergraduate research program (URP) at TSU. These students entered as freshmen at TSU between fall 2008 and fall 2012. In the spring semester before participating in UR, six students were freshmen, nine were sophomores, 14 were juniors, and five were seniors. The study's 20 student participants from the College of Science and Technology (COST) were undergraduates majoring in science, technology, engineering, or mathematics (STEM) fields, which included engineering, transportation, aviation science, mathematics, computer science, biology, chemistry, and physics. The 14 students in colleges and departments other than COST included majors in sociology, social work, psychology, health science, education, English, political science, administration of justice, and fine arts. Students' data came from their application materials and from TSU's Office of Institutional Effectiveness.

Recruitment information about the 10-week summer program was communicated through flyers posted throughout the campus and an email announcement to all faculty members. The program was open to all undergraduates at TSU regardless of major. Most of the students chose their own research mentor, although some were aided in finding a mentor by the Office of Research. All mentors were full time faculty of at least the assistant professor rank, and they were required to have sufficient resources to carry out the students' projects. All students were required to submit an application containing personal and academic information, a personal statement, three letters of recommendation, a certified copy of their transcripts, and a short description of the proposed research. The Office of Research determined the appropriateness of the mentors and research projects. Sufficient funds were available so that all students who completed the application process, regardless of GPA, were accepted into the program. A stipend of \$2,000 was provided for full-time participation (30 or more hours per week). The program

consisted of an orientation program lasting a full day, a progress report submitted after four weeks, a closing poster presentation by all students, and oral presentations by selected students. In the orientation meeting, topics including research ethics, laboratory safety, and scientific methodology were covered. Students did not receive academic credit, nor did mentors receive support for salary or supplies.

The control groups came from the 2006 freshman COST cohort (n=268). The 2006 cohort, with a mean GPA of 2.17, had a 49-percent persistence rate after the first year, while the URP cohort had 100 percent persistence, with a mean GPA of 3.20. To accommodate the wide differences in GPA and persistence between the undergraduate researchers and the 2006 cohort, two different control groups were constructed based on GPA or persistence: Group I (n=128, GPA 3.12) was based on students having a minimum GPA of 2.5 or greater for fall 2006; Control Group II (n=65, GPA 3.22) consisted of the subset of 128 students in Control Group I who were continuously registered at TSU from fall 2006 through fall 2008.

Progression rates were from fall to fall and were measured from the fall freshman year for one year (sophomore progression) or two years (junior progression). For analysis of graduation rates of research students, the 2011 and 2012 entering freshmen (n=12) were excluded because they were at TSU for fewer than four years. Analyses of six-year graduation rates assumed that the students who no longer were registered at TSU did not transfer and graduate from another college or university.

Graduation data through December 2014 was used. GPA data were analyzed by students' t-tests. All other statistical analyses between URP students and control subjects were done by chi-square analyses using a two-tailed test. Statistical significance was set at $p < 0.05$.

Table 1: Demographics of the URP and Control Populations

Groups	URP Students	Control Group I	Control Group II
African-American	31/34 (91.2%)	115/128 (89.8%)	58/65 (89.2%)
Female Students	23/34 (67.6%)	66/128 (51.6%)	37/65 (62.2%)
STEM Majors-for those who graduated only	10/17 (58.8%)	24/34 (70.6%)	24/34 (70.6%)

Statistics: chi-square analyses; race, gender or STEM major-URP versus control groups—no significant differences.

Results

Table 1 shows the demographic data for URP students and those in Control Groups I and II. Approximately 90 percent of students in each group were African-American. More than 50 percent of each group was female, and the groups were not significantly different from each other statistically. Also, the percentage of students in each group who graduated with STEM majors was not significantly different from each other statistically.

Table 2 shows that there was no significant difference in the GPAs of URP students between their fall freshman semester and their final cumulative GPAs. However, in Control Group I there was a highly significant decrease in student GPAs between their fall freshman semester and their final cumulative GPAs ($p < 0.0001$). Similarly, in Control Group II there was a highly significant decrease in student GPAs between their fall freshman semester and their final cumulative GPAs ($p < 0.0001$). As the fall freshman GPAs for all groups were not different (Table 2), the groups mainly differed in that the URP students did mentored research between their fall freshman semester and December 2014, if they had not graduated in 2014.

Table 2: Mean GPA in the Freshman Fall Semester Compared to Mean Cumulative GPA

Groups	Fall GPA Freshmen (SEM)*	Cumulative GPA (SEM)	T-Test Paired t (p-value)
URP Cohort N=34	3.20 +/- 0.12	3.18 +/- 0.09	0.17 (NS)
Control Group I N=128	3.12 +/- 0.03	2.61 +/- 0.06	10.20 (< 0.0001)
Control Group II N=65	3.22 +/- 0.05	2.76 +/- 0.06	7.50 (< 0.0001)
URP / Group I T-Test Unpaired t (p-value)	0.84 (NS)	4.8 (< 0.0001)	-
URP / Group II T-Test Unpaired t (p-value)	0.18 (NS)	3.8 (< 0.0003)	-

*Standard Error of the Mean

Table 3 shows progression rates for URP students compared to control groups. The progression rates from the freshman to the sophomore year for URP students were significantly higher compared to those for students in Control Group I ($p < 0.0001$) and Control Group II ($p < 0.0001$). Similarly,

Table 3: Progression Rates of URP Students and Control Populations

Groups	Number	Progression to Sophomore	Progression to Junior
URP Cohort	34	28 (82.4%)	22 (64.7%)
Control Group I	128	29 (22.7%)	15 (11.7%)
Control Group II	65	25 (38.5%)	14 (21.5%)

URP versus control group I (Sophomore Progression); $\chi^2 = 42.0$, $p < 0.0001$.
 URP versus control group I (Junior Progression); $\chi^2 = 42.8$, $p < 0.0001$.
 URP versus control group II (Sophomore Progression); $\chi^2 = 17.3$, $p < 0.0001$.
 URP versus control group II (Junior Progression); $\chi^2 = 18.0$, $p < 0.0001$

the progression rates from the sophomore to the junior year for URP students were significantly higher compared to students in Control Group I ($p < 0.0001$) and Control Group II ($p < 0.0001$).

Table 4 shows the six-year graduation rates of URP students compared to those of students in the two control groups. The six-year graduation rates were significantly higher for the URP students compared to students in Control Group I ($p < 0.0001$) and Control Group II ($p < 0.0060$).

Table 4: Fall Freshman GPA and Six-year Graduation Rates of URP Students and Control Populations

Groups	Number	GPA	6 yr graduation	Statistics* χ^2 (p-value)
URP (2008-2010 Freshmen)	22	3.09	17 (77.3%)	-
Control Group I	128	3.12	28 (21.9%)	27.4 (< 0.0001)
Control Group II	65	3.22	28 (43.10%)	7.7 (< 0.0060)

*Statistics: URP versus control group.

Discussion

As noted above, TSU is an HBCU with its own summer undergraduate research program for TSU students (Owerbach, Ohia and Oyekan 2013). Most studies of African-Americans doing undergraduate research are at sites external to HBCUs (NSF-REU and HHMI programs) that apply rigorous selection standards (Beninson et al. 2011). By contrast, all TSU undergraduate students who applied by the deadlines were accepted into the URP.

Institutional data revealed that the 2006 student cohort

($n=268$) from the College of Science and Technology had a mean GPA of 2.17 and that only 49 percent of these students persisted for more than one year. For a valid and meaningful study, it was essential to have a control group or groups matched as closely as possible to the URP group. Our Control Group I ($n=128$) consisted of students with GPAs of 2.5 or greater in their fall freshman year—a criterion that led to the exclusion of 140 students from the initial COST cohort ($n=268$). Control Group II was even more selective and was based on the subset of students in Control Group I (65 of 128) who remained registered at TSU from fall 2006 through fall 2008. The URP and both control groups had similar mean GPAs as freshmen during their initial fall semester (Table 2), thus eliminating initial GPA as a bias.

A critical observation is that the URP students maintained their GPAs, while the students in both control groups earned significantly poorer grades after their initial fall semester (Table 2, URP versus Control Group I, $p < 0.0001$; Control Group II, $p < 0.0001$). To our knowledge, few studies have reported the effect of undergraduate research on GPA when both the students exposed to research experience and the control populations had similar initial GPAs. In one study that is most comparable to ours, Kinkel and Henke (2006) showed that GPAs significantly increased for students exposed to research, from 2.59 to 3.03 at graduation. In their control group, the student GPAs were unchanged (2.59 before exposure to research and 2.63 at graduation). Our study differs from Kinkel and Henke (2006) in that starting GPAs for both our URP students (3.20) and control subjects (3.12) were much higher than the mean GPA of 2.59 in their study. Furthermore, the racial composition of the two studies was different as their study included only one African-American. However, both studies are similar in that students exposed to research had higher GPAs relative to control populations.


In evaluating how GPA affects progression and graduation rates, we compared these metrics between URP students and the control populations. The significantly higher sophomore and junior progression rates and six-year graduation rates compared to students in Control Groups I and II (Table 3 and 4) are striking. This is underscored by the fact that Control Group II ($n=65$) consists of fewer than 25 percent of the initial COST student cohort ($n=268$), as most of the COST cohort had very poor fall freshman GPAs (137 students with GPAs of less than 2.5) and/or extremely low retention rates (136 students did not persist beyond the first year). Clearly,

the students in Control Group II had a sufficiently high GPA in the fall semester to indicate sufficient academic skills for student success at TSU. Furthermore, the fact that these students all remained registered at TSU from fall 2006 through fall 2008 indicates their motivation for academic persistence.

Since both Control Groups I and II had initial GPAs similar to the URP population in the freshman fall semester, additional factors were examined to determine if they affected our findings of differences in GPAs and rates of progression and graduation. The widely recognized academic under-performance of minorities led us to examine race as a variable. Both control groups and the URP students were approximately 90 percent African-American, thus eliminating this variable as a major contributory factor. Because 100 percent of our control populations entered TSU as STEM majors and because our URP participants at the time of the program majored in both STEM (59 percent) and non-STEM majors (41 percent), we examined the majors of the students from our URP (n=17) and control groups (n=34 each) at the time of graduation. The percentage of STEM majors between groups was similar and indicates that students' majors were not a significant factor (Table 1). Gender was also considered as a variable in our study. The percentage of female students in URP (67.6 percent) and Control Group II (62.2 percent) was similar and thereby eliminates this variable as a contributory factor.

Our study has two major limitations. The first is the relatively small size of the URP population (n=34), and the second has to do with the degree of similarity between the experimental and control populations. Although the URP and control groups had similar starting GPAs, ethnicity, gender, and majors, other variables were not studied. Specifically, the URP population was selected on the basis of those volunteering to participate in a summer research program, and the control populations were those without mentored research exposure. In other words, what motivates some students to participate in summer research and why do some students with high initial grades in their fall freshman semester have poor retention and graduation rates? Some variables to examine in future studies include students' financial status (student aid, family-support obligations, and time spent at outside jobs) and student academic factors (non-research faculty mentoring interactions and participation in campus organizations).

Overall, our results are consistent with other studies reporting improved progression and graduation rates for undergraduates participating in undergraduate research programs (Pascarella and Terenzini 1979; Jonides 1995; Nagda et al. 1998; Jones, Barlow and Villarejo 2010). The novelty of our study is the differential cumulative GPAs and progression

and graduation rates between URP and control populations despite similarities in race, gender, STEM majors, and initial freshman fall GPAs. More studies are especially needed to examine the effect of undergraduate research on GPA improvement, as the literature in this area is scanty (Kinkel and Henke, 2006; Junge et al. 2010). 

References

- Beninson, Lida A., Jessica Koski, Erika Villa, Ronnie Faram, and Sally E. O'Conner. 2011. "Evaluation of the Research Experiences for Undergraduate (REU) Sites Program." *CUR Quarterly* 32(1): 43-48.
- Crowe, Mary, and David Brakke. 2008. "Assessing the Impact of Undergraduate Research Experience on Students: An Overview of Current Literature." *CUR Quarterly* 28(4): 43-50.
- Fakayode, Sayo O., Mamudu Yakubu, Olasumbo M. Adeyeye, David A. Pollard, and Abdul K. Mohammed. 2014. "Promoting Undergraduate STEM Education at a Historically Black College and University Through Research Experience." *Journal of Chemical Education* 91(5): 662-665.
- Jones, Melanie T., Amy E. L. Barlow, and Merna Villarejo. 2010. "Importance of Undergraduate Research for Minority Persistence and Achievement in Biology." *The Journal of Higher Education* 81(1): 82-115.
- Jonides, John. 1995. "Evaluation and Dissemination of an Undergraduate Program to Improve Retention of At-Risk Students." Michigan, Ann Arbor, MI: College of Literature, Science, and the Arts, University of Michigan.
- Junge, Benjamin, Catherine Quinones, Jakub Kakeitek, Daniel Teodorescu, and Pat Marsteller. 2010. "Promoting Undergraduate Interest, Preparedness, and Professional Pursuit in the Sciences: An Outcomes Evaluation of SURE program at Emory University." *CBE - Life Sciences Education* 9(2): 119-132.
- Kinkel, Doreen H., and Scott E. Henke. 2006. "Impact of Undergraduate Research on Academic Performance, Education Planning, and Career Development." *Journal of Natural Resources & Life Sciences Education* 35(1): 194-201.
- Lopatto, David. 2004. "Survey of Undergraduate Research Experiences (SURE): First Findings." *Cell Biology Education* 3(4): 270-277.
- Lopatto, David. 2007. "Undergraduate Research Experiences Support Science Career Decisions and Active Learning." *CBE - Life Sciences Education* 6(4): 297-306.
- Lopatto, David. 2010. "Undergraduate Research as a High-Impact Student Experience." *Peer Review- Association of American Colleges and Universities* 12(2): 27-30.
- Nagda, Biren A., Sandy R. Gregerman, John Jonides, William von Hippel, and Jennifer S. Lerner. 1998. "Undergraduate Student-Faculty Research Partnerships Affect Student Retention." *The Review of Higher Education* 22(1): 55-72.
- Nnadozie, Emmanuel, John Ishiyama, and Jane Chon. 2001. "Undergraduate Research Internships and Graduate School Success." *Journal of College Student Development* 42(2): 145-156.

Owerbach, David, Sunny E. Ohia, and Adebayo Oyekan. 2013. "Outcomes of Texas Southern University's Summer Undergraduate Research Program." *CUR Quarterly* 34(2): 43-46.

Pascarella, Ernest, and Patrick T. Terenzini. 1979. "Student-faculty Informal Contact and College Persistence: A Further Investigation." *The Journal of Educational Research* 72(4): 214-218.

Taraban, Roman and Erin Logue. 2012. "Academic Factors that Affect Undergraduate Research Experiences." *Journal of Educational Psychology* 104(2): 499-514.

David Owerbach

Texas Southern University, owerbachd@tsu.edu

David Owerbach is a proposal-development officer in the TSU Office of Research and program coordinator for the summer undergraduate research program. Before joining TSU, Owerbach was an associate professor of pediatrics at Baylor College of Medicine in Houston.

Adebayo Oyekan is professor of pharmacology in the College of Pharmacy and Health Sciences and is director of the Center for Cardiovascular Diseases at TSU. Oyekan has used resources from his National Institutes of Health grants to promote undergraduate research training at TSU since 2000, with many of the participants in the annual summer research internships subsequently entering graduate and professional programs around the nation.

Registration is now open for CUR Dialogues 2016

Mentorship Matters: Innovative Approaches to Achieving Professional Services

February 18-20, 2016

Hyatt Regency Capitol Hill, Washington, D.C.

CUR Dialogues provides attendees with a unique opportunity to speak informally with a variety of federal and private foundation program officers and experts in advocacy and grant preparation. In addition, participants have ample opportunities to network with each other to discover shared research interests and possible collaborators.

For more information and to register, visit www.cur.org/cd16/.

■ Assessing the Impact of Undergraduate Research on Graduation Rates at the University of Georgia

Participation in undergraduate research (UR) is already widely recognized as a high-impact practice, and the benefits of UR—increased self-confidence and larger gains in skills compared to students who did not participate in UR, as well as higher GPAs—have been well catalogued. For instance, introducing discovery-based research in STEM (science, technology, engineering, and mathematics) fields in the first two years of college can positively affect retention and engagement in STEM fields among members of minority groups (PCAST 2012). Others have demonstrated that UR promotes gains in skills, self-confidence, interest in science careers, and active learning (Lopatto 2004, 2007, 2009). Gains in skills, scientific understanding, self-confidence, and commitment to science and research have been reported in numerous studies, and participation in research activities was also found to increase retention in science and the likelihood of matriculation to graduate school for minority students and women compared with peers who did not engage in UR (Bauer and Bennett 2003; Seymour et al. 2004; Russell 2008; Trosset et al. 2008; Nagda et al. 1998; Gregerman 1999; Hathaway et al. 2002; Lopatto 2004; Bauer and Bennett 2008; Campbell and Skoog 2004).

At the University of Georgia, in Athens, Georgia, those learning outcomes and student successes are promoted through a faculty-mentored research initiative called the Center for Undergraduate Research Opportunities (CURO). Participation in CURO coursework and programming have been linked to higher GPAs (Fechheimer et al. 2011), and since the inception of CURO, every recipient of a Udall or Goldwater scholarship from UGA has participated previously in CURO research coursework, as is also the case with recipients of Rhodes, Marshall, and Gates Cambridge scholarships.

However, these successes require an additional model of assessment as UGA and institutions of higher education in general place greater emphasis on degree-completion and graduation rates as the metrics that will determine an institution's success—and in some cases, its funding. As college costs and enrollment have grown over the past ten years, policymakers at the state and federal levels have called for increased accountability from colleges and universities. Given this increased scrutiny and the need for easily quantifiable student outcomes, graduation rates and “time to completion” metrics have become important indicators of student success and institutional accountability (Cook and Pullaro 2010; Supiano 2011). For instance, in 2012, Georgia governor Nathan Deal approved a change in state funding

for UGA that shifted from a model based on enrollment to a model based on “performance”—for example, students' progress to a degree and the number of degrees and certificates awarded (Diamond 2012). This change goes into effect in fiscal 2016, and degree completion and other performance measures therefore have been given increased emphasis in our institutional assessment methods. Georgia is not alone in making this change, and completion rates have increasingly become measures by which state and federal dollars flow to public institutions (Mangan 2012; Selingo 2012; Milligan 2013). Put bluntly by Bryan Cook and Natalie Pullaro, “[it] is clear in nearly every conversation about higher education accountability that graduation rates are increasingly viewed as a critical, if not the critical, measure of both student and institutional success” (2010, 9).

We therefore sought to determine if any correlation existed between participation in CURO coursework and improved time-to-degree completion rates. For our own program-assessment purposes, we also wanted to know if participation in CURO coursework interfered with students' progress through their degree programs. A common question from students who investigate the possibility of such coursework is whether or not they “have time” to conduct the research, both in the course of the given semester and in relation to their overall program of study. This question is also often echoed by students' parents. Furthermore, research into the benefits of introducing undergraduates to research experience and practice typically focuses on projects undertaken through summer research, internship programs, or other learning activities outside of the students' program of study (Hunter et al. 2006; Kardash 2000; Lopatto 2004; Russell et al. 2007; Seymour et al. 2004; Wilson and Howitt 2012). We wanted, therefore, an overview of the impact on graduation rates of structured undergraduate research courses in which students earn credit applicable to their degree programs.

We examined how participation in CURO coursework affected graduation rates for 318 students who matriculated between 2001 and 2005. It is worth noting that 311 of these 318 students were honors students, and thus we include a description of the Honors Program. We found that participants in CURO coursework graduated in four years 89 percent of the time, and in six years 99.7 percent of the time, compared to graduation rates of 51.9 percent and 79.8 percent, respectively, university-wide. Additionally, the earlier students participated in research, the earlier they graduated.

CURO and UGA Honors Programs

The University of Georgia is a research-intensive, land-grant and sea-grant public university serving approximately 26,000 undergraduate students. Founded in 1960, the UGA Honors Program serves the top 10 percent of that undergraduate student body in majors found in every undergraduate school or college on campus. The director of the program serves as an associate provost and reports directly to the senior vice president for academic affairs and provost. CURO is housed and administered by the Honors Program, but offers research opportunities for all UGA undergraduates without regard to academic discipline, GPA, or honors status. CURO was launched through a grant from the Fund for the Improvement of Postsecondary Education in 1997, and was institutionalized at UGA in 2000 following a commendation by the Southern Association of Colleges and Schools for the center's contributions to excellence in undergraduate education.

From 1999 to 2008, student credit hours in CURO research courses at University of Georgia grew approximately 500 percent, from about 1,000 credit hours in 1999 to about 5,000 in 2008 (Fechheimer, Webber, and Kleiber 2011, 157). Through CURO, students can begin undergraduate research as early as their first semester and can continue for up to four full years. While the majority of participating students for 2012-2104 were in their third or fourth years of college, first- and second-year students made up an average of 26.5 percent of the participants. We believe that this early access to UR may contribute to increased rates of graduation, and find a corollary in the PCAST findings discussed above regarding the positive effects of UR on students' retention and engagement in STEM fields (PCAST 2012).

CURO is modeled not on one immersive experience in a limited and specific context (e.g., participation in a summer-only experience), but rather on a coursework model that is progressive and flexible. Students can conduct research during the fall, spring, and summer semesters, choosing when and how often they participate. Students need not choose, for instance, between undergraduate research or a summer internship (or travel experience); rather, they can plan, as part of their program of study, research that is complemented fully by summer learning and enrichment experiences. Interested students propose a research project in collaboration with a faculty mentor. The proposal requires a verification that they have completed training on research with human subjects (when applicable), a description of the research project and the student's role therein, a list of all assignments and due dates, and a schedule of meetings with the faculty mentor.

Students can become involved with an existing research project or they can ask faculty mentors to oversee projects of their own design. Depending on the faculty mentor's research area and methods, students might join a team of graduate, professional, and undergraduate researchers, while others might pursue a "directed reading" project working individually with a faculty mentor. Faculty may be working with multiple students each term on the same project or on projects unique to each student.

Once the proposal is approved, a unique course carrying from one to four credit hours and graded A to F is created for that student. The credit hours are attributed to the faculty mentor's department, but they do not count toward the mentor's standard teaching load. In an effort to integrate these research experiences into the students' programs of study, UGA offers CURO research credit in 90 different course prefixes (e.g. ECON, BIOL, GENE, HIST) from 10 schools and colleges (with an interdisciplinary prefix for work across disciplines and schools). That variety enables many students to count this coursework toward their specific degree requirements. Because most of these individual courses are repeatable, there is effectively no limit to the number of research hours a student can earn through CURO.

Assessment Methods

To assess the relationship between undergraduate research and college-completion rates, we first gathered data (removing personal identifications) on students earning undergraduate research credit through CURO, collecting information on the timing of their coursework (when they completed their first UR course and how many such courses they completed), their cumulative GPAs, and the time it took for these students to graduate. We looked at "true first-year students" who matriculated from 2001 to 2004. (This method may not capture the full spectrum when it comes to completion rates; for more on the debates surrounding the calculation of accurate completion rates that include transfers, returning students, and "non-traditional" students, see Cook and Pullaro 2010 and Selingo 2012). These years were used as parameters because they represented academic terms for which we had reliable records of research participation. These terms would also place students within a range that would indicate a good chance of their having graduated before the data were gathered (and within the four- to six-year graduation rate parameters). UGA publishes its completion rates through its Office of Institutional Research, so we used that data as a control to compare "average" UGA graduation rates. Because participants in CURO were more likely to be in the Honors Program, we compared graduation rates of UR participants while con-

Table 1. Summary of Completion Rates for UGA Students Campus-Wide and Within the Honors Program

Graduation Rates				
Year	Overall UGA 4 year	Honors 4 year	Overall UGA 6 year	Honors 6 year
2001	42.1%	77.9%	70.3%	92.5%
2002	42.1%	73.0%	70.3%	90.6%
2003	39.9%	78.1%	71.3%	95.0%
2004	40.4%	75.0%	72.4%	92.8%
2005	42.5%	77.8%	73.2%	93.7%

trolling for the effects of participation in the Honors Program (see Table 1). Based on this control, the observed difference in completion rates can be attributed to the influence of students’ earning CURO research credits.

We removed from our data those students who completed degrees that require more than four years—for example, students who had declared majors in landscape architecture, where the normal graduation time is five years, and we removed returning students and transfers. This produced a group of 318 students. We then checked the CURO students’ transcripts to determine the actual time it took them to complete a bachelor’s degree, as well as calculating a rate based on whole years. In this model, a student who required nine semesters to graduate (four years and then the following fall semester) was defined as a five-year graduate.

To calculate the expected number of students graduating, we used University of Georgia graduation rates specific to the year of matriculation for students in the Honors Program (n=311) and non-Honors Program students (n=7). The num-

Table 2. Summary of Observed and Expected Number of Graduates Involved in Undergraduate Research

Student Type	Sample	4-Year		6-Year	
		Observed	Expected	Observed	Expected
Honors	311	277	235.5	310	288.9
Non-Honors	7	6	2.9	7	5.0
Total	318	283	238.3	317	293.8

Note: Expected graduation rates were calculated using matriculation year-specific four- and six-year graduation rates for honors students and UGA as a whole (Table 1).

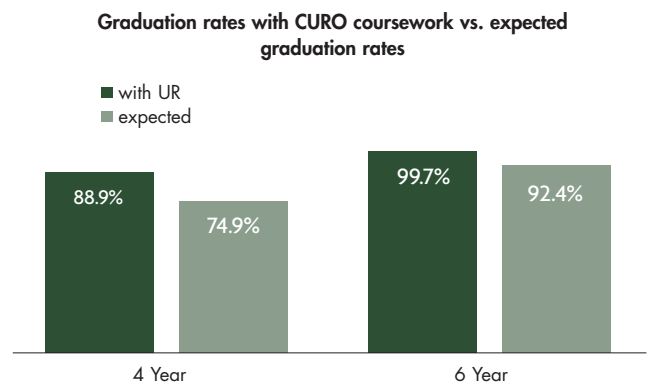
ber of observed and expected graduates in four and six years was then compared using a Chi square test.

Additionally, we constructed a general linear model to examine the effect of timing of UR on time to graduation. In this model, we predicted the number of semesters to graduation by the students who had participated in CURO coursework (n=318), by the timing of their CURO research coursework. Grade-point-average was also included in this model as a control to better isolate the impact of the timing of UR on time to graduation, rather than trying to draw broad conclusions about the role of GPA in time to completion.

Results and Conclusions

In addition to the learning outcomes cited above, participation in CURO coursework can be associated with better outcomes for students in terms of graduation rates and time to graduation. Honors students involved in research coursework through our program had significantly higher four- and six-year graduation rates ($p < 0.0001$, see Table 2 and Figure 1). A total of 88.9 percent of students graduated in four years and 99.7 percent of students graduated in six years, compared to the expected rates of their non-research cohort—74.9 percent and 92.4 percent, respectively. The causation is not clear and would typically be a complex combination of factors. However, the data indicate that participation in undergraduate research courses is associated with shorter time to graduation.

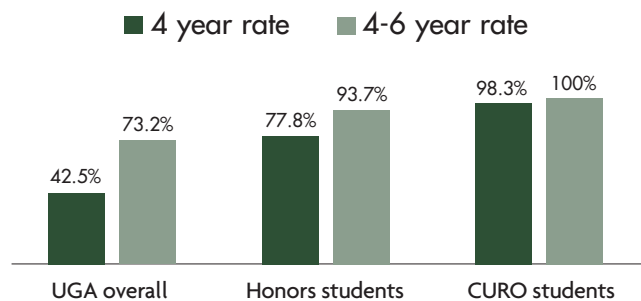
Figure 1. Expected Versus Actual Graduation Rates for Students Participating in CURO Coursework



Note: Comparison of expected and actual graduation rates in four and six years for students participating in undergraduate research (n=318). Expected graduation rates were calculated based on the year of the students’ matriculation and whether or not they were in the honors program. (See Table 1).

Drilling down into one specific cohort, we examined the transcripts of students who completed CURO coursework who matriculated as first-semester, first-year students in 2005. Of sixty-one students who fit that definition, 100 percent graduated in four to six years as opposed to the overall graduation rate of 73.2 percent for that entire cohort (see Figure 2). Controlling for the honors status of most of the sixty-one CURO participants, we still see a better graduation rate for those students who completed CURO coursework. Admittedly, there is a large difference in the sample rates here—4,711 UGA first-year students and only 61 CURO students.

Figure 2. 2005 Graduation Rate Comparisons



Note: Summary of graduation rates for students who matriculated in 2005.

Within our sample of students participating in CURO research coursework, students who became involved in CURO coursework earlier in their college career graduated earlier. Additionally, students with higher GPAs graduated sooner.

The answer then to students' (and parents') questions about whether or not UR inhibits students' progress through their degrees is that we see no indication that UR holds back students' progress.


There is more to be done, but next steps are clear. Because CURO credit hours rose 25 percent (from 4,000 to 5,000 hours) from 2004 to 2008 and continue to rise, the data should be reanalyzed in the future to see if results hold with larger sample sizes and with non-honors students. The number of non-honors participants in CURO coursework has grown from 51 in 2009-10 to 189 in 2014-15—a 271 percent increase. Since honors status correlates with faster graduation times, we would be interested to see if the non-honors CURO participants also enjoy decreased time to graduation.

Because our Honors Program offers a variety of learning enhancements in addition to UR opportunities, it would also be beneficial to try to identify how these other opportunities relate to CURO participation and whether or not these opportunities can be isolated as contributors to shorter time to graduation. Within the framework of our analysis, however, we have controlled for these additional opportunities by only comparing graduation rates of honors students to honors students who participated in research, not to the student body as a whole.

We believe that the course-centered approach of CURO, described above, may be one of the reasons that CURO coursework is associated with shorter time to graduation. The obvious advantage to a credit-bearing approach is that credits earned can help students meet degree requirements. Normalizing the experience as a curricular unit that occurs within the registration cycle also offers predictability and structure. Other research or inquiry-driven activities surely enrich student learning, but they may not offer the same structure and sustained, progressively collaborative relationship with a faculty mentor. Students involved in research outside of coursework may also not have time to see the larger findings of the research project develop or to be part of significant findings in the project. Sustained and progressive research coursework that keeps students engaged with the results of research may encourage in students long-term thinking and planning about other aspects of their academic careers. This is admittedly speculation, but Wilson and Howitt point out that implementation of research experiences within a degree program results in gains in confidence, time-management skills, and independence (2012), which may contribute to a generally more successful approach to meeting the requirements of degree programs.

It should be noted that CURO does not represent the entirety of undergraduate research at UGA. There are "independent study" and directed-reading courses on campus that are not affiliated with CURO, and students often volunteer for undergraduate research positions with faculty across campus (which is to say, they do not receive credit). Because we relied on our own record of students' applications for CURO coursework, we did not have a mechanism in place to track the number of students clocking these "invisible" research hours. Therefore, the benefits of undergraduate research to the institution as a whole go beyond participants in CURO coursework. This study would benefit from the inclusion of students who completed such experiences in comparison with those who completed the graded coursework.

The factors that contribute to graduation times are no doubt complex (financial, social, academic, psychological), and

it is difficult to isolate the benefits of CURO from the constellation of academic opportunities and individual student traits that contribute to undergraduates' graduation rates. Regardless of that complexity, it is critical that such investigations be conducted on the ways in which undergraduate research in all of its forms contributes to students' retention and graduation rates. As time to completion of degrees increasingly becomes used as an assessment metric for institutions of higher education, UR offices, centers, and programs will be well served by examining their programs' relationships to students' graduation rates. If state and private funding agencies can see the benefit of UR in terms of graduation and retention gains, they may be more likely to allocate appropriate resources and training to better develop (or sustain) UR programs such as CURO. In this way, UR offices can promote and protect the learning enrichments and positive student-learning outcomes associated with faculty-mentored undergraduate research. 

References

- Bauer, Karen W. and Joan S. Bennett. 2003. "Alumni Perceptions Used to Assess Undergraduate Research Experience." *The Journal of Higher Education* 74(2): 210-230.
- Bauer, Karen W. and Joan S. Bennett. 2008. "Evaluation of the Undergraduate Research Program at The University of Delaware: A Multifaceted Design." In *Creating Effective Undergraduate Research Programs in Science*, edited by Roman Taraban and Richard L. Blanton, 81-111. New York: Teachers College Press
- Campbell, Ashley and Gerald Skoog. 2004. "Preparing Undergraduate Women for Science Careers: Facilitating Success in Professional Research." *Journal of College Science Teaching* 33(5): 24-26.
- Cook, Bryan and Natalie Pullaro. 2010. "College Graduation Rates: Behind the Numbers." Washington DC: American Council on Education. Accessed May 14 2014. <http://www.acenet.edu/news-room/Documents/College-Graduation-Rates-Behind-the-Numbers.pdf>.
- Diamond, Laura. 2012. "Georgia College Funding To Focus on Graduation, Not Enrollment." *The Atlanta Journal-Constitution*, December 12, 2012. Accessed January 21, 2015. <http://www.ajc.com/news/news/local/georgia-college-funding-to-focus-on-graduation-not/nTTY/>.
- Fechheimer, Marcus, Karen Webber, and Pamela Kleiber. 2011. "How Well Do Undergraduate Research Programs Promote Engagement and Success of Students?" *Life Sciences Education* 10(2): 156-163.
- Gregerman, Sandra. 1999. "Improving the Academic Success of Diverse Students Through Undergraduate Research." *CUR Quarterly* 20(2): 54-59.
- Hathaway, Russell S., Biren Nagda, and Sandra R. Gregerman. 2002. "The Relationship of Undergraduate Research Participation to Graduate and Professional Education Pursuit: An Empirical Study." *Journal of College Student Development* 43(5): 614-31
- Hunter, Anne-Barrie, Sandra L. Laursen, and Elaine Seymour. 2006. "Becoming a Scientist: The Role of Undergraduate Research in Students' Cognitive, Personal, and Professional Development." *Science Education* 91(1): 36-74.
- Kardash, Carol Anne M. 2000. "Evaluation of an Undergraduate Research Experience: Perceptions of Undergraduate Interns and Their Faculty Mentors." *Journal of Educational Psychology* 92(1): 191-2010.
- Lopatto, David. 2004. "Survey of Undergraduate Research Experiences (SURE): First Findings." *CBE-Life Sciences Education* 3(4): 270-277.
- Lopatto, David. 2007. "Undergraduate Research Experiences Support Science Career Decisions and Active Learning." *CBE-Life Sciences Education* 6(4): 297-306.
- Lopatto, David. 2009. *Science in Solution: The Impact of Undergraduate Research on Student Learning*. Tucson: The Research Corporation for Science Advancement. Accessed January 28, 2015. http://web.grinnell.edu/sureiii/Science_in_Solution_Lopatto.pdf.
- Mangan, Katherine. 2012. "Tie State Funds to Colleges' Graduation Rates, Texas Governor Urges." *The Chronicle of Higher Education*, October 4, 2012. Accessed May 12, 2014. <http://chronicle.com/article/Tie-State-Funds-to-Colleges/134856/>.
- Milligan, Susan. 2013. "Performance-based Education Funding: Taxpayer Dollars and Graduation Rates, Student Test Scores; Public Colleges and Universities Graduating Older and Low-income Students." *Stateline*, July 8 2013. Accessed May 12, 2014. <http://www.pewstates.org/projects/stateline/headlines/graduation-rates-test-scores-drive-higher-education-funding-85899488906#>.
- Nagda, Biren A., Sandra R. Gregerman, John Jonides, William von Hippel, and Jennifer S. Lerner. 1998. "Undergraduate Student-Faculty Research Partnerships Affect Student Retention." *Review of Higher Education* 22(1): 55-72.
- President's Council of Advisors on Science and Technology (PCAST). 2012. "Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics." Accessed May 12, 2014. http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-executive-report-final_2-13-12.pdf.
- Russell, Susan, Mary P. Hancock, and James McCullough. 2007. "THE PIPELINE: Benefits of Undergraduate Research Experiences." *Science* 316(5824): 548-549.
- Russell, Susan H. 2008. "Undergraduate Research Opportunities: Facilitating and Encouraging the Transition from Student to Scientist." In *Creative Effective Undergraduate Research Programs in Science*, edited by R. Taraban and R. L. Blanton, 53-80. New York: Teachers College Press.

Selingo, Jeff. 2012. "The Rise and Fall of the Graduation Rate." *The Chronicle of Higher Education*, March 2, 2012. Accessed May 12, 2014. <http://chronicle.com/article/The-RiseFall-of-the/131036/>.

Seymour, Elaine, Anne Barrie Hunter, Sandra Laursen, and Tracee DeAntoni. 2004. "Establishing the Benefits of Research Experiences for Undergraduates in the Sciences: First Findings from a Three-Year Study." *Science Education* 88(4): 493-534.

Supiano, Beckie. 2011. "College Enrollments Continue to Climb, While Graduation Rates Hold Steady." *The Chronicle of Higher Education*, February 2, 2011. Accessed May 14, 2014. <http://chronicle.com/article/College-Enrollments-Continue/126191/>.

Tinto, Victor. 2012. *Completing College: Rethinking Institutional Action*. Chicago: the University of Chicago Press.

Trosset, Carol, David Lopatto, and Sarah Elgin. 2008. "Implementation and Assessment of Course-Embedded Undergraduate Research Experiences: Some Explorations." In *Creating Effective Undergraduate Research Programs in Science*, edited by Roman Taraban and Richard L. Blanton, 33-49. New York, NY: Teachers College Press.

Turner, Sarah E. "Going to College and Finishing College. Explaining Different Educational Outcomes." In *College Choices: The Economics of Where to Go, When to Go, and How to Pay For It*, edited by Caroline M. Hoxby, 13-52. Chicago: the University of Chicago Press.

Wilson, Anna and Susan Howitt. 2012. "Is More Always Better? An Australian Experiment with a Research-Intensive Undergraduate Degree." *CUR Quarterly* 33(2): 28-32.

Martin Rogers

University of Georgia, martyr@uga.edu

Martin Rogers is the associate director of the University of Georgia Honors Program and its Center for Undergraduate Research Opportunities. He has taught classes in the university's Department of English, as well as in the Department of Film Studies. His research interests involve the assessment of honors programming, undergraduate research, and other high-impact learning practices. He also writes about American fiction and film.

William G. McDowell is an aquatic ecologist who received his doctorate from the University of Georgia's Odum School of Ecology. His teaching experience includes ecology courses, pedagogy, and mentoring students in the Center for Undergraduate Research Opportunities Honors Scholars Program. He is currently a faculty fellow in the Department of Environmental Studies at Colby College, Waterville, ME.

Advancing Undergraduate Research



Collaboration and Innovation in a Global Society

SAVE THE DATE: June 26-28, 2016 in Tampa, FL



CURQ Vignettes

Eagle Apprenticeship Program: Supporting Recruitment, Retention, and Undergraduate Research

Scott Cooper, Louise Janke, and Corey Sjoquist

University of Wisconsin-La Crosse, scooper@uwlax.edu

At the University of Wisconsin-La Crosse (UW-L) we are using a novel funding source to support undergraduate research called the Eagle Apprenticeships. This program is a collaboration among the Offices of Admissions, Financial Aid, and Undergraduate Research and Creativity. Apprenticeships are awarded to 25 outstanding freshmen as a recruiting incentive through our admissions office. Eagle Apprentices are selected during their senior year of high school based upon the rigor of their courses, grade-point averages, class ranks, and ACT/SAT test scores. In the summer before students arrive as freshmen, the Office of Undergraduate Research and Creativity contacts the students to find out their career interests and then pairs them with a faculty mentor for research or scholarship that interests them.

These student apprentices are compensated with \$1,000 in their first year and \$2,000 in their second year to work with a faculty mentor on research. The funding for these 50 students is administered by the financial aid office and is provided through institutional resources, so it does not come out of the undergraduate research office's budget for grants. In addition to recruiting and retaining talented students on campus, engaging the students with a mentor gives them valuable experience in their disciplines, which helps them make educated career decisions early in college. Approximately 25 percent of the apprentices switch majors after their freshman year, but a survey of both apprentices and mentors shows that over 90 percent were pleased with being part of the program. A long-term goal is for this early experience to lead to more formal undergraduate research projects in the students' junior and senior years. 📺

The Moms Project

Catherine Batsche, Roger Boothroyd, and Mary Armstrong

University of South Florida, cbatsche@usf.edu

The Moms Project, an endowed fund at the University of South Florida, provides financial support for undergraduate research assistantships in the College of Behavioral and Community Sciences. The project was initiated in 2010 by three faculty members who were strongly committed to undergraduate research. By coincidence, each of these faculty members was taking care of his or her mother, whose average age was 88. The "Moms" shared a common history: None had been able to pursue a college education as a young woman because of the Great Depression, World War II, and



Ruth Boothroyd, Ellen Nizzi, and Alice Armstrong enjoying a birthday celebration for Ruth's son, Roger Boothroyd.

family responsibilities. The three faculty members therefore created The Moms Project to honor the sacrifices made by their mothers and to support undergraduate research.

Each award focuses on a research topic of importance to one of the Moms. The Ruth Boothroyd Award focuses on nutrition and wellness because Ruth Boothroyd had hoped to become a dietician. The Alice Armstrong Award is dedicated to research on substance abuse based on the impact this disorder had on a member of Armstrong's family. The Ellen Nizzi Award focuses on positive aging to recognize Nizzi's persistence in achieving her life-long dream of obtaining a college education—which she completed at the age of 90!

Now in its fifth year, the program is fully endowed and provides a permanent base of financial support for its undergraduate research assistantships. Although the minimum contribution needed to establish an endowed fund may seem to be out of reach for many individual faculty members, the Moms Project became feasible because the faculty members pooled their resources and were allowed to pay the pledged amount over a five-year period. In addition to the endowed fund, a Moms Honor Roll has been established to accept cash contributions from alumni and friends who also want to honor their mothers. Additional information on The Moms Project may be found at: <http://www.cbcs.usf.edu/Development/MomsProject/>. 📺

CUR Book Review

Getting In: The Insider's Guide to Finding the Perfect Undergraduate Research Experience

By David G. Oppenheimer and Paris H. Grey

Reviewed by Christopher Galvan, Bradley University, ctgalvan@mail.bradley.edu and Jessica Wallace Szmania, Bradley University, jwallace@mail.bradley.edu



Gainesville, FL
Secret Handshake
Press, 2015. 177
pages.
ISBN-13: 978-
0692488348, \$22.50

David G. Oppenheimer and Paris H. Grey provide direct and accessible guidance for undergraduate science students (and indeed all undergraduates) as they explore the opportunities to work with faculty members in actual hands-on research. Most students love experiential-learning opportunities, and this helpful guide is designed in every way to assist the student by providing the tools they need to find positions, apply, and survive in any research environment. Despite the potentially challenging subject matter tackled by this book, the way it is written and edited makes it readily accessible to a wide range of readers, including faculty and students.

Chapters are short, conversational, and to the point. The first chapter explains that many sections of the book will be focused on key points that are highlighted in bold-faced text. The authors go so far as to discourage readers short on time from reading the entire book and instead advise them to simply focus on the bold-faced sections, stating “Although the information in *Getting In* is important, the bold was strategically selected to help you learn the essential information quickly.” This is a radical, yet pragmatic, approach—pointing to the importance of communicating the key ideas about undergraduate research in a way designed to reach more readers.


The body of the text begins by first telling the reader why it is important to pursue undergraduate research in the first place and what benefits it will have in the long run for a student's career. The reader can appreciate the fact that this is not simply rhetorical, for the book describes many of these benefits, including the development of research and communication skills, a more fully developed future graduate school application and resume, and a more productive mentoring relationship with professors. With the explicit arguments regarding the value of undergraduate research, the book helps motivate the reader to pursue research opportunities. You truly leave the text feeling that a research project “is the ultimate in experiential learning.”

Oppenheimer and Grey then clearly outline the basics of the research experience. This information includes specifics such as what a potential research student can expect from the position, what the research mentor and lab will expect of the research student, description of various lab roles, the differences between

various types and cultures of labs, and even a detailed list of common procedures used in research work. The text also stresses the importance of finding the right research position. Chapter 4 begins in this way: “... you'll be happier and more successful if your expectations of what research should be closely match the experience you choose.” This bold-faced key point is followed by an entire chapter dedicated to helping students understand their expectations for a research position so all parties involved are satisfied—rather than frustrated—throughout the length of the research work.

One of the greatest challenges for many regarding research is the time factor for projects requiring extensive hours in the lab. Chapter 5 suggests students begin their search for a project by creating a schedule that includes the amount of time they have available for the research position, and then using that time to search for research opportunities. In this way students will be practicing needed time-management skills as part of realistic advance planning. Oppenheimer and Grey detail a list of ways the reader can find potential research positions and opportunities. Helpful suggestions include technology-based methods such as how to word an Internet search to obtain the best results and how to electronically catalogue information about the possible positions so it can be easily referenced. They also instruct readers to use other methods such as checking bulletin-board postings and attending discussions, conferences, and symposia. Each suggestion comes with a list of guidelines to follow.

The last major section of the book delineates the interview process, beginning with how to dress (for the lab—in case the position starts right away) and how to phrase answers to questions. The interview section also identifies common types of interviews, how to decline or accept a position, how to format follow-up emails, and the right way to negotiate any “deal breaker” issues that could prevent the acceptance of an offer. The text suggests stating something such as: “I am so excited about this research project. ... However, I have only twelve hours to dedicate to research per week. ... If eighteen hours per week is firm, I will, unfortunately, need to decline the offer to join the lab.” By doing this, the interviewee explains the deal breaker in a way that gives the interviewer the final decision; the interviewee does not over-commit or feel forced to decline the offer without explanation.

Oppenheimer and Grey have crafted an eminently useful book to help undergraduates learn the value and possibilities of hands-on research. It employs a confident and encouraging tone, conveying that most students sincerely interested in research opportunities will be successful in finding them. The clear and simple steps outlined in the book are designed to enable students to find the right positions for them, and Oppenheimer and Grey conclude their book with a positive message outlining what to expect during the first day of the research position. This is an excellent book of value for any faculty member involved in undergraduate research, for undergraduate advisers working with various students, and for virtually any undergraduate. 

SUBMISSION

Guidelines

General Criteria —

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.

Manuscripts that are unrelated to undergraduate research or focus on the success of an individual or institutional undergraduate research program without providing a substantive presentation of goals, strategies, and assessed outcomes related to the program are not suitable for publication. Manuscripts that describe novel programs that can serve as models for other institutions, those containing significant assessment of outcomes, and those articulating research on the efficacy of undergraduate research programs are particularly suitable for publication in the *CUR Quarterly*.

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.chicagomanualofstyle.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 the 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.

Suggested titles for review and book reviews should be submitted via email to:

Book Review Editor
Susan Berry Brill de Ramirez
brill@fsmail.bradley.edu

CUR Comments

The *CUR Quarterly* will consider for publication scholarly commentaries from readers on issues vital to the health and vigor of the undergraduate research enterprise. *CUR Comments* should be limited to 250 words, and must be on topics relevant to CUR's mission. *CUR Comments* will be published at the sole discretion of the Editors and will be edited if necessary. The writer will be shown the edited version for her/his approval.

Undergraduate Research Highlights

Highlights consist of brief descriptions of recent (past six months) peer-reviewed research or scholarly publications in scholarly journals. These publications must be in print and must include one or more undergraduate co-authors. A quarterly call for submissions will be sent to all members and posted on the CUR Web site.

Submissions should include:

- Title of the article and full journal citation (inclusive pages).
- A brief description (3-5 lines) of the research and its significance.
- Title and department or program affiliation of the faculty member.
- A brief description of the student co-author(s). Include the year of study in which the student(s) undertook the work, the opportunity through which the work was undertaken, (independent study project, summer project, REU program, senior thesis project, etc.), and the current status of the student (graduate school, employed, still enrolled, etc).
- The source of funding for the work.

For questions, contact:

Undergraduate Research Highlights Editor
Marie Graf
annennis@georgiasouthern.edu

For general questions regarding the CUR Quarterly, contact:

CUR Quarterly Editor-in-Chief:

James T. LaPlant, College of Arts and Sciences
Valdosta State University
jlplant@valdosta.edu



Council on Undergraduate Research
734 15th Street NW, Suite 550
Washington, DC 20005-1013

Non Profit Org.
U.S. Postage Paid
Hanover, PA
Permit NO. 1541

IN THIS ISSUE OF *CURQ on the Web*

CURQ on the Web, Winter 2015 edition
http://www.cur.org/publications/curq_on_the_web/

Endowing Undergraduate Research to Ensure Growth and Stability

—Candace Rypisi, Michael Bergren

Undergraduate Research and Study Abroad: Lessons from an NSF Partnership in Research and Education (PIRE) Grant

—Alice Bean, Susan B. Twombly

Vignettes

Supporting Undergraduate Research through Targeted Alumni Groups

—Kristi Haik, Keith Walters

Advancing Undergraduate Research



Collaboration and Innovation in a Global Society

SAVE THE DATE: June 26-28, 2016 in Tampa, FL



The VCU Quest: Forging New Paths to Support Undergraduate Research

—Herbert Hill