Developing Undergraduate Scientists by Scaffolding the Entry into Mentored Research

Navigating the Academic Landscape: How Mentored Research Experiences Can Shed Light on the Hidden Curriculum

Faculty Change from Within: The Creation of the WMSURE Program

Diverse Student Scholars: A Five-Faceted Model of Student Transformation from Embedded Research Mentorship in Marketing Courses

Surveying Faculty Perspectives on Undergraduate Research, Scholarship, and Creative Activity: A Three-Institution Study
Scholarship and Practice of Undergraduate Research (SPUR) is published in the fall, winter, spring, and summer by the Council on Undergraduate Research. The mission of the Council on Undergraduate Research (CUR) is to support and promote high-quality undergraduate student-faculty collaborative research and scholarship.

SPUR publishes scholarly work that examines effective practices and novel approaches, explores pedagogical models, and highlights the results of assessment of undergraduate research. As a peer-reviewed publication of the Council on Undergraduate Research, the journal provides useful and inspiring information that increases our understanding of undergraduate student-faculty engagement in research, scholarship, and creative work in all disciplines and at all types of higher education institutions in the United States and abroad.

Prospective authors do not have to be members of CUR to submit their work. They may continue to apply for membership after publication. Faculty and students who wish to publish the results of projects or results of their specific undergraduate research endeavors are encouraged to consider other disciplinary or student-focused journals.

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## Models of Undergraduate Research Mentoring

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 Undergraduate Research Highlights
Introduction

Models of Undergraduate Research

Mentoring

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Any of us are where we are today because of a mentor. Given our role as educators, all of us have mentored students in some capacity. From the days of Homer’s Odyssey to the modern era, mentoring has been shown to be a critical feature of higher education. Mentoring students, either informally or formally, can be a highly rewarding aspect of teaching. Effective mentorship often results in myriad benefits for students, including academic gains, heightened understanding of the research process, development of a research identity, and preparation for graduate school. Mentorship can also be transformative, leading students to pursue paths that they may not have previously considered.

Despite the importance of mentoring, students can encounter a variety of barriers when seeking a mentor. Several articles in this issue explore effective methods for increasing student access to faculty mentors, especially for first-generation and underrepresented students. Heather Haeger, Carla Fresquez, John Banks, and Camille Smith explore this topic in their article, “Navigating the Academic Landscape: How Mentored Research Experiences Can Shed Light on the Hidden Curriculum.” The authors describe an undergraduate research program at California State University, Monterey Bay designed to teach students the norms and expectations of academia and their chosen discipline. Through faculty panels and seminars, students learn about the importance of finding a mentor, as well as information about graduate school (e.g., funding options, grant work, and the difference between academic positions).

Cheryl L. Dickter, Anne H. Charity Hudley, Hannah A. Franz, and Ebony A. Lambert examine the successes and barriers experienced by underrepresented students as they participate in mentored undergraduate research. They describe the William and Mary Scholars Undergraduate Research Experience (WMSURE), a program designed to increase undergraduate research among underrepresented students. The program provides formal mentoring and weekly workshops for students that focus on academic topics, as well as issues associated with discrimination. Additionally, the program offers faculty workshops that address the educational needs of underrepresented students. The WMSURE provides an excellent model of mentored undergraduate research, as findings reveal that program participants feel more supported by faculty, are more interested in research, and more informed about the research process, as compared to students outside the program.

Jeanette Sims and colleagues describe the transformative effects of mentored research for underrepresented students in their article, “Diverse Student Scholars: A Five-Faceted Model of Student Transformation from Embedded Research Mentorship in Marketing Courses.” The Diverse Student Scholars program includes curricular and co-curricular research opportunities, with faculty mentoring embedded in elective courses. The benefits of mentorship for students in the program include a greater understanding of the research process, an increased accountability for their work, an involvement in professional development, a heightened appreciation for teamwork, and an increased ability to critically evaluate their own work.

Farron McIntee and coauthors demonstrate that it’s never too early to begin the mentoring process in their article, “Developing Undergraduate Scientists by Scaffolding the Entry into Mentored Research.” They describe ReBUILDetroit, a program geared toward introducing undergraduate research to underrepresented, first-year students in the biomedical sciences. Students in the program are matched with a faculty member through a multistep, formal process that includes interviewing a faculty member, participating in a speed-pairing event with potential mentors, and ultimately receiving a placement in a lab with their chosen mentor. The authors report significant gains for students in their perceived ability to apply knowledge to research work, improved research and presentation skills, and the development of a scientific identity.

With much of the existing mentoring research focused on student outcomes and perceptions, Janet Morrison and colleagues address an important gap in the literature by examining faculty members’ perceptions of mentoring in their article, “Surveying Faculty Perspectives on Undergraduate Research, Scholarship, and Creative Activity: A Three-Institution Study.” The authors observe that more than half of the respondents did not believe undergraduate research was valued enough at their institution. Moreover, surveyed faculty identified several barriers that prevent them from participating in mentored undergraduate research (e.g., lack of time and funding).

The vignettes included in this issue address different aspects of mentored research. Catalina Ormsby discusses the University of Michigan’s efforts to recruit high-achieving community college students from diverse backgrounds in her
vignette, “Community College Pipeline Programs: Creating Successful Pathways to the Research University.” She describes the Undergraduate Research Opportunity Program, a 10-week summer research program that seeks to provide a more seamless transition for students transferring to the university from community colleges. Valerie A. Ubbes discusses how she utilizes inquiry-based pedagogy, constructivist-developmental pedagogy, and relational pedagogy to foster learning in independent studies in her vignette, “Three Pedagogical Approaches to Independent Studies.”

As the articles in this issue demonstrate, the future of mentorship is dependent on a constant stream of innovation as well as improved evaluative techniques. As these researchers have ably shown, effective mentoring can take many forms. This in itself leads to the conclusion that good mentoring is not a static construction. As such, faculty and program staff members who wish to modify existing mentoring methods or implement new programs with a mentorship focus may find a number of useful tools within these pages.

Coming up in SPUR...

Winter 2018: General Issue

Spring 2019 and Summer 2019: “Big Data as a Tool to Promote Undergraduate Research”
Developing Undergraduate Scientists by Scaffolding the Entry into Mentored Research

Farron McIntee, Wayne State University
Kendra R. Evans, University of Detroit Mercy
Jeanne M. Andreoli, University of Detroit Mercy and Marygrove College
Abigail J. Fusaro, Marygrove College
Melanie Hwalek, SPEC Associates
Ambika Mathur, Andrew L. Feig, Wayne State University

Abstract
For many college students, joining a research group is a critical step toward developing strong mentor-mentee relationships that help shape their science identities and research self-efficacy. ReBUILDetroit, a program that seeks to diversify the biomedical research workforce, uses a scaffolded process to help its scholars transition into research. The first-year curriculum includes a research methods course and a course-based undergraduate research experience that prepare ReBUILDetroit Scholars for entering a research group. Curricular and cocurricular elements prepare scholars for faculty interactions and diminish barriers that might otherwise prevent diverse students from obtaining these research experiences. The program facilitates research placements through student coaching and speed-pairing events. Quantitative and qualitative data on the scholars show strong perceived gains in science identity, enhanced research self-efficacy, and greater research preparedness.

Keywords: diversity, inclusion, mentorship, science identity, self-efficacy

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Overview of the Challenge
Research experiences and the mentor-mentee relationships involved are of particular importance for career progression of trainees in biomedical disciplines (Brink 1995; Cupples 1999; Eagan et al. 2013; Lopatto 2007; Moed 2012). Students who participate in undergraduate research receive multiple layers of mentorship as a result of joining research groups. Positive relationships tend to lead students to persist through the challenges and transitions of their undergraduate careers, whereas less supportive relationships lead students to self-select out of the field (Linn et al. 2015; Lopatto 2007). For undergraduates, the process of identifying suitable career mentors is often arbitrary and challenging (Hurtado et al. 2009). In the case of students from underrepresented backgrounds, this challenge is even greater because, in many cases, the faculty come from very different backgrounds, do not look like them, and may be difficult to approach (Prunuske et al. 2013; Prunuske et al. 2016). The process of helping early undergraduates find research mentors in their discipline must become more intentional if the diversity of the scientific workforce is to be achieved (Boyd and Wesemann 2009; Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline 2011; Packard 2015; Ramirez 2012).

Studies on the impact of undergraduate research have struggled to articulate the contribution of the mentor-mentee relationships to student development, degree completion, and career progression (Packard 2015; Thiry and Laursen 2011). These relationships are complex and multifaceted, often including additional parties such as graduate students and research group members that enrich the experience but also make it more difficult to control (Aikens et al. 2017; Aikens et al. 2016; Pfund et al. 2016). Graduate programs rarely include training on how to be a good mentor; mentoring skills are most often learned informally by...
observing one’s own mentors (Handelsman et al. 2009; Sorkness et al. 2013). Likewise, incoming college students may not be ready to enter productive mentoring relationships and often little is done to help students understand the bidirectionality of mentoring (Branchaw, Pfund, and Rediske 2010). How are students prepared to be receptive mentees? How are faculty and bench mentors trained to be more inclusive? Is there intention in how mentors are paired with mentees? Finally, how are successful mentoring relationships assessed and quantified in order to identify best practices and enhance self-awareness in both mentors and mentees so that they build the productive relationships that lead to career success? These are some of the questions that ReBUILDetroit attempts to address in preparing the undergraduate students in this program for careers in biomedical research.

ReBUILDetroit

ReBUILDetroit is a National Institutes of Health (NIH)–funded collaboration among the University of Detroit Mercy, Marygrove College, and Wayne State University (WSU), designed to enhance diversity in the biomedical research workforce by improving STEM persistence; four- and six-year graduation rates; and entry into graduate and professional programs of students underrepresented in STEM disciplines based on gender, race, or socioeconomic status (Andreoli et al. 2017). The three ReBUILDetroit institutions are located in the urban core of Detroit within a few miles of each other and serve as the backbone of higher education within the city. Detroit Mercy and Marygrove are primarily undergraduate institutions with relatively small student enrollment and low student-to-faculty ratios, whereas Wayne State is a large, public urban research university. Although the three institutions draw more than 85 percent of their undergraduates from the Detroit metropolitan region, with a high percentage of nonresidential students, each institution tends to attract a different population of students based on its mission and culture.

The students exemplify diverse, urban, postsecondary student populations in the twenty-first century. Many take nonlinear pathways through college and work while in school to pay their bills (Kuh et al. 2006; Malcom and Feder 2016). Finding time to participate in undergraduate research is often not a top priority due to financial pressures. Therefore, one critical aspect of the program is that the ReBUILDetroit Scholars receive a stipend if they remain in good academic standing. This support makes room in their schedules for cocurricular activities, like research, and facilitates a transition to academically relevant employment opportunities, such as paid internships and laboratory positions. Across the consortium, there are approximately 40 to 50 scholars per year, limited by the amount of financial aid that can be targeted to this program through either grant or institutional resources. Table 1 shows the distribution of ReBUILDetroit Scholars from 2015 through 2017 based on consortium institution, gender, socioeconomic status (as determined by Pell Grant eligibility), and racial/ethnic classification.

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Institution</th>
<th>Number of scholars</th>
<th>Pell eligible (%)</th>
<th>UR (%)</th>
<th>Female (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>WSU</td>
<td>17</td>
<td>53</td>
<td>65</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>UDM</td>
<td>26</td>
<td>81</td>
<td>62</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>MG</td>
<td>9</td>
<td>63</td>
<td>100</td>
<td>66</td>
</tr>
<tr>
<td>2016</td>
<td>WSU</td>
<td>13</td>
<td>46</td>
<td>62</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>UDM</td>
<td>23</td>
<td>78</td>
<td>78</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>MG</td>
<td>6</td>
<td>83</td>
<td>83</td>
<td>50</td>
</tr>
<tr>
<td>2017</td>
<td>WSU</td>
<td>15</td>
<td>27</td>
<td>67</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>UDM</td>
<td>21</td>
<td>76</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>MG</td>
<td>5</td>
<td>-</td>
<td>-</td>
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</tr>
</tbody>
</table>

Note: MG = Marygrove College, UDM = University of Detroit Mercy, WSU = Wayne State University

*Number of ReBUILDetroit Scholars reported at the beginning of the academic year and before the speed-pairing process; some scholars did not participate in the speed-pairing process depicted in Figure 3.

*UR: Underrepresented groups. Based on NIH-NOT-OB-15-053, which includes only race and ethnicity. New guidance from NIH is forthcoming in NIH-NOT-18-122 that may affect future reporting, as it includes a broader definition of underrepresented groups.

*In August 2017, Marygrove College announced that it would close its undergraduate programs after the fall 2017 semester. All Marygrove ReBUILDetroit Scholars transferred to University of Detroit Mercy to continue their education and finish the ReBUILDetroit program.
Developing Undergraduate Scientists

Dimensions and found that they had more than adequate reliabilities as measured by coefficient alpha. Responses to the URSSA items were arranged on a 5-point Likert-type scale, ranging from “no gains” (1) to “great gains” (5). Responses on the items within each dimension were summed to create a scale score. Because the number of items and number of response options varied across dimensions, standardized scale scores were created so that each scale would range from 0 to 100 percent. The number of usable responses varied by scale as some responses had to be discarded if a survey response within the scale was insufficient.

Two-hour focus groups were conducted with scholars after they completed their summer research in 2017. For these interviews, students were separated by both institution and cohort year. Thus, a total of six focus groups was conducted, representing the three partner institutions (University of Detroit Mercy, Marygrove College, and Wayne State University) with a total of 24 students participating from the first cohort (2015) and 19 students participating from the second cohort (2016).

Results

Program Design and Implementation

Studies on underrepresented and socioeconomically disadvantaged groups often point to early college experiences that lead these students to leave STEM majors (Hurtado et al. 2008; Hurtado et al. 2017; Wilson et al. 2015). Therefore, ReBUILDetroit focuses on the first-year experience as an important transition period that will benefit scholars the most, setting the students on a path to college success and STEM degree attainment (see Figure 1). The integrated experience integrates academic expectations, instills a positive science identity and self-efficacy through a combination of mentorship and coursework, and transitions the students from simple consumers of knowledge to creators of knowledge, or researchers.

ReBUILDetroit Scholars across institutions and disciplines begin their first academic year in the program,
whether as first-year or transfer students, by enrolling in a research methods course. This class is part of a coordinated first-year curriculum that also includes a course-based undergraduate research experience (CURE) that is discipline-specific (biology, chemistry, health disparities; see Figure 1). The research methods course is designed to incorporate elements of Branchaw, Pfund, and Rediske’s *Entering Research* (2010). ReBUILDetroit Scholars are introduced to some essential elements of research, including searching and reading the scientific literature, laboratory record keeping, and methods for selecting lines of research. Another important objective of the course is to develop students’ self-efficacy in communicating and networking with research scientists. A faculty interview project helps break down barriers that prevent undergraduate students, particularly those from underrepresented groups, from effectively finding high-quality mentors (Hurtado et al. 2011). This interview serves as the first step in pairing scholars with research mentors for their summer research experience. A unique aspect of the program is that ReBUILDetroit Scholars are permitted and even encouraged to consider research mentors across the consortium. As a result, scholars have the opportunity to select faculty interviewees from a diverse array of disciplines, laboratory types, and institutions; these types of partnerships are essential for providing broad access to high-quality undergraduate research experiences (Boyd and Wesemann 2009).

Scholars are coached during preparation for their faculty interviews with scaffolded assignments: reading and summarizing a research paper by the prospective research mentor, developing questions to ask mentors about research interests and professional background, developing short biographical sketches of themselves to share with the mentors, and crafting emails to send to them. An additional topic of conversation is standard interview etiquette (proper attire, resume preparation, etc.). Faculty mentors affiliated with the ReBUILDetroit program are reminded by program staff that ReBUILDetroit Scholars will be requesting meetings to ensure good mentor response rates, especially between institutions. Following the interviews, the scholars prepare a brief summary of the meeting and reflect on what they have learned during this experience.

The second step is a speed-pairing event between the scholars and potential research mentors, occurring during the second semester of the academic year as a curricular activity alongside the CURE class. Speed-pairing has been used in a few settings to help mentees identify mentors (Guse et al. 2016; Kurré et al. 2014) but seldom implemented at the undergraduate level and never with advanced training of the mentees. By creating a formalized process for pairing, scholars are placed on a more equitable footing with respect to finding a research mentor. The coaching that occurs prior to the pairing events explicates some of the expectations of which scholars may not be aware that may affect some scholars as they seek appropriate research placements.

To prepare for speed-pairing, scholars review mentors’ research agendas and submit a list of mentors whose research is of interest to them. The lists are compiled and used to match student and faculty interests during the pairing event. Prior to the speed-pairing event, scholars are informed of the mentors they will interview. They then apply the skills learned during the research methods course to review the work of the prospective mentors, which increase the scholars’ confidence during the interviews. During the speed-pairing event, scholars participate in three or four 20-minute interviews, mostly one-on-one but occasionally in pairs (see Figure 2). Following the speed-pairing interviews, mentors rank the scholars with whom they have met and indicate their willingness to accept them into their research groups; likewise, the scholars rank their interest in working with specific mentors following the interviews.

The mentor-mentee pairing committee, composed of ReBUILDetroit faculty and staff, facilitates the event and coordinates the summer research placements. In addition to mentor and scholar ranking, other criteria are considered when placing scholars in a laboratory. For example, the goal is to place two scholars with each mentor to provide peer-level support for each student. Student success coordinators who work one-on-one with each
scholar throughout the year are able to provide valuable insights regarding each scholar, such as level of academic preparedness, professional goals, and access to transportation if research at another institution is considered. ReBUILDetroit faculty facilitating the speed-pairing also are experienced researchers from a variety of biomedical disciplines and are able to assess both the scope of the research performed by each mentor and the academic experience of each scholar. The goal is to ensure that each scholar is prepared with the necessary skills, knowledge, and disposition to acclimate easily to the mentor’s research group. This intentional coaching over the academic year and during the speed-pairing process ideally pairs the scholar and a research mentor with whom the scholar will continue to work throughout the undergraduate program. Although most of the scholars from WSU stay at WSU, about one-half of the scholars from Detroit Mercy and Marygrove come to WSU for their research experiences (see Figure 3).

Once the research placement process is complete, the research mentors are invited to participate in a two-hour mentor training workshop based on the curricula developed by the National Research Mentoring Network (Pfund et al. 2016; Pfund et al. 2015). Bench mentors, graduate students, and postdoctoral trainees who may serve as daily contacts for the ReBUILDetroit Scholars also are encouraged to attend. The workshop curriculum includes content on implicit bias, effective communication, and mentoring agreements that can be used to convey expectations for both mentor and mentee. Finally, the mentor-mentee relationship is monitored throughout the summer research experience via brief biweekly online surveys, which are reviewed upon receipt by student success coordinators and faculty on the mentor-mentee pairing committee. The survey feedback allows for rapid intervention if any engagement or interpersonal issues develop.

**Student Outcomes**

ReBUILDetroit is designed to help seamlessly transition students into mentored research through a series of phased activities that build their science identities and research self-efficacy over the course of the students’ first year. In the research methods course, scholars learn how research problems are identified and how to select suitable approaches to examining them. CUREs provide a protective environment in which to explore solving a problem with a group of relative novices. The speed-pairing process is intended to provide both mentor and mentee with some agency related to entering the mentor-mentee relationship and to improve the likelihood that students have a positive transition to mentored research that builds their self-identity as scientists (Chang et al. 2011). As students build that self-efficacy and science identity, it is hypothesized that they will become better prepared for their first mentored research experiences, be able to persist through difficult parts of the curriculum, and be more likely to graduate with STEM degrees.

All eligible ReBUILDetroit Scholars (N = 123) participated in mentored summer research during summer 2016 and summer 2017. An adapted version of the Undergraduate Research Student Self-Assessment (URSSA) questionnaire was used to measure scholars’ perceptions of gains from their undergraduate research experiences (Weston and Laursen 2015). Dimensions of URSSA relevant to assess-
ing the ReBUILDetroit summer research experiences were (1) gains in thinking and working like a scientist, (2) personal achievements related to research work, (3) improvements in research and presentation skills, (4) changes in attitudes or behaviors as a researcher, and (5) perceived quality of overall research experience (see Table 2).

After one summer of research, ReBUILDetroit Scholars reported significant gains across all five dimensions of science identity and self-efficacy (see Figure 4). Scholars rated their research experiences highly, such that they exceeded 75 percent on all five dimensions of the URSSA quality scales. Furthermore, the students from the first cohort (N = 51) showed small but significant increases across all five dimensions after their second summer research experience ($p < 0.05$; see Figure 4). The majority of scholars (65 percent) chose to remain with the same research mentor for the second summer, even when offered the opportunity to transfer to a new laboratory. Scholars therefore valued the opportunity for prolonged experience within a single research group over variation and exploration of a new area.

**TABLE 2. Formation of Science Identity and Self-Efficacy Scale Scores Derived from URSSA Data**

<table>
<thead>
<tr>
<th>Scale</th>
<th>URSSA items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gains in thinking and working like a scientist: Application of knowledge to research work.</td>
<td>Q1.1 Analyzing data for patterns.</td>
</tr>
<tr>
<td>Q1. How much did you gain in the following areas as a result of your most recent research experience?</td>
<td>Q1.2 Figuring out the next step in a research project.</td>
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<td>Q1.3 Problem solving in general.</td>
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<td>Q1.4 Formulating a research question that can be answered with data.</td>
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<td>Q1.5 Identifying limitations of research methods and designs.</td>
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<td></td>
<td>Q1.6 Understanding the theory and concepts guiding my research project.</td>
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<td>Q1.7 Understanding the connections among scientific disciplines.</td>
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<td></td>
<td>Q1.8 Understanding the relevance of research to my coursework.</td>
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<tr>
<td>Personal gains related to research work.</td>
<td>Q2.1 Confidence in my ability to contribute to science.</td>
</tr>
<tr>
<td>Q2. How much did you gain in the following areas as a result of your most recent research experience?</td>
<td>Q2.2 Comfort in discussing scientific concepts with others.</td>
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<tr>
<td></td>
<td>Q2.3 Comfort in working collaboratively with others.</td>
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<td></td>
<td>Q2.4 Confidence in my ability to do well in future science courses.</td>
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<td>Q2.5 Ability to work independently.</td>
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<td>Q2.6 Developing patience with the slow pace of research.</td>
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<td>Q2.7 Understanding what everyday research work is like.</td>
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<td>Q2.8 Taking greater care in conducting procedures in the lab or field.</td>
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<tr>
<td>Gains in research and presentation skills.</td>
<td>Q3.1 Writing scientific reports or papers.</td>
</tr>
<tr>
<td>Q3. How much did you gain in the following areas as a result of your most recent research experience?</td>
<td>Q3.2 Making oral presentations.</td>
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<td>Q3.3 Defending an argument when asked questions.</td>
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<td>Q3.4 Explaining my project to people outside my field.</td>
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<td>Q3.5 Preparing a scientific poster.</td>
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<td>Q3.6 Keeping a detailed lab notebook.</td>
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<td>Q3.7 Conducting observations in the lab or field.</td>
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<td>Q3.8 Using statistics to analyze data.</td>
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<td>Q3.9 Calibrating instruments needed for measurement.</td>
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<td>Q3.11 Understanding journal articles.</td>
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<td>Q3.12 Conducting database or internet searches.</td>
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<td></td>
<td>Q3.13 Managing my time.</td>
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<tr>
<td>Changes in attitudes or behaviors as a researcher.</td>
<td>Q4.1 Engage in real-world science research.</td>
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<tr>
<td>Q4. During your research experience how much did you:</td>
<td>Q4.2 Feel like a scientist.</td>
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<td>Q4.3 Think creatively about the project.</td>
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<td>Q4.4 Try out new ideas or procedures on your own.</td>
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<td>Q4.5 Feel responsible for the project.</td>
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<td>Q4.6 Work extra hours because you were excited about the research.</td>
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<td>Q4.7 Interact with scientists from outside your school.</td>
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<td></td>
<td>Q4.8 Feel a part of a scientific community.</td>
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<tr>
<td>Perceived quality of overall research experience</td>
<td>Q5.1 My working relationship with my research mentor.</td>
</tr>
<tr>
<td>Q5. Please rate the following:</td>
<td>Q5.2 My working relationship with research group members.</td>
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<td></td>
<td>Q5.3 The amount of time I spent doing meaningful research.</td>
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<td></td>
<td>Q5.4 The amount of time I spent with my research mentor.</td>
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<td></td>
<td>Q5.5 The advice my research mentor provided about careers or graduate school.</td>
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Developing Undergraduate Scientists

Scholars talked excitedly about the research they were doing with their mentors and how their lab work allowed them to contextualize and integrate it with course-based learning within their majors. One student said:

I feel like I have learned so much more working in my lab than I had in my classes, so much more. And that is why I get more excited about it because the fact that this is what I am going to be able to do once I leave—even throughout the rest of undergrad and grad school. I am going to be able to work in a lab and actually do this stuff. And that is what I really like about BUILD, it helped me find that passion.

Scholars also highly valued the pairing process that allowed them to meet several faculty members. The majority of students described highly satisfying relationships with their mentors. Another student said:

With my mentor, I would keep the way he sees learning. He’ll give us the basics of what we need to do in an experiment. And then he’ll let us have full rein of the experiment—like, everything from the design, how we approach the next step.

Focus group interviews were used to gain additional insight into the student perspective of ReBUILDetroit’s mentored research experiences. The findings confirmed that students valued the relationships they formed with their faculty mentors, the extended scientific learning opportunities, and the process for mentor pairing. One student said:

I would say my relationship with (mentor name) is excellent. We see eye to eye every single time. If she has an issue with what I’m doing in the lab, then she brings it up to me in a respectful way but still in a way that lets me see that I messed up somewhere so I need to fix it. She helps me take steps necessary to fix it. I’ve only had positive experiences with her.

Although that is the insight of a single individual, it reflects a sentiment that was voiced repeatedly during the focus group interviews. The overall quality of the mentor-mentee interactions was critical to program success, as it led students to elect to continue with mentored research.

Almost unanimously, students included their research mentors as part of the support network they felt they gained from the ReBUILDetroit program. The majority of students described highly satisfying relationships with their mentors. Another student said:

Qualitative Validation of Outcomes

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FIGURE 4. Data on Student Growth Related to Science Identity and Self-Efficacy as a Result of the ReBUILDetroit Program and the Summer Research Experience (SRE)

Note: Raw data were collected using an adapted version of the URSSA instrument (Weston and Laursen 2015). Scales were developed by aggregating items from the URSSA instrument as described in the text and Table 2. Data are presented as frequency distributions of students’ perceptions of gain. Different vectors have different response options, following the response options used in the original URSSA measure. Values for the number of students vary slightly for each scale as a result of insufficient responses to individual questions from some participants.
displayed for the scholars different types of scientific projects that were available and the diverse approaches of faculty toward mentoring.

I liked the interview process you have at the beginning before you start your summer research because you get to talk to several different individuals. And BUILD helps you set up connections with them so you don’t have to do it all on your own—like, email these people and find them all on your own. That’s helpful.

Multiple comments echoed the sentiment that building relationships with mentors was a highlight of the year. Taken together, the qualitative outcomes from the focus groups mirrored the data from surveys and revealed that students felt prepared to enter mentored research at the end of their first year in ReBUILDetroit; the scaffolded structure of the program allowed them to seamlessly transition into mentored research; and the research experience added perspective relative to academic and career interests.

Discussion
Research experiences and the mentor-mentee relationship involved are of particular importance for career progression of trainees in biomedical disciplines (Boyd and Wesemann 2009; Chopin 2002; Dolan and Johnson 2010; Eagan et al. 2013; Hurtado et al. 2009). Most scientists can trace their careers back to specific individuals who shaped their perspective on their field and set them on their career trajectory. In the sciences, this process often starts with joining a research group. Entering research changes a student’s approach to science and develops a positive science identity and self-efficacy that supports continuation within the field and academic success (Haeger and Fresquez 2016; Hurtado et al. 2009). The ReBUILDetroit program is designed to help students make this transition in an intentional environment, helping to place students successfully with research mentors and encouraging them to take full advantage of the opportunities available to them in college.

Many undergraduates have difficulty finding quality mentored research experiences, even when a culture of undergraduate research exists on campus (Aikens et al. 2017; Morales, Grineski, and Collins 2016). Students are often left to their own devices to find undergraduate research experiences and mentors. Students with high levels of social capital effectively navigate this process, whereas other students, especially first-generation college students or those from underrepresented backgrounds, may fare less well (Aikens et al. 2016; Morales, Grineski, and Collins 2017). An additional potential barrier has been highlighted in studies that found bias in how faculty respond to emails from students seeking research opportunities based on the ethnicity and gender reflected in specific names (Milkman, Modupe, and Chugh 2015).

A scaffolded entry into mentored research, including the speed-pairing process, provides a time-efficient opportunity to help students overcome barriers to identifying a mentor and joining a research group. Coaching in advance of the pairing event better prepares students to successfully navigate the placement process. By the simple metrics of efficiency and agency, speed-pairing is highly effective. Faculty can spend an hour at the event and meet several students who are interested in their work, and students can meet multiple faculty members and explore the breadth of their options. In the case of a consortium-based program like ReBUILDetroit, this process creates opportunities for the scholars to join research labs on partner campuses (Morales et al. 2016). Although data are sparse for years prior to ReBUILDetroit, it was relatively uncommon for students from Marygrove College or Detroit Mercy to seek out research experiences at WSU. An additional hallmark of successful research pairings is the number of students who choose to continue their undergraduate research with the same mentor in subsequent years, evidence that the speed-pairing process is intentional in matching mentor and mentee interests and that productive relationships form as a result. Such relationships not only contribute to the ReBUILDetroit Scholars’ perceived gains and quality of research, as measured by URSSA, but also are essential for the scholars to identify as part of a community of scientists and develop as independent scientists.

The URSSA outcomes show tremendous growth in the ReBUILDetroit Scholars’ perceptions of science identity and self-efficacy after the first summer of mentored research. Such gains in self-assessment of science identity and self-efficacy are reproducible from year to year. The second summer research experience does not differ programmatically for continuing scholars; however, the data reveal that the second summer of research leads to smaller but significant increases in perception of gains in science identity and self-efficacy. By the second year, the scholars have sufficient experience to take advantage of the research opportunity. One might argue from these data that a single summer experience may be sufficient for undergraduate students to develop solid skills such as understanding the theory and concepts guiding their research (dimension 1), being comfortable discussing scientific concepts with others (dimension 2), or working with computers (dimension 3). However, in the second and third years, students learn other aspects of being a scientist that are measured by dimensions in URSSA not assessed in this study of first-year students (e.g., attending conferences, presenting posters or making presentations about their research, and intentions to enroll in graduate degree programs). Going forward, URSSA questions about more senior level skills related to publications, awards, and proposal writing will be used to track the advanced research skills and awareness obtained through prolonged research exposure. It is believed that this interpretation supports
the benefits of extended mentored research experiences that lead to greater skills development and a deeper understanding of research projects. Linn called for additional study on the benefits of undergraduate research experiences (Linn et al. 2015). Open questions regarding requisite dosage, psychosocial benefits from peer and near-peer interactions, and the importance of nonlaboratory activities that support research experiences must all be answered to fully understand how research experiences impact student development.

The question of how to reliably measure the quality of an undergraduate research experience is still unanswered. Two instruments are often used. The Summer Undergraduate Research Experience Survey (Lopatto 2004) focuses principally on program elements, whereas the URSSA questionnaire (Weston and Laursen 2015) emphasizes perceptions and attitudes. Neither instrument fully captures the impact of research experiences nor addresses why some students report greater gains than others. Therefore, consideration is being given to scale scores that bin questions related to common themes. These themes align with those that the original creators of URSSA used to categorize items. A deeper look at how different students develop as researchers and what practices lead to that development is still important. If such measures can be developed and validated it will be easier to study the impact of individual elements of research experiences, such as the mechanism of pairing students with mentors or the impact of mentor training on the overall quality of the undergraduate research experience.

It is important to remember that the ReBUILDetroit program focuses on a scaffolded first-year curriculum; the speed-pairing process and resulting mentored research experience are two elements of an integrated program that involves several curricular and extracurricular interventions (see Figure 1). Given the symbiotic relationship of the interventions received by these students, it is not possible to specifically dissect the impact of individual elements within the context of the scholars’ perceptions of science identity and persistence in undergraduate STEM careers. Thus, the progression of the ReBUILDetroit Scholars’ sense of scientific identity and persistence in undergraduate STEM fields must be viewed as part of the intervention across the entire spectrum of activities. Nevertheless, the ReBUILDetroit model of scaffolding the mentored research experience, including the speed-pairing to match undergraduates with research mentors, can be incorporated into campus research programs with relative ease.

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Abstract
For new-majority students (traditionally underrepresented minority, first-generation, and low-income students) who are less likely to have access to support systems, learning how to navigate the often hidden facets of academia can be a challenge. Providing programming that helps students learn how to navigate the academic landscape as they undertake undergraduate research (UR) increases understanding of the hidden curriculum and helps new-majority researchers chart a course through academia, develop higher educational aspirations, and prepare for graduate school. To demonstrate the effectiveness of these interventions, the authors use a mixed-methods approach, including testing common misconceptions, students’ written reflections on their learning, and survey data. Findings suggest that the inclusion of programming explicitly designed to shed light on the hidden curriculum increases the impact of UR and can better prepare students for graduate school and the workforce.

Keywords: assessment, cultural capital, first-generation college students, minority-serving institutions, underrepresented minority students

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As students travel the road through college and into the workforce or graduate school, they need to learn the unspoken rules, or the hidden curriculum, of academia (Conley 2005). Although all students benefit from learning about this hidden curriculum, it is especially crucial for new-majority students (traditionally underrepresented minority, first-generation, and low-income students), as they are less likely to have access to support systems that can provide full information about academia (Pascarella and Terenzini 1991; Ramirez 2011).

This article considers how undergraduate research (UR) and related programming at a minority-serving institution (MSI)—California State University, Monterey Bay (CSUMB)—can shed light on the hidden curriculum and help new-majority students be successful in college and beyond. Providing an overview of programming that helps students learn the unspoken rules of academia, the authors discuss how to help new-majority researchers navigate academia, develop higher educational aspirations, and prepare for graduate school. We will provide specific examples of two interventions (a faculty mentor panel and the activity Academic Landscape) and present the assessment of the impact of these interventions. In addition, the overall impact of combining mentored undergraduate research with interventions aimed at shedding light on the hidden curriculum is discussed more broadly.

This article will add to the knowledge on UR in three ways by:
• Using the hidden curriculum as a framework for supporting new-majority students and designing support programs for UR students
• Describing specific programs and interventions that illuminate the hidden curriculum, with notes for implementation (see Figure 1)
• Providing results from assessment of these programs and specifically addressing how interventions that teach the hidden curriculum affect knowledge of the hidden curriculum and educational or career aspirations.
The Hidden Curriculum

A key component of what gives UR impact is the opportunity for students to be invited into their discipline in an authentic way and the resulting development of a deeper understanding of what research looks like. Because of this, UR can be an effective way to help students understand their discipline and persist in their field (Bauer and Bennett 2003; Cole and Espinoza 2008; Collins et al. 2010; Haeger and Fresquez 2016). This active engagement in research helps students learn both the explicit and unspoken practices of research (Aikens et al. 2016; Holligan 2015; Wilson et al. 2010). Explicit practices are those skills and techniques typically associated with UR, such as learning lab techniques, performing data analysis, or cataloging an archive. Explicit norms may include laboratory safety, research ethics, and practices such as updating a lab book daily. These are expectations that are explicitly communicated to students verbally or in writing. In contrast, the unspoken norms and practices that can be equally critical for academic and professional success compose the hidden curriculum (Conley 2005).

When applied to the educational experience of UR, the hidden curriculum can be described as the norms, expectations, and rules that are learned as one is socialized into an academic discipline and the institutions of research and higher education associated with that discipline. In this context, everything from how to interact with a potential research mentor to an understanding of the different types of graduate degrees in a specific field and their relationship to potential career choices can be described as part of the hidden curriculum. Individuals who have progressed through higher education and subsequent careers, especially those in academia, have all been repeatedly exposed to this hidden curriculum and have adopted these norms and expectations. These norms eventually become so ingrained that the people implementing and perpetuating this status quo may forget that they are even there.

A significant body of research has explored how these hidden rules, norms, and expectations shape academic, career, and economic success for undergraduate students (Lareau and Weininger 2003; Winkle-Wagner 2010). Conley (2005) demonstrates how access to the hidden curriculum of undergraduate education prepares students to successfully transition into college. Other research on the academic impact of these hidden requirements or knowledge describes it as cultural capital (Bourdieu 1986) and academic capital (Winkler and Sriram 2015). Cultural capital refers to cultural knowledge that provides an advantage within a particular setting; for example, knowing that graduate schools value undergraduate research experience leads students with that knowledge to actively pursue undergraduate research experiences and ultimately become more competitive in graduate school applications (Ramirez 2011). Recent research has identified cultural knowledge related to academia (e.g., knowledge about financial aid, ability to navigate academic systems) as academic capital (Winkler and Sriram 2015). Although the hidden curriculum is strongly related to cultural and academic capital, the authors of this article make a distinction and use the term hidden curriculum for two reasons. First, the concept of capital is centered on the transfer of knowledge from parents to children so that wealth and advantage can be transferred to the next generation. As such, it is often critiqued as deficit-based, with an emphasis on problems instead of solutions (Yosso 2005). The focus here is instead on the hidden curriculum, suggesting that, instead of relying on students to learn these hidden rules from parents or others, institutions of higher education can find ways to expose them. Second, the concept of the hidden curriculum helps students understand that it exists, and developing strategies for discovering it can generally benefit all students and also provide a more equitable educational experience for those who would not otherwise have exposure to that cultural or academic capital.

The challenge arises when students unfamiliar with the hidden curriculum related to academic research are held to these hidden norms and expectations. This is particularly problematic for new-majority students who may not have parents or peers who know the jargon, norms, or expectations of academic or research environments and thus may have related misconceptions. Seemingly minor misconceptions can have a disproportionately large impact on a student’s educational goals and trajectory. For example, misconceptions related to the distinctions between adjunct and tenure-track faculty or unfamiliarity with the emeritus distinction can negatively affect a student’s ability to find future research opportunities or identify potential graduate school mentors. Even as students endeavor to build relationships with potential mentors, misunderstandings regarding faculty standing within the higher education institution can undermine the identification of beneficial research or graduate opportunities.
These critical misconceptions can prevent new-majority students from even seeing graduate school as a possibility.

The Undergraduate Research Opportunities Center (UROC) at CSUMB has instituted a number of programmatic interventions to expose students to the hidden curriculum of research and academia. These interventions inform students about the hidden curriculum both indirectly through faculty mentors and directly through programming (workshops, research seminar courses, and summer programs). Programming is implemented during the school year through workshops and research seminar courses (Head and Brown 2012; Banks et al. 2018) and also offered via a summer program with weekly workshops and a virtual community (Oehlman et al. 2016). Topics include an introduction to research norms, ethics, and practices in different disciplines; an overview of graduate degrees, preparation for them, and application procedures; funding options for graduate school; practice with professional communication, including professional emails, an elevator pitch, poster and oral presentations, and abstract writing; and exploration of academic conference norms, culture, and expectations.

The following sections describe key components of this program that shed light on the hidden curriculum through the mentor-mentee relationship and the activity Academic Landscape. In addition, a holistic assessment of the effects of hidden curriculum programming on knowledge of educational and careers options is provided.

Methods
To explore the impact of interventions that teach students about the hidden curriculum, a mixed-methods approach is used to test two specific interventions (a research mentor panel and a workshop activity) and holistic assessment of programming that sheds light on the hidden curriculum is provided.

The assessment protocols were submitted to the CSUMB Institutional Review Board, which determined that the research was exempt because all interventions and data collection happened through normal educational activities, posed no significant risk, and were tied to program evaluation.

Intervention 1: Mentoring
Informal learning from faculty, graduate students, and postdoctoral mentors is how students traditionally become acquainted with the hidden curriculum and how to navigate academia, but further work that would encourage mentors to make these norms and expectations explicit would benefit all students and create a more equitable research experience for new-majority students. To this end, one step has been the introduction of targeted interventions that empower students to ask their mentors to shed light on the hidden curriculum. One intervention is a faculty mentor panel attended by many UR students when they first join UROC. In this panel, faculty from across campus talk about their experiences with research mentorship and the process of research in their field (answering questions such as “Please speak to the importance of having multiple mentors in your life,” and “What is your top piece of advice for a student who is just starting to develop a relationship with a research mentor?”) To assess the impact of this intervention, students are asked to reflect on what they learned from the panel and submit a short statement about what they learned (n = 41). The authors reviewed these statements to identify and present common themes.

Intervention 2: The Academic Landscape
One activity developed to enlighten students regarding the hidden curriculum is called the Academic Landscape. The goal of this activity is to introduce students to some aspects of academia and nurture their understanding of academic systems, jargon, and processes so as to support their educational and career goals.

To quantify student familiarity with basic academic structures associated with graduate school funding, faculty positions, and academic degrees, novice undergraduate students participating in undergraduate research opportunities were surveyed and found to have a number of misconceptions about basic academic structures. The baseline survey was completed by students prior to their first summer research experience during a research seminar course that prepared students for research. All students completed the survey at the start of class. This survey of academic misconceptions (baseline n = 20) was used to compare students’ understandings of the hidden curriculum after participating in the activity (post-activity n = 99). The post-activity survey was completed at the end of the class for the same population of 20 students and also after completing the activity for an additional 79 students in a summer research workshop.

The Academic Landscape activity is conducted in a room where headings and subcategories have been posted on the walls for (1) degrees: master’s, doctorate, professional, and academic; (2) graduate school funding: financial aid, scholarships, fellowships, and assistantships; and (3) academic positions: tenure track, instructor, and researcher. Each student is handed a strip of paper with jargon, definitions, and statements that pertain to each of the headings posted on the walls (e.g., “paid positions that include tuition reduction and a stipend for living expenses; also may include benefits like health care,” or “PI: principal investigator is the lead investigator on a research project and/or grant; is often an assistant, associate, or full professor”). Students go through three rounds to organize all of their individual strips of paper under the appropriate heading and subcategory (see Figure 2).
Holistic Assessment

UROC has implemented a variety of interventions with the explicit goal of shedding light on the hidden curriculum. These interventions happen in the form of academic-year workshops for students, a summer workshop series for students doing research on campus, and as part of a two-year research seminar offered to students (see Head and Brown 2012, and Banks et al. 2018, for more detail on the research seminar curriculum). To test the overall impact of this hidden curriculum programming on skill development and educational and career aspiration, students at the end of each summer research experience from 2012 to 2016 were surveyed. Students who participated in mentored undergraduate research before additional programming was implemented (2012–2013, n = 139) were compared with students who participated in UROC support programs that illuminate the hidden curriculum as well as mentored undergraduate research (2015–2016, n = 121; see Table 1).

As seen in Table 1, the survey respondents from both groups were similar in terms of size and gender, race, class standing, and parental education level. Descriptive statistics along with mean comparisons of pre- and post-programming surveys were used to test the impact of this programming.

Results

Intervention 1: Mentoring

All students who attended the research mentor panels felt they learned something or gained insights about research or the mentor-mentee relationship (see Figure 3). Many students expressed a better understanding of how to inter-
Heather Haeger, Carla Fresquez, John E. Banks & Camille Smith

Students are frequently surprised that their faculty mentors were not born knowing that they wanted to do research and that their educational and career paths were not linear but instead contained twists and turns along the way. In addition to attending the mentor panel, students are asked to talk to their mentors and then create a presentation for their cohort about the mentor’s path through college, graduate school, and into research. Through this process, students become aware of a variety of educational and career pathways, and are able to have frank discussions with their mentors and peers about diverse options that may not be otherwise encountered or acknowledged.

**Intervention 2: The Academic Landscape**

To test students’ knowledge of the hidden curriculum, a survey with true/false questions about common academic misconceptions was created. In the baseline, pre-intervention sample (see Table 2), only half of the students knew that doctorate degrees required a culminating dissertation. It also was found that 15 percent believed that no financial aid was available for graduate students, and 45 percent did not know that assistantships were a common means of funding graduate school. These critical misconceptions may prevent new-majority students from seeing graduate school as a possibility. Additionally, even students actively engaged with faculty in a mentored UR experience did not understand academic structures like the tenure track; more than half of the students did not know the difference between adjunct faculty and associate faculty positions.


<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td></td>
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<td>Fourth-year</td>
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<td>Prefer not to respond/missing</td>
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<td>4.8</td>
</tr>
<tr>
<td>African American/Black</td>
<td>5</td>
<td>4.8</td>
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<td>1.9</td>
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<td>Asian</td>
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<td>5.8</td>
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<td>51.9</td>
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<td>25</td>
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<tr>
<td>Pacific Islander or Native Hawaiian</td>
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<td>1</td>
</tr>
<tr>
<td>Biracial/multiracial</td>
<td>4</td>
<td>3.8</td>
</tr>
<tr>
<td>Other (please specify)</td>
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<td>1</td>
</tr>
<tr>
<td>Guardian education</td>
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<td></td>
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<td>N/A or Prefer not to respond</td>
<td>1</td>
<td>0.01</td>
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<tr>
<td>Parent or guardian has a college degree</td>
<td>41</td>
<td>59.6</td>
</tr>
<tr>
<td>First generation in college</td>
<td>62</td>
<td>55.3</td>
</tr>
</tbody>
</table>

**FIGURE 3. The CSUMB Summer Research Symposium**

Heriberto Marquez, left, presents his research at the symposium with his mentor, Ruben Mendoza.

This is an example of how a common misconception can lead to major misunderstandings between faculty and students.
In testing following a single, one-hour intervention to address these misconceptions, there were mixed results. As seen in Table 2, none of the items were clarified for 100 percent of the students, but the vast majority (93 percent) of participants in the Academic Landscape activity found it helpful. One student said, “I did not know much about this topic, but after participating in this activity I am very familiar now and have a better idea what to expect during my post-undergrad work.” Through the Academic Landscape activity, many items were clarified, whereas other areas of misconceptions—particularly about tenure and the characterization of tenure-track positions—persisted. The final column in Table 2 presents the increase or decrease in understanding of academia as measured by the difference in the percentage of students answering questions correctly before and after the activity. Overall, more students answered items correctly after participating in the Academic Landscape activity, with the largest change in the percentage of students (23 percent more) having learned about graduate assistantships as a source of graduate school funding. In contrast, the smallest change (little to no change) related to tenure-track academic positions.

**Holistic Assessment**

In addition to assessing these specific interventions, students who participated in a summer program designed to teach them about the hidden curriculum were compared to students who only participated in research over the summer (see Table 3).

Students who participated in the UR support summer programs were significantly more likely to say that they had a broadened awareness of academic and career opportunities ($t = -1.97$, $df = 257$, $p < 0.05$). Other statistically significant differences after the program was implemented included research and professional competencies such as development of research-related skills ($t = -2.72$, $df = 256$, $p < 0.05$), sense of competence as a researcher ($t = -2.50$, $df = 257$, $p < 0.05$), and self-sufficiency ($t = -3.30$, $df = 262$, $p < 0.001$; see Table 3).

Overall, students also were more likely to want to attend graduate school, with some important shifts in aspirations (see Figure 4). Fewer students were undecided about their educational plans, and fewer students were aspiring to earn medical degrees. Instead, more students expressed interest in pursuing a PhD.

**Discussion**

Findings suggest that the inclusion of programming explicitly designed to uncover the hidden curriculum increases the impact of undergraduate research. Students overwhelmingly reported that both the mentor panel and the Academic Landscape activities were beneficial. The
mixed results of the assessment of the Academic Landscape activity reinforces the fact that more than a single, one-hour intervention is needed to thoroughly illuminate the hidden curriculum. The Academic Landscape activity represents one of a variety of programmatic structures implemented by UROC to prepare students involved in undergraduate research for success. In testing the effectiveness of these programs overall, there was evidence that participating students clarified their career goals, increased their educational aspirations, and felt more confident about their professional and research skills (see Figure 5).

As universities decide how to allocate resources and students decide how to invest their time, this research demonstrates that supportive programming in addition to the research experience can better prepare students for graduate school and the workforce. A combination of institutional support and external funding to support student research activities, especially in fields such as the humanities and the arts (Walker and Unruh 2017), is critical to achieving these goals.

The assessments of students’ perceptions of academia described here clearly highlight the need to explicitly address many elements of the hidden curriculum for undergraduate researchers. Certainly individual research mentors and faculty may play an important role in shedding light on many of these elements — although, as already noted, this relies on a certain level of awareness by mentors that may require additional coordination and deliberate training. Because illuminating the hidden curriculum is arguably beneficial to all students, regardless of whether or not they plan to conduct undergraduate research, supportive programming that helps ensure students are well-prepared for success can have a meaningful impact on their overall educational experiences.

### TABLE 3. Student Development Before (2012–2013, n = 139) and After (2015–2016, n = 121) Hidden Curriculum Programming

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broadened awareness of academic and career</td>
<td>4.26 (0.952)</td>
<td>4.48* (0.782)</td>
</tr>
<tr>
<td>opportunities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of research-related skills</td>
<td>3.90 (0.660)</td>
<td>4.11* (0.600)</td>
</tr>
<tr>
<td>Sense of competence as researcher</td>
<td>3.76 (0.912)</td>
<td>3.92* (0.851)</td>
</tr>
<tr>
<td>Self-sufficiency in academic pursuits</td>
<td>3.94 (1.01)</td>
<td>4.32**(0.863)</td>
</tr>
</tbody>
</table>

*Note:* *p < 0.05, **p < 0.01

### FIGURE 4. Student Educational Aspirations

As universities decide how to allocate resources and students decide how to invest their time, this research demonstrates that supportive programming in addition to the research experience can better prepare students for graduate school and the workforce. A combination of institutional support and external funding to support student research activities, especially in fields such as the humanities and the arts (Walker and Unruh 2017), is critical to achieving these goals.

The assessments of students’ perceptions of academia described here clearly highlight the need to explicitly address many elements of the hidden curriculum for undergraduate researchers. Certainly individual research mentors and faculty may play an important role in shedding light on many of these elements — although, as already noted, this relies on a certain level of awareness by mentors that may require additional coordination and deliberate training. Because illuminating the hidden curriculum is arguably beneficial to all students, regardless of whether or not they plan to conduct undergraduate research, supportive programming that helps ensure students are well-prepared for success can have a meaningful impact on their overall educational experiences.
not they engage in undergraduate research, campuses may profit by incorporating activities such as those described here more broadly into the curriculum. The optimal time and place for this to occur may vary, depending on campus resources and pedagogical approaches. This approach has the added benefit of providing opportunities to better align and even create synergies among student success initiatives led by academic affairs and student affairs units on campus. In general, the earlier the better: as resources allow, campuses might consider committing to explicitly illuminating the hidden curriculum in first-year programs. In some cases, these activities and lessons may be incorporated directly into classes by faculty or featured in special weekly or biweekly workshop or laboratory sections. These workshops and lab sections also may highlight helpful strategies pertaining to study habits and habits of mind, time management, and other quality hallmarks of first-year programs. In the authors’ experience, a combination of these approaches is most effective, although this requires careful calibration and coordination among faculty, staff, and administrators, not to mention dedicated resources. Furthermore, such programs ideally are implemented in a systematic way across disciplines. Finally, repeatedly exploring and revisiting elements of the hidden curriculum throughout the undergraduate years, carefully calibrated to each stage, will help codify the experience and prepare students for postgraduate study and success.

As has been demonstrated, misconceptions about academia can be a barrier for new-majority students, but programmatic support and mentoring can help illuminate the hidden curriculum. These barriers can be addressed by creating more explicit and inclusive norms and expectations in research environments and by helping students navigate new academic settings. The value of these programmatic interventions is not only in the specific knowledge they convey to students but also in showing students how to uncover the hidden curriculum. Creating structures and programs that empower students to learn the hidden curriculum—and, even more crucially how to uncover it—will not only help students better navigate the academic landscape but also will allow them to successfully navigate other settings. Students who have learned the norms of research and know how to look for the hidden curriculum can step into a professional setting and learn how to be successful there as well.

References


Heather Haeger also is serving as the assessment and research coordinator for the Council on Undergraduate Research (CUR), surveying current literature on undergraduate research, developing research and assessment tools for CUR members, and studying the role of faculty mentoring of undergraduate research in tenure and promotion. Haeger received her PhD in education policy, studies, and practices from the University of Arizona. From 2011 to 2014 she was part of the assistant research faculty in the Center for Postsecondary Research at Indiana University. She worked on designing, testing, and administering surveys on student engagement, including the National Survey of Student Engagement and the Law School Survey of Student Engagement.

Carla Fresquez is the research associate at UROC at CSUMB. She received her graduate degree in ecology and evolutionary biology from the University of California, Santa Cruz. Her research interests include examination of the factors shaping communities of sensitive intertidal marsh species and the identification of mentoring strategies effective for supporting students in undergraduate research. She is co-coordinator of the Louis Stokes Alliance for Minority Participation and is an UndocuAlly at CSUMB.

John E. Banks is director of UROC at CSUMB. He earned an MS in applied mathematics at the University of Southern California and a PhD in zoology at the University of Washington, Seattle. He spent 16 years as a faculty member and administrator at University of Washington, Tacoma, where he was professor of environmental science and served as director of international programs and director of undergraduate education. Trained as a quantitative ecologist, he has published more than 75 scientific articles, book chapters, and technical reports—several with undergraduate coauthors—exploring biological control and predator/prey population dynamics in agroecosystems, ecotoxicology, and the conservation of biological diversity in natural and managed systems in both temperate and tropical environments.

Camille Smith is a collaborative health and human services major at CSUMB. She is currently a UROC researcher under the mentorship of Haeger, assessing the impact of various interventions on the success of students engaged in undergraduate research and identifying students’ perceived barriers to engagement in undergraduate research.
ASSESSMENT

Faculty Change from Within: The Creation of the WMSURE Program

Cheryl L. Dickter, College of William & Mary
Anne H. Charity Hudley, University of California Santa Barbara
Hannah A. Franz, College of William & Mary
Ebony A. Lambert, Virginia Commonwealth University

Abstract

Underrepresented students have less knowledge of research experiences available on campus and are less likely to feel supported by faculty than represented students. To address these issues and increase the number of underrepresented undergraduate researchers, faculty at the College of William & Mary created the William & Mary Scholars Undergraduate Research Experience (WMSURE). Community-based and participatory research methods were used to work with students in developing research questions and in collecting and analyzing quantitative and qualitative data about their academic and personal experiences. This led to the development of academic and research advising services, workshops, faculty education, and research funding to support underrepresented students. This article evaluates the program. Results suggest that the WMSURE program has increased research opportunities and feelings of support on campus.

Keywords: mentoring, student programming, student support, undergraduate research, underrepresented students

doi: 110.18833/spur/2/1/6

Purpose: Addressing the Need for the Program

Undergraduate research has been shown to be a critical factor in addressing academic success by improving the quality of learning experiences for underrepresented students (e.g., Lopatto 2007). One benefit of conducting undergraduate research is having a close working relationship with a faculty member; indeed, students who have mentors achieve more and have better college experiences than those without mentors (Bearman et al. 2007; Clark, Harden, and Johnson 2000; Phinney et al. 2011). Previous research, however, has demonstrated that undergraduates from underrepresented racial (American Indian or Alaska Native, black or African American, Native Hawaiian or other Pacific Islander, multiracial) and ethnic (Hispanic or Latinx) backgrounds in the United States (National Institutes of Health 2015; National Science Foundation 2014) as well as students who are the first in their family to attend college (U.S. Department of Education 2018) are less likely to have research experiences in college than their peers (e.g., Russell, Hancock, and McCullough 2007). For the purposes of this article, underrepresented students are defined as those who self-identify with the racial and ethnic groups previously mentioned, as well as first-generation students.

The kind of mentoring experiences that can be forged through undergraduate research are especially important for underrepresented students. Faculty members who are themselves from underrepresented communities are ideal mentors for such students (Blake-Beard et al. 2011) but often find themselves stretched thin by other commitments. Because faculty from underrepresented communities are themselves underrepresented in the academy, they often find themselves in demand as research advisers. They, too, often require additional support (e.g., Laden and Hagedorn 2000). To complicate factors even more, at predominantly white institutions (PWIs), white faculty often lack ways to reach out to underrepresented students, even though underrepresented students may gain significant advantages from having white mentors...
Underrepresented students, in turn, are often uncomfortable and sometimes dissuaded from approaching faculty about research opportunities and can feel isolated and unsupported at their institution. Educating faculty about ways to engage with and mentor students from disadvantaged backgrounds, then, can help support underrepresented undergraduates through quality research experiences and mentoring, and offer a way to improve the academic and social outcomes of underrepresented students. Improving these outcomes also can contribute to making more inclusive and equitable campuses and educational experiences for all students.

The College of William & Mary is a public university in the southeastern United States with a nationally acclaimed undergraduate program. It boasts a moderate size, dedicated faculty and a distinctive history that fosters close interaction among students and teachers. Yet William & Mary has a centuries-long history of reliance on slavery and the mistreatment of African American employees and students. William & Mary has been successful in increasing the diversity of its undergraduate student body from 14 percent students of color in 2001 to 29 percent today. Eleven percent of William & Mary undergraduates are the first in their families to go to college. One contributor to this achievement is the William & Mary Scholars program. Established in 2002, it draws on institutional resources to provide approximately 40 to 60 in-state scholarships in each enrolling class to academically distinguished students who have overcome unusual adversity and/or are members of groups who contribute to campus diversity. Approximately 33 percent of current students who receive the William & Mary Scholars award are first-generation students.

William & Mary has the smallest black-white student gap in graduation rates among public universities in the nation. However, there is room for improvement in the number of William & Mary Scholars who become undergraduate researchers. About 10 percent of William & Mary students conduct senior honors theses, but only about 5 percent of African American students and about 3 percent of students who self-identify as Latinx or Hispanic (including those self-identifying as Chicanx) do so. There also are disparities in research experiences between first-generation and non-first-generation students: only 30.6 percent of William & Mary first-generation students are involved in mentored research, compared to 40.8 percent of non–first-generation students. Underrepresented students at William & Mary also report having less knowledge about research opportunities available on campus than white students and are less likely to feel supported and mentored by faculty.

To address these issues and ensure that underrepresented students are engaging in high-impact activities in college, faculty at William & Mary created the William & Mary Scholars Undergraduate Research Experience (WMSURE). The program’s goal is to increase the number of underrepresented students engaging in undergraduate research by providing formalized mentoring, academic programming, and increased research opportunities to nurture the academic skills and leadership potential of students from underrepresented backgrounds (see Figures 1 and 2). The program also was designed to help students pursue graduate scholarships and provide other educational supports specifically designated for underrepresented and first-generation students.

WMSURE is open to all William & Mary students. The majority of participants (50 to 60 each year) are incoming students who are chosen by the admissions office to...
receive the William & Mary Scholarship, a merit-based scholarship that covers in-state tuition and is presented to academically distinguished students who will contribute to campus diversity or who have overcome unusual adversity and are members of underrepresented groups.

Although other colleges and universities have successfully designed and implemented programs focusing on underrepresented students that have led to student success, the authors used community-based research methods, co-designed with WMSURE students, to collect information from a representative sample of underrepresented students at William & Mary to build a program that would address the specific needs of William & Mary students. They worked with undergraduate students, including article coauthor Ebony Lambert, as research collaborators, identifying the most frequent components of and challenges to successful research experiences. Students were thus active throughout the research process, collaborating on research questions, research design, participant recruitment, data collection, and data analysis, as well as designing the subsequent WMSURE events.

Mixed-methods investigations were conducted using qualitative and quantitative measures to identify the successes of underrepresented students, as well as the barriers that they face at William & Mary. Sixty-five students completed an online survey that assessed their experiences with research and mentorship and examined their perceptions of support from students and faculty. Psychological constructs of stereotype threat and solo status also were evaluated with validated measures. The responses of underrepresented students were compared to those of represented students. Stereotype threat is the experience faced by individuals when they think about the risk of confirming negative stereotypes about their group (Steele and Aronson 1995); this was measured to assess potential challenges to academic success. Solo status is the experience of being the only member of a particular sociocultural group in a setting such as a classroom (Lord and Saenz 1985), which can lead underrepresented students at a primarily white institution to feel that their perspectives are not acknowledged. In addition to these quantitative data, qualitative data were gathered via interviews and focus groups to get a richer sense of the empirical data. From these data, the specific needs of students were identified to create WMSURE. This mixed-methods approach allowed for personalization of the program around educational experiences, academic goals, and engagement of students throughout all four years of their college experience. To illustrate how these data were used to create the program, each element is described in the next section.

WMSURE: Mentoring and Advising

One of the first elements of the program recognized as critical was mentoring from faculty members. Data showed that 50 percent of underrepresented students stated that they did not receive mentorship from faculty. As mentorship is such an important part of academic success in college, WMSURE created a cohort of mentors from research faculty in different departments and programs throughout the campus. This group, designated WMSURE mentors, works directly with students (rather than staff, who are assigned to roles that focus on diversity, inclusion, or student success). Mentors are selected based on their previous record of support for students from underrepresented groups and are provided with professional development on specific issues reported by underrepresented students at William & Mary. Some of these mentors also serve as first-year advisers to incoming scholars. These advisers initiate communication before the students’ first year via email. In-person meetings commence once students arrive on campus, before classes begin (see Figure 3). This early contact allows students to establish a relationship with a faculty member whom they can ask both academic and personal questions. Furthermore, faculty mentors work to make policy changes on behalf of the students at the department and college levels.

WMSURE: Weekly Student Workshops

Data also suggested that weekly workshops, where students can obtain support and learn about issues in academia, would be important to mentoring and helping students become successful academic researchers. To this end, WMSURE developed weekly workshops addressing academic topics (e.g., writing, time management) based on the data (see Figure 4). Because research identified that underrepresented students at William & Mary report discrimination and negative experiences on campus, several workshops also were created to address issues of solo status, stereotype threat, and racial discrimination, giving students multiple tools for use in confronting academic and social challenges. In addition to the collection of data via a survey, conversations were held with
underrepresented students in research spaces and classrooms, and during office hours, to assess their needs. Using this information as well as programming from similar programs across the country (e.g., Meyerhoff Scholars Program at the University of Maryland, Baltimore County 2018), the article authors also included workshops geared for students transitioning from high school to college. These workshops focused particularly on underrepresented minority and first-generation students, covering such topics as time and energy management, financial planning, library resources, finding and communicating with faculty advisers, writing research papers, presenting research, and preparing for graduate and professional school. Community-based learning and the use of research for the public good were emphasized to ensure that students could engage with the various social inequities they encountered as both scholars and active citizens. Workshops were scheduled to correspond to students' trajectories throughout the year, including deadlines for exams, research grants, graduate school applications, and declaration of majors. Each workshop included a presentation with a panel of faculty, staff, and/or students with expertise on the specific topic. This presentation was followed by small-group advising and networking, with the purpose of establishing an informal cohort of students and interacting with faculty in a less formal setting, which could lead to faculty-student research collaborations. This model continues to be used to the present, with the topics modified each year based on informal and formal feedback; students thus drive the workshops. WMSURE faculty mentors also attend the workshops and learn about topics affecting students.

**FIGURE 3. WMSURE Scholars in the WMSURE Lounge**

The space includes a meeting room and two large offices. The physical space gives the program cohesion and serves as an informal meeting space for students as well as a formal place to meet WMSURE faculty.

**FIGURE 4. A WMSURE Student Workshop**

William & Mary Provost Michael Halleran welcomes a new class of WMSURE scholars to the college.

The data collected from students inform student programming and assist staff in counseling and student services as well as faculty in departments and programs that have had fewer successes with underrepresented students. In this way, a holistic approach is taken to helping students develop the tools needed to achieve their academic and social potential. This is important because, although many faculty learn how to teach their discipline in graduate school, they do not receive education relevant to understanding the needs of underrepresented students. Due to the importance of research in faculty members' work, providing compelling evidence of the issues faced by underrepresented students may be one way to help faculty understand these needs as it fits into their educational model. Examples of faculty workshop topics include reducing stereotype threat and solo status, mentoring underrepresented students, and helping students get started with undergraduate research.

**WMSURE: Faculty Workshops**

The data collected from students inform student programming and assist staff in counseling and student services as well as faculty in departments and programs that have had fewer successes with underrepresented students. In this way, a holistic approach is taken to helping students develop the tools needed to achieve their academic and social potential. This is important because, although many faculty learn how to teach their discipline in graduate school, they do not receive education relevant to understanding the needs of underrepresented students. Due to the importance of research in faculty members’ work, providing compelling evidence of the issues faced by underrepresented students may be one way to help faculty understand these needs as it fits into their educational model. Examples of faculty workshop topics include reducing stereotype threat and solo status, mentoring underrepresented students, and helping students get started with undergraduate research.
In addition, qualitative data were collected to further assess the impact of WMSURE programming. A WMSURE graduate assistant and a WMSURE undergraduate student designed an interview protocol and conducted interviews with WMSURE students to learn about their experiences of solo status and how the negative impacts of solo status might be mitigated (Charity Hudley et al. 2017). In collaboration with the WMSURE undergraduate student, the graduate assistant analyzed the interview data thematically according to the actions, contexts, and impacts surrounding solo status described by the scholars (see Charity Hudley et al. 2017 for a comprehensive report of these qualitative methods).

**Quantitative Data**

As demonstrated in Table 1, results indicated that WMSURE students felt significantly more supported by faculty than non-WMSURE students, but there were no differences in how the students felt supported by other students. WMSURE students were more likely to have a faculty mentor on campus than non-WMSURE students. WMSURE students reported being more interested in conducting research than non-WMSURE students. WMSURE students felt more informed about research than non-WMSURE students, although WMSURE students reported no differences in how much discrimination they had personally experienced or in the support they had before coming to William & Mary. WMSURE students reported having fewer students of their own race in their classes on average than non-WMSURE students.

<table>
<thead>
<tr>
<th>Variable</th>
<th>WMSURE students</th>
<th>Non-WMSURE students</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support from faculty</td>
<td>3.65 (0.08)</td>
<td>3.04 (0.18)</td>
<td>t(74) = -3.58, p = 0.001</td>
</tr>
<tr>
<td>Support from students</td>
<td>3.51 (0.64)</td>
<td>3.43 (0.66)</td>
<td>t(60) = -0.46, p = 0.650</td>
</tr>
<tr>
<td>Interest in conducting research</td>
<td>3.37 (0.48)</td>
<td>2.95 (0.15)</td>
<td>t(68) = -2.05, p = 0.046</td>
</tr>
<tr>
<td>Informed about research</td>
<td>2.89 (0.13)</td>
<td>2.43 (0.21)</td>
<td>t(65) = -2.13, p = 0.014</td>
</tr>
<tr>
<td>Faculty mentor on campus</td>
<td>75.5%</td>
<td>50.0%</td>
<td>χ² = 4.97, p = 0.026</td>
</tr>
<tr>
<td>How much discrimination exists</td>
<td>2.84 (0.14)</td>
<td>2.43 (0.21)</td>
<td>t(61) = -2.00, p = 0.050</td>
</tr>
<tr>
<td>Discrimination personally experienced</td>
<td>2.41 (0.80)</td>
<td>2.00 (1.12)</td>
<td>t(55) = -1.58, p = 0.119</td>
</tr>
<tr>
<td>Number of students of own race in class</td>
<td>2.55 (0.18)</td>
<td>3.37 (0.36)</td>
<td>t(59) = 2.27, p = 0.027</td>
</tr>
<tr>
<td>Support before coming to William &amp; Mary</td>
<td>2.08 (1.56)</td>
<td>1.76 (1.37)</td>
<td>t(59) = -0.76, p = 0.441</td>
</tr>
</tbody>
</table>

Note: Numbers represent means or percentages; number in parentheses are standard errors.
A total of 10 WMSURE students received summer research grants in 2013 and 2014, 15 received funding in 2015, and 15 received in-year funding in 2016. In addition, WMSURE scholars were funded by other sources, including individual faculty grants, National Science Foundation Research Experiences for Undergraduates (REU), and NASA.

Qualitative Data

Given that empirical evidence has demonstrated a causal relationship between increases in performance apprehension and decreases in performance level in underrepresented students who experience solo status (Sekaquaptewa and Thompson 2002; Sekaquaptewa, Waldman, and Thompson 2007), interviews were conducted to assess student perspectives on how to reduce the prevalence and impact of solo status. In this community-based approach, solo status was an important topic to examine; the relevance of solo status to the WMSURE community was apparent, as several WMSURE scholars chose solo status as a topic for their own research and for WMSURE workshops. In interviews, students were asked whether they were familiar with the term solo status; students’ definitions were consistent with being underrepresented or being in an outgroup. In addition to knowing the term, all interviewed scholars described experiencing solo status. Although scholars identified some positive effects of solo status, there was a greater focus on negative effects throughout the interviews.

WMSURE scholars described solo status as an obstacle to academic success at William & Mary (see Charity Hudley et al. 2017 for a comprehensive analysis of results). Scholars experienced solo status when their perspectives were not acknowledged, especially in academic contexts—a type of intellectual solo status. WMSURE scholars explained that solo status can be mitigated when they connect with other students, faculty members, and/or the curriculum. For example, one scholar summarized this need:

I think for African Americans to be better represented, it’s not a matter of throwing financial aid at them ... I think it’s more important that they get that education once they get to William and Mary, they’re going to have those connections, and that they feel like they’re part of that community that they’re joining, to be able to be better represented, because they need to be able to be seen and be heard and you have to really nurture that feeling when they’re coming to college.

Increasing the number of underrepresented students who pursue research experiences, as well as the quality of those experiences, has been imperative to the goals of WMSURE, as it aims to ensure that students feel that they are a part of the William & Mary academic community.

Scholars explained that as their comfort levels in class and with faculty increased, the negative effects of solo status were mitigated. When underrepresented students face a longer adjustment period to academic contexts than other students, inequities are created in terms of those who have immediate access to opportunities for working with faculty. Some scholars explained that their peers who did not participate in WMSURE may not have been able to adjust to solo status in classes. WMSURE has addressed this challenge by holding workshops that provide prospective students with an understanding of research and ensure that incoming students already have familiarity with the research process. Participation in WMSURE has increased since the implementation of these workshops.

Case Studies: Focus on the Individual Scholar

The profiles of two students, WMSURE Scholar 1 (2013) and WMSURE Scholar 2 (2015), illustrate the impact of WMSURE on educational equity and inclusion. At the heart of WMSURE has been the principle that each individual student matters, so their stories represent that mission. For faculty advisers mentoring students during their research experiences, the case studies illustrate the importance of understanding the full scope of students’ lives and experiences. These models are especially important for faculty who come from different backgrounds than WMSURE students. Faculty learn that the precollegiate experiences of students play a big role in their understanding of available research opportunities and whether such opportunities are actually created for them. Faculty are encouraged to talk with students with these points in mind and to present opportunities to them. The case studies also provided a sense of the postcollege opportunities obtained by WMSURE students and the role of WMSURE participation and research in their experiences after graduation.

Scholar 1 is an example of a scholar who participated in a middle school program aimed at increasing the academic success of high-achieving, underrepresented minorities in high school. She was one of the few African American students in her middle school’s gifted and talented program and at her very selective high school. Scholar 1’s excellence followed her to William & Mary, where she was selected as a William & Mary Scholar. For her honors thesis, she examined how autism affects the ability to acquire social language variation among African American children. Scholar 1 collected speech samples from African American families where one or more of the children were on the autism spectrum. Scholar 1’s participation in WMSURE allowed her to form a cohort with other WMSURE scholars across disciplines that supported her in her research and graduate application process. Scholar 1 earned the award for the most outstanding Phi Beta Kappa initiate and was a consummate role model to other WMSURE participants. She went on to earn a master’s of science degree in speech-language pathology at Vanderbilt University. Upon completion of her graduate study, the Vanderbilt Department of Hearing and Speech Science...
selected her to receive the award for outstanding clinical and academic achievements in speech-language pathology. She is now a speech-language pathologist at MD Anderson Cancer Center in Houston, Texas. She plans to focus her career in speech pathology on serving veterans with communication disorders.

Scholar 2 is an example of a white, first-generation student who found WMSURE and then became a mentor to other WMSURE students. He bravely reminded everyone of the experiences and needs of white, first-generation students who may go unnoticed, particularly on elite college campuses, where their race puts them in the dominant group, but their social status does not. Scholar 2 researched the history of coal mining to gain a better understanding of the issues facing his home state, writing an honors thesis on the history of the largest mining disaster in Europe. He received more than $12,000 in grants to fund his research projects and helped expand the WMSURE programming to include workshops that addressed the social and academic challenges of transitioning to college for those from rural, low-income backgrounds. Following graduation, Scholar 2 wanted to expand college access in his home state. He returned home to help his family and took a position with the West Virginia Higher Education Commission, where he oversaw the successful expansion of financial aid initiatives aimed at increasing overall college enrollment and support among traditional and nontraditional students. He now attends the Harvard Graduate School of Education.

These case studies highlight how WMSURE programming supported high-achieving students from underrepresented backgrounds with particular research opportunities and programming, tailored by feedback, to their intellectual, social, and emotional needs. Using this community-participation, research-based model, these students were able to share their experiences with other students in a formal manner through their participation in the WMSURE program.

Discussion

The quantitative and qualitative data collected from WMSURE students provided a fuller sense of the nuanced challenges and barriers faced by underrepresented students at William & Mary. The initial data collected helped inform the development of mentoring and advising services, workshops, faculty education, and research funding to support underrepresented undergraduates. Results suggest that institutions must provide comprehensive support for underrepresented scholars that includes these elements. The article authors encourage institutions to use community-based research to build a program that addresses the specific needs of their students. At William & Mary, workshops were developed to ensure that students would find their perspectives acknowledged in a scholarly context, as WMSURE focuses on research in multiple disciplines with varied approaches, with particular attention to any voices, lenses, and perspectives that are not represented in current research paradigms. The workshops designed for WMSURE emphasized the importance of underrepresented perspectives in research, framing student perspectives that differ from current paradigms not as deficits but as strengths that should inform bodies of research across disciplines. Workshops also focus on topics—including solo status—that, although pertinent to the experiences of many underrepresented students, may go overlooked in other academic venues.

This study also provides insights into the characterization of the students and the program; however, these are limited based on the inability to determine a causal difference between groups. The preliminary evaluation suggests, however, that the WMSURE program may have improved outcomes of interest and that it presents a model that other schools can adapt through the use of community-based participatory research methods that allow for real-time mixed-methods analysis of the student experience.

Lessons Learned and Future Directions

As the WMSURE program is implemented and further developed, it is important to continue assessing its impact on current students. Success of the program is based on providing as many WMSURE scholars as possible with high-quality, faculty-mentored research experiences. The quality of these research experiences is continually assessed. This feedback is used to implement programming that enhances these experiences. Faculty advisers are educated about what they can do to improve faculty-student research. For example, a small cohort of faculty was chosen to work with two to four WMSURE students each year, supported by a grant from the Andrew W. Mellon Foundation; these faculty advisers meet as a group and also attend workshops on a regular basis to exchange information on improving their advisees’ research experiences. Students’ feelings of support and belonging on campus are assessed annually, and WMSURE programming is changed as necessary. Based on this feedback, for example, the number of workshops focused on dealing with race-related issues such as discrimination and campus climate was increased this year.

On a university-wide level, work with faculty continues to expand this model of undergraduate research across William & Mary through enhancement of teaching that is focused on increasing underrepresented students’ access to high-impact experiences such as undergraduate research. For example, presentations were given this year to several departments on mentoring underrepresented undergraduates, and a presentation on WMSURE was conducted for chairs of departments and programs in the arts and sciences.
Additionally, the success of WMSURE has been shared with other institutions so that they may adapt the model for their underrepresented students. The research conducted with the students led to The Indispensable Guide to Undergraduate Research: Success in and Beyond College (Charity Hudley et al. 2017); more than 20 WMSURE students wrote vignettes for the book. This research-based guide seeks to advise first- and second-year college students, with a focus on the needs and interests of students who are underrepresented in college. In addition, the Andrew W. Mellon Foundation recently awarded William & Mary a grant to allow for the expansion of WMSURE. This provides funding for a group of faculty for student-led projects, as well as the hiring of an associate director of the program to oversee day-to-day activities and expand the program. Work is underway on adapting the model at other institutions, such as the University of California Santa Barbara. The same evidence-based model will be used in which the experiences and needs of students and faculty are assessed, which will in turn inform the design of the program, including the nature of the research opportunities and workshops. Research will continue, especially, to examine student success, specifically with regard to undergraduate research opportunities, students’ feelings of support and belonging, and students’ desires to pursue graduate programs. Creating communication across institutions, including lessons learned, will allow refinement of the model for specific types of institutions. As research proceeds to examine ways to ensure student success, it is imperative that students and faculty from different universities work together to talk about supporting undergraduate research and to learn from each other.

References


Faculty Change from Within

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Abstract

Undergraduate research in higher education has become a movement linked to institutional efforts at integrating high-impact practices and infusing transformative learning. University of Central Oklahoma’s Diverse Student Scholars (DSS) is one such program of faculty mentorship that is hosted by a department of marketing within a college of business. This article overviews DSS and introduces a five-faceted model of student transformation from embedded research mentorship in marketing courses. Based on DSS student reflections, the data suggest that embedded research mentorship generates student transformation in five areas: a transformed research mindset, personal self-discovery, applied career development, team preparation and appreciation, and reflective and corrective growth.

Keywords: business, Diverse Student Scholars, embedded research mentorship, transformative learning, undergraduate research

doi: 10.18833/spur/2/8

The Diverse Student Scholars program as a model can complement existing university efforts to advance student research skills; the timeliness of such an effort is increasingly important given the need to graduate professionals with greater workforce diversity competence and given the emphasis in higher education on transformative learning and high-impact practices. (Sims et al. 2016)

The strong disconnection between universities and research has been so prevalent that Ronald Barnett calls the more recent push for undergraduate research into higher education a “movement that is gaining momentum around the world” (Barnett 2017, 33). The movement runs parallel to the heightened emphasis on high-impact practices as well as the increased focus on transformative learning. For purposes of this article, transformative learning involves expanding students’ perspectives of their relationships with self, others, community, and the environment in a holistic process of active and reflective experiences (University of Central Oklahoma Center for Excellence in Transformative Teaching and Learning 2017).

This article discusses Diverse Student Scholars (DSS), a faculty-driven program of undergraduate research engagement that reflects this type of engagement in a college of business, and offers insights from more than 10 years of faculty mentorship. First, it provides an overview of DSS, along with its objectives, curricular and cocurricular integration, sources of support, success factors, and program accomplishments. Next, using reflections directly from students who have participated in DSS through mentored research embedded in marketing courses, a five-faceted model depicting the areas of student transformation is offered.

Diverse Student Scholars

Diverse Student Scholars is a program of interdisciplinary research with 11 years of engaging students in transformative learning through undergraduate research. Jeanetta D. Sims founded this program of faculty-mentored research engagement as an effort to align faculty tenure-track efforts with the institutional emphasis of undergraduate research while promoting greater diversity in higher education (Scott and Sims 2018; Sims 2011; Sims and Scott
Shanahan and colleagues (2015) point out the under-representation of business students in undergraduate research, stating that, although 15 percent of Bridgewater State University students belong to the Ricciardi College of Business, they only make up 10 percent of the school’s undergraduate researchers. Students belonging to Bridgewater State’s College of Science and Mathematics are considered overrepresented in undergraduate research. Similar to Shanahan’s findings, undergraduate research participation in the UCO College of Business, where DSS has grown, lags behind the robust undergraduate research productivity in UCO’s College of Mathematics and Science.

In the marketing department, DSS has a threefold aim of engaging students in the research pipeline process of scholarly inquiry; developing and enhancing students’ cognitive, affective, and behavioral skills related to research and professional career preparation; and cultivating students’ abilities to interact and work with people from different backgrounds (Sims et al. 2016). Published research (e.g., Scott and Sims 2018; Sims, Anderson, and Murray 2012; Sims et al. 2011, 2012, 2013) provides support for the accomplishment of program goals. See Figure 1, which reflects the various stages in the research pipeline process for DSS.

In DSS, students work on various projects through primarily cocurricular research activities, with DSS curricular integration in three marketing elective classes (Digital Media and Content Marketing, Public Relations and Marketing Campaigns, and Business Leadership and Identity), in which 100 percent of students in all classes accomplish a coauthored conference presentation. Table 1 offers research project titles, company names, and/or marketing-related areas in each of the research-embedded courses. Embedded research mentorship is the intentional effort of faculty to require multiple steps of the research pipeline process in their course instruction with a commitment to oversee and guide students through the submission process. Embedding undergraduate research into elective courses permits faculty to design assignments around conditions that are ripe for research success (Basu, Lee, and Chapdelaine 2011).

The faculty founder has secured research assistantship support through multiple on-campus sources (e.g., student grants, faculty grants, Student Transformative Learning Record (STLR) grants, and a transformative learning scholar appointment). As well, some students enroll in independent studies to work on research. Figure 2 provides an overview of the types and progression of DSS growth given the ability to secure research assistantship support. Regardless of the source of support, students meet weekly throughout the semester with the faculty founder to keep teams progressing on research timelines, conference submissions, presentation preparation, and publication deadlines.

From the faculty founder’s perspective, success factors for DSS are similar to the critical factors mentioned in the research of Mancha and Yoder (2014); in particular, DSS is a testament to hard-working students, institutional support, and the development of doable research projects, which are the top three critical factors cited for the success of
in student research teams to stimulate shared coauthorship on presentations and on manuscripts moved on to publication, and engaging deliberately within a research pipeline and personal undergraduate research plan framework (see Hammack et al. 2017).

<table>
<thead>
<tr>
<th>Student research presentation title</th>
<th>Cross-listed course title</th>
<th>Company name/marketing-related research area</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Evolution of Leadership and Identity within the Ford Motor Company</td>
<td>BCOM/MRKT4910: Business Leadership and Identity</td>
<td>Ford Motor Company</td>
</tr>
<tr>
<td>An Examination of Amazon’s Identity: From Start to Prime</td>
<td>BCOM/MRKT4910: Business Leadership and Identity</td>
<td>Amazon</td>
</tr>
<tr>
<td>Leadership through Thick and Thin: An Examination of Corning’s Identity Development</td>
<td>BCOM/MRKT4910: Business Leadership and Identity</td>
<td>Corning</td>
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<tr>
<td>Global Disney: How a Brand Fails, Adapts, and Succeeds across Cultures</td>
<td>BCOM/MRKT4910: Business Leadership and Identity</td>
<td>Disney</td>
</tr>
<tr>
<td>Inside Out: An Analysis of Southwest Airlines’ Identity Development</td>
<td>BCOM/MRKT4910: Business Leadership and Identity</td>
<td>Southwest Airlines</td>
</tr>
<tr>
<td>Coast-to-Coast Growth: An Identity Analysis of Love’s and Their Family Values</td>
<td>BCOM/MRKT4910: Business Leadership and Identity</td>
<td>Love’s</td>
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<td>Dove’s Real Beauty Campaign: Strategies for Building Relationships and Resonating Brands with Women</td>
<td>BCOM/MRKT4910: PR and Marketing Campaigns</td>
<td>Dove</td>
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<tr>
<td>Sonic, Two Dudes, and a 10-Year Campaign: Insights on Being Relatable and Building a Brand</td>
<td>BCOM/MRKT4910: PR and Marketing Campaigns</td>
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<tr>
<td>Taco Bell’s Live Más Campaign: Lessons on How to Regain Consumer Interest</td>
<td>BCOM/MRKT4910: PR and Marketing Campaigns</td>
<td>Taco Bell</td>
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<td>A Feeding Frenzy: RSS Feeds in Today’s Social Media</td>
<td>BCOM/MRKT4910: Digital Media and Content Marketing</td>
<td>RSS Feeds</td>
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<tr>
<td>Blogging: The Social Media Tool of Storytelling and Engagement</td>
<td>BCOM/MRKT4910: Digital Media and Content Marketing</td>
<td>Blogging</td>
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<tr>
<td>Corporate Websites and the Quest to Connect with Consumers</td>
<td>BCOM/MRKT4910: Digital Media and Content Marketing</td>
<td>Corporate Websites</td>
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<tr>
<td>eBooks: Publishing Directly to Interested Consumers</td>
<td>BCOM/MRKT4910: Digital Media and Content Marketing</td>
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<td>Facebook in Business and Politics</td>
<td>BCOM/MRKT4910: Digital Media and Content Marketing</td>
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<td>Google in Social Media Marketing: A Closer Look at SEO and Google+</td>
<td>BCOM/MRKT4910: Digital Media and Content Marketing</td>
<td>SEO and Google+</td>
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<tr>
<td>LinkedIn: The Professional’s Networking Tool</td>
<td>BCOM/MRKT4910: Digital Media and Content Marketing</td>
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<td>QR Codes: A Growing Tool for “Real Time” Marketing</td>
<td>BCOM/MRKT4910: Digital Media and Content Marketing</td>
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<td>Social Bookmarking: The Solution to Brain Information Overload</td>
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<td>Social Bookmarking</td>
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<td>Twitter Matters: The Role of Microblogging in Sports and Business</td>
<td>BCOM/MRKT4910: Digital Media and Content Marketing</td>
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<tr>
<td>Wikis: A Beneficial Tool for Business Success</td>
<td>BCOM/MRKT4910: Digital Media and Content Marketing</td>
<td>Wikis</td>
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Since inception, 100 percent of DSS undergraduates have earned a degree, and all students (through both curricular and cocurricular engagement) have coauthored at least one conference presentation during their involvement in the program. For comparative purposes, the overall graduation rate among marketing majors in the College of Business at the same institution is 60 percent, with the highest graduation rates among students majoring in finance (76 percent) and economics (70 percent), respectively, based on the most recently reported graduation rate data (University of Central Oklahoma College of Business 2015).

Collectively, DSS has involved more than 60 students (less than 10 percent have been graduate students) who have accomplished 30 independent studies, more than 25 funded grants, more than 80 conference presentations, and more than 20 coauthored proceedings and journal publications. The coauthored research of DSS students with their faculty mentor has received three national conference top-paper awards from conferences in three business-related disciplines (in 2017 from the North American Management Society, in 2013 from the Marketing Management Association, and in 2009 from the National Communication Association). DSS students have represented the program and the university by presenting interdisciplinary research. The program has a 100 percent funding ratio for all on-campus grant submissions through the university’s Research Creative & Scholarly Activities (RCSA) program for students housed in the Office of High-Impact Practices and through the Student Transformative Learning Record funding program (University of Central Oklahoma Center for Excellence in Transformative Teaching and Learning 2017) housed in the university’s Center for Excellence in Transformative Teaching and Learning.

The Impact of Embedded Research Mentorship in Marketing Courses

The extensive faculty mentorship in DSS provides a unique opportunity to learn the nature of student transformation from undergraduate research mentorship. Rivera (2017, 39) contends that “college should affect the student in meaningful ways that include intellectual development, personal development, and the development of attributes related to the student’s academic discipline.” Within the STEM fields, the introduction of course-based research has had an overwhelmingly positive response in helping students improve understanding of scientific material, take on demanding research, and choose a career path (Overath, Daiyuan, and Hatherill 2016). What then has been the meaningful transformative impact of embedded research mentorship in marketing courses through the DSS program?
TABLE 2. Five-Faceted Model of Student Transformation from Embedded Research Mentorship

<table>
<thead>
<tr>
<th>Facet name</th>
<th>Facet description</th>
<th>Key concepts associated with facet</th>
</tr>
</thead>
</table>
| Transformed research mind-set    | Research engagement altered students’ initial conceptions of research toward an expansive broader set of research cognitions | • Research engagement  
• Committed involvement  
• External/internal research  
• Presentations                                                                 |
| Personal self-discovery          | Research engagement prompted students toward greater self-awareness and accountability for their unique contributions | • Improvement  
• Research contributions  
• Responsibility  
• Identifying strengths/weaknesses                                                                 |
| Applied career development       | Research engagement developed professional, transferable skills that were directly applicable to future careers | • Research necessity  
• Research essentialism  
• Campaign effectiveness                                                                 |
| Team preparation and appreciation| Research engagement prompted students toward shared responsibility and cooperation required to achieve a collective goal | • Team contribution  
• Communication  
• Time management  
• Individual/team strengths                                                                 |
| Reflective and corrective growth | Research engagement among students made personal critiques for improvements more salient | • Applied research  
• Research/communication skill improvement  
• Personal identity  
• Academic performance                                                                 |

TABLE 3. Facet 1: Selected Quotes from “Transformed Research Mind-Set”

<table>
<thead>
<tr>
<th>Research engagement altered students’ initial conceptions of research toward an expansive broader set of research cognitions.</th>
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<tbody>
<tr>
<td>“Research engagement to me means taking the time to carefully analyze data and putting it together to show its importance to those who are being presented to. My understanding of research has evolved from searching for information for a report, to searching for meaningful data to compile to show those interested what the research means and how it is useful to them.”</td>
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<tr>
<td>“Based on all our readings and from what we discussed in class, it can be seen that research is the most critical step as it sets the foundation for every campaign … To me, research engagement means having a meaningful involvement in research where you are utilizing and making use of all the available resources to gain beneficial research results. For there to be engagement, you must have the interest and motivation to do the analysis.”</td>
</tr>
<tr>
<td>“In my opinion, research engagement is fully committing your individual efforts towards executing a project. This can be done through application of both internal and external information searches. Internal resources use past experience and knowledge towards building research by engaging cognitive skills. External research uses secondary resources such as Internet, databases, annual reports, or even personal networking contacts through engagement of analyzing and social skills.”</td>
</tr>
<tr>
<td>“Research has definitely changed for me in regard to how I approach everything and how to pull important information out of the data that’s being collected. There’s so many aspects of research I’ve never touched on, such as industry analysis (in-depth) and statistics. When it comes to improving my research skills as a student, it’s important to apply the PIE process and plan out what you want to research. Use a list with bullet points to know exactly what you need to look up. It’s also important to document everything in a readable manner for reference.”</td>
</tr>
<tr>
<td>“Research engagement to me is being involved and active in the process of completing a project. If you just google all the answers to a question that is not really research engagement to me. It requires going out into the real world and talking to people and seeing how business works in real time.”</td>
</tr>
<tr>
<td>“I have always felt research findings were to be presented in the form of a paper. During this course, I presented research in the form of an oral presentation with visual aids and through a theory-based debate. I enjoyed the oral research presentation and how it allowed me to discuss my research findings.”</td>
</tr>
<tr>
<td>“My understanding of the term ‘research’ has sustained through the course of the semester. My application of research is what has evolved. Prior to this course, I was always wanting to be more involved in research, and through this class I’ve been able to allow my interest to bloom into implementation. I’ve wanted to be involved in research from the beginning of my college career and I’m so grateful that this class allowed me to try my hand at it.”</td>
</tr>
</tbody>
</table>
This question was addressed by examining the de-identified reflection papers of more than 20 students who participated in the research projects embedded in the marketing elective courses summarized in Table 1. Similar to other models of undergraduate research (e.g., Mumford, Hill, and Kieffer 2017), the three marketing courses required students to create poster presentations for presentation at Oklahoma Research Day (a statewide research symposium) and write student reflections related to their research, group work, and consideration of the research process.

Using a constant comparative analysis (Glaser and Strauss 2006), researchers identified “themes that seemed meaningful to the producers of the message” (Berg 2001, 245). Researchers discussed the conceptual themes identified in the reflections to reach consensus on the five facets that demonstrated student transformation. To protect students’ identities, all referenced names in the student reflections are fictitious pseudonyms that were created by researchers in advance. The results suggest the emergence of five areas of transformative impact, including a transformed research mind-set, personal self-discovery, applied career development, team preparation and appreciation, and reflective and corrective growth. Table 2 provides a summary of the five-faceted model of student transformation from embedded undergraduate research mentorship in these marketing courses.

### Facet 2: Personal Self-Discovery

Students in DSS suggested that research engagement altered their cognitions related to research (see Table 3). The data revealed that students experienced growth in their understanding of research and possessed altered conceptions of research as a result of their research engagement. Through presentations and committed involvement, students mentioned transformed mind-sets regarding research.

#### Table 4. Facet 2: Selected Quotes from “Personal Self-Discovery”

<table>
<thead>
<tr>
<th>Facet 2 description: Research engagement prompted students toward greater self-awareness and accountability for their unique contributions.</th>
<th>“I specifically worked on the business overall analysis. I was in charge of researching the company overview/history, the development, sales history, current marketing mix, and other factors.”</th>
<th>“In the project, I was responsible for: attractiveness of the environment, what is the onset of the purchase decision, the SWOT analysis, the competitive environment, the target audience, the market positioning, and Pinterest, along with the introduction and the conclusion in the paper. I feel like I performed a large amount of research to ensure I was getting high quality information for the clients.”</th>
</tr>
</thead>
<tbody>
<tr>
<td>“I became the default head researcher for this portion of the project. I absolutely love research, so I started by studying Cancierge’s business as well as their competition. I also investigated the current marketing environment and analyzed the various target markets.”</td>
<td>“I know that I’ve improved at participating in group discussions. I’ve always tended to keep my opinions to myself but I feel this class forced me to speak up, and I now find myself speaking up more in other classes as well. I’ve also gotten immensely better at researching and critical thinking. I find myself identifying aspects of identity almost everywhere I go.”</td>
<td></td>
</tr>
<tr>
<td>“I feel like I learned a great deal about identity in both personal and business aspects. I achieved my learning goals in the class and had fun doing assignments, which is hard to come by in most college coursework these days. I feel like this class helped develop my strategic thinking and my research engagement. I feel like a better student coming out of this course.”</td>
<td>“My strength included identifying the main points of the presentation at hand and keeping the communication amongst the team members consistent. I lacked the skills to do in-depth research over the industry due to my inexperience with research; therefore, I investigated the surface information and created the structure for the presentation. Identifying key factors that would make the information more relatable to the client was also my role in the team. I was also the member that raised important questions to verify whether the presentation was proceeding towards the direction that it should.”</td>
<td></td>
</tr>
</tbody>
</table>
**TABLE 5. Facet 3: Selected Quotes from “Applied Career Development”**

| Research engagement developed professional, transferable skills that were directly applicable to future careers. |
| “Research is necessary to make meaningful changes to the firm, whether it be through campaigns or any other form that would grow profits for the company … Campaigns and research are greatly related and intertwined. Without research, a campaign could not have the background knowledge to be successful, since little to nothing would be known about the company.” |
| “Doing research increases a campaign effectiveness by giving campaigners a direction to developing the right strategies and messages. We have been drilled throughout the semester the role of research and I believe that research is the most important and crucial part of creating a campaign and strategists should spend the time on this phase to thoroughly research and be as informed and detailed as they can.” |
| “Over the course of the semester, my view of ‘research’ and the essential role that plays in things has changed. Before, I didn’t think much about the term. Research had meant finding background information, facts, and statistics to better understand a problem or to support a conclusion. However, now I have a clearer picture of how the role of research is connected and the starter for a successful strategy. Yes, research is about finding and analyzing information, but it is also an area where the compiled research forms the foundation that strategies can now build on. The level of success or failure depends on the quality of this research, making it a stage that a person must spend a lot of time and detail on.” |
| “After building an understanding of the origin, multiple factors such as demographics, economic and social dilemmas of the current period needed to be accounted for. Research is not meant to simply find an answer, but to identify the factors and causes that influences those answers. Understanding the material and utilizing pieces of information to support claims is detrimental. Therefore, research is needed in order to establish credibility as it is crucial in any setting.” |
| “Campaigns and research engagement are related through the initial step of having to perform research beforehand to gather information about a topic, which is part of the PIE (planning, implementation, and evaluation) process. In order to start this process, research must be done in advance to know information of the target audience in order to create a suitable campaign.” |
| “I have developed stronger leadership skills, awareness of my personal identity, and knowledge about the importance of identity within a corporation. I plan to use the knowledge I gained in this course to help better myself as a leader and to better the corporation I work for.” |
| “I learned so much from this course about business and how communication intertwines greatly with it. I also learned what kind of role I need to take in a business. I really liked learning about myself throughout this class as well. I feel that I learned how I act in pressure situations and I learned about myself through the lens of the different facets.” |
| “The career field I am going into uses research on almost everything they do. Research has to be used in the communications field for our jobs to be efficient and effective. I have come to appreciate this more and, in turn, enjoy it more.” |

Conclusion

Diverse Student Scholars has been an accomplished, faculty-led undergraduate research program with state, national, and international travel for coauthored conference research presentations. Although not all research engagement of DSS has involved embedded research mentorship in marketing courses, the three marketing courses examined in this article offer insights about the nature of student transformation from course-embedded research mentorship. Based on research results as offered in the five-faceted model of student transformation, undergraduate research has the potential to be inextricably linked to transformative learning—that is, undergraduate research engagement can alter students’ views of themselves, others, and their environment.

Through an insistence on small, doable projects that can be completed within each student’s time in the DSS program (see Diverse Student Scholars 2016 for samples of student vitas based on the length of time in the DSS program), students are able to reap the benefits of coauthored research presentations and publications. As the movement of
TABLE 6. Facet 4: Selected Quotes from “Team Preparation and Appreciation”

<table>
<thead>
<tr>
<th>Facet 4 description: Research engagement prompted students toward shared responsibility and cooperation required to achieve a collective goal.</th>
<th>“When it came to the second presentation, we focused on being prepared to present each part that each individual contributed in the paper, but also to do so in a manner that each of our parts really correlated and came together.”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>“I truly believe we all pulled our weight and contributed a fair amount of work towards the project, we all worked well together and were able to easily agree on key points of the presentation.”</td>
</tr>
<tr>
<td></td>
<td>“Each member came to every meeting prepared and ready to work and get things done. And before we all leave each meeting, we made sure that everyone knew what the next steps are and what needs to be done and finished before the next meeting. We took the initiative in taking responsibility of a part in the project and divided the work so that everyone has an equal amount of work, but also according to the individuals’ strengths and knowledge. The best thing about this group is that we made sure to finish things on time in order to give us time to prepare for the presentation because we knew we were presenting in front of an actual client.”</td>
</tr>
<tr>
<td></td>
<td>“Both Mary and Sue contributed a good amount for both projects. Although communication wasn’t always there, they always pulled through and we completed everything. Mary was always able to attend the meetings and contributed creative content to help develop the campaigns like the sales promotion and how to integrate Instagram into the campaign. Sue did a good amount of research that contributed to both projects which included doing the industry analysis and worked on the majority of the power point with me.”</td>
</tr>
<tr>
<td></td>
<td>“The research would not have been as impeccable as it was without my fellow research members. The team never divided the work to be done separately during each member’s individual time, but the entire team decided on specific times and dates to work on the material together. Each member had their own strengths and weaknesses; therefore, we mutually decided to focus on our individual strengths.”</td>
</tr>
<tr>
<td></td>
<td>“My teammates were a pleasure to work with, and I hope to work with them in the future. Although seemingly quiet, Jill is a natural-born leader and highly intelligent. She kept the group focused, and I would consider her to be the leader of the group. She took control of situations when opinions were divided, and she always had solid reasoning for her decisions. Cathy has a knack for finding the thing nobody wants to do and tackling it without hesitation. She worked on [E]xcel spreadsheets, edited body copy that no one could stand to read again, and she kept a smile on her face the whole time. She has great ideas and pitches them with confidence.”</td>
</tr>
<tr>
<td></td>
<td>“When conducting research, if in a group, then member abilities should be utilized. Everybody has a different thought process, abilities, and amounts of knowledge which strengths can be pulled from to combine.”</td>
</tr>
<tr>
<td></td>
<td>“I think that a lot of students lack working with groups and teams. I think that doing research as a team helped me learn to do my part and also to rely on others to make sure they get their part done.”</td>
</tr>
</tbody>
</table>

undergraduate research continues to flourish, the hope is that DSS can assist other faculty, particularly those in business schools, in accomplishing greater student transformation through undergraduate research mentorship.

References


**TABLE 7. Facet 5: Selected Quotes from “Reflective and Corrective Growth”**

<table>
<thead>
<tr>
<th>Facet 5 description: Research engagement among students made personal critiques for improvements more salient.</th>
<th>“I could do a better job of knowing exactly what it is that I'm trying to get out of my research, and really searching for just that and applying it better. Knowing exactly what I want in my research in itself will help me to apply my research better, and then after that, I need to get a lot better at just breaking down what I have learned and how what I have learned can be applied to my study. I could also get better at breaking my research down into pieces, because when you look at it as a whole, it can really seem overwhelming and make your research seem scattered as well.”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>“There are things that I can do to further improve my researching skills. One is to expand my horizon on different methods and tools that can be used to do research. Another area that I want to improve on is how to better make sense and analyze the research results that I find. Finding information is one thing, but I want to become better in looking deeper into its meaning and seeing how it applies to the goal and objective.”</td>
</tr>
<tr>
<td></td>
<td>“I know that I could improve my communication and leadership skills to reduce the amount of groupthink within my future group projects. I need to play devil’s advocate even when I agree with my team members so that we see all sides of the current problem. Due to this realization, I think the opportunity to work with these students helped me to see my potential as both a leader and a team member.”</td>
</tr>
<tr>
<td></td>
<td>“Two of the areas that I need improvement on are essentially my research skills and my communication skills with the client. My research skills have definitely improved since this plan presentation, due to the consistent search for information throughout the month. Therefore, I must take it upon myself to maintain this practice. Since the presentation for the client, I noticed that I forget to mention information that would have been very beneficial to the client. This happens almost immediately after the presentation. In order to effectively communicate all of the information I obtained during the research process, I must remember to practice and use notecards to remind myself of key information.”</td>
</tr>
<tr>
<td></td>
<td>“I believe that two areas that I could work on for future projects are procrastination and time management. Being in the class I learned that there is no room for procrastination and that time management is important because there is a lot going on during a limited time frame to complete everything.”</td>
</tr>
<tr>
<td></td>
<td>“Various things I could do in order to increase my research skills and competencies as a college student is knowing how to come up with a schedule that has a series of due dates of the project and delivering the work for those due dates. Also, knowing what questions to research, and most importantly, knowing how to use all the resources I have access to correctly, especially the ones that the school provides.”</td>
</tr>
<tr>
<td></td>
<td>“As far as the two areas that I have identified that I need to improve, this goes back to knowing who I am and who I want to be. I can’t answer these two questions outright today. Heck, up until last week I didn’t even question myself. I was on a path of stagnation without thought or perspective. Our one-on-one session has brought me to the journey I am on now.”</td>
</tr>
<tr>
<td></td>
<td>“A few of the areas in my performance I feel need improvement are improving my academic ability and being confident in my personal identity. I want to excel and become the best all-around person I came become. To become that better person, I strive to obtain more beneficial knowledge. I plan to take more challenging undergraduate courses, read more advanced scholarly works, and most importantly, not underestimate my abilities.”</td>
</tr>
</tbody>
</table>


Sims, Jeanetta D., Peggy Anderson, Sarah Neese, and Atoya Sims. 2013. “Enhancing Student Cognitive, Affective, and Behavioral
Jeanetta D. Sims
University of Central Oklahoma, jsims7@uco.edu

Jeanetta D. Sims is interim dean of the Jackson College of Graduate Studies and a professor in the Marketing Department of the University of Central Oklahoma (UCO), where she teaches courses in marketing and communication and is accredited in public relations. Her program of research includes strategic communication, workforce diversity, and persuasion and social influence.

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Oon Feng Lim is a former undergraduate research assistant in the Diverse Student Scholars program. He graduated with a bachelor’s of business administration in marketing from UCO. As a research assistant for one year, Lim coauthored one publication and three conference presentations. He currently resides in Malaysia.
Surveying Faculty Perspectives on Undergraduate Research, Scholarship, and Creative Activity: A Three-Institution Study

Janet A. Morrison, The College of New Jersey
Nancy J. Berner, The University of the South
Jill M. Manske, University of St. Thomas
Rebecca M. Jones, Shannon N. Davis, Pamela W. Garner, George Mason University

Abstract
The authors surveyed faculty (n = 239) at three diverse institutions to probe perceived motivations for and barriers to involvement in undergraduate research, scholarship, and creative activity (URSCA) across scholarly disciplines. URSCA mentors were significantly more likely than non-participants to express proficiency in involving students in their research/creative activities, to acknowledge student contributions to their scholarly work, and to state that URSCA mentoring should be considered in personnel decisions. More than half perceived that their institutions did not place sufficient value on mentoring URSCA. Results suggested that institutional URSCA cultures could be enhanced by building mentoring into faculty workload, tenure materials, and promotion documents; using early, course-based research to improve student readiness; providing faculty development on research mentoring aimed at underrepresented disciplines; and seeking novel funding sources targeted at faculty-mentored URSCA.

Keywords: creative activity, faculty, mentoring, multi-institutional survey, undergraduate research

doi: 10.18833/spur/2/1/1

High-impact practices, including undergraduate research, scholarly activity, and creative activity (URSCA), can increase undergraduate retention, graduation rates, and graduate school enrollment. Additionally, students who participate in research activities show improvements in thinking critically and independently, interpreting data, analyzing literature, and presentation skills (Bauer and Bennett 2003; Chopin 2002; Hu et al. 2008; Hunter, Laursen, and Seymour 2007). These intellectual gains are even more pronounced in students who participate in research during their first and second years of college and in traditionally underrepresented students (Girves, Zepeda, and Gwathmey 2005; Kuh 2008; McKinney, Saxe, and Cobb 1998). In response to these documented outcomes, many colleges and universities are investing significant financial and human resources in undergraduate research programs (e.g., Nazaire and Usher 2015; Ramirez et al. 2015). Concurrent with these investments and the associated educational reforms fueling launches of URSCA programs has been the development of a substantial body of academic research on student experiences, perceptions, participation, and outcomes of URSCA. However, far less research has examined faculty members’ experiences or their perceptions of and motivators for mentoring undergraduates in these activities (Webber, Laird, and BrckaLorenz 2013). Quantitative research is particularly lacking (Buddie and Collins 2011).

Within this limited but growing body of research on faculty members’ perceptions of mentoring URSCA run the common themes that they believe it provides significant educational benefits to students (Gates et al. 1999; Kar-dash 2000; Zydney et al. 2002) along with significant benefits to their own quality of work and life. For example, faculty members get personal satisfaction from working with students (Adedokun et al. 2010; Cech 2003; Chopin 2002; Hunter et al. 2007; Zydney et al. 2002), it can enhance their professional growth (Chopin 2002; Mateja
and Otto 2007), and student presentations at research conferences highlight faculty-student work in ways that can enhance visibility of their campus programs (Chapman 2003). Studies that explored faculty mentoring of URSCA have identified a diverse set of motivators, such as the desire to influence the careers of talented young students (Zydney et al. 2002), personal satisfaction, assistance with research tasks, and overarching educational goals and mission (Webber et al. 2013). Some faculty members report that students help them with their research projects by providing additional labor to a project, or by bringing new perspectives to research topics (Cech 2003; Coker and Davies 2006; Zydney et al. 2002).

Although URSCA has laudable benefits for both students and faculty members, it is not without challenges and significant trade-offs for the faculty. Faculty members may value their mentoring relationships with students, but they also may perceive negative effects on their own scholarly work (Buddie and Collins 2011; Mervis 2001). An oft-cited barrier to faculty participation in URSCA is that undergraduate research is too time consuming. In fact, faculty report lack of time as the biggest barrier to mentorship (Webber et al. 2013). Some faculty members report that students are underprepared for research (Bowman and Stage 2002; Chopin 2002; Coker and Davies 2006; Hu et al. 2008).

Given the important educational outcomes associated with URSCA, more research is needed on the faculty perspective to increase the amount and quality of undergraduate research being conducted at colleges and universities. Little empirical research has examined faculty members’ actual experiences supervising undergraduate research, including how many students they supervise, how long they spend with their undergraduate researchers, how the research partnership starts, and what motivates faculty members to engage in mentoring URSCA (Buddie and Collins 2011). The purpose of the present study was to examine the factors that influence faculty members’ participation in and perception of URSCA across various institutional contexts and types of scholarly and creative activities. Specifically, the goal was to identify factors that motivate faculty members to participate in URSCA and barriers that exist to participation and to compare these factors in faculty members who did and did not participate in URSCA mentoring.

**Methods**

This study was conducted by a multi-institutional research team of faculty and administrators that originated from a research seminar organized and sponsored by the Center for Engaged Learning at Elon University (Vandermaas-Peeler et al. 2014–2016). Based upon previous work (Jones and Davis 2014), an electronic survey was developed to assess faculty perspectives on faculty-student scholarly and creative activity across different types of institutions and disciplines.

**Data Collection**

Using an online platform (SurveyMonkey 2017), the survey instrument was deployed to all faculty at three participating institutions in the United States. Approval from the three surveyed universities’ Human Subjects Review Boards was granted for this research. Each institution is described, in brief, below.

The University of St. Thomas (UST) is a private doctoral university. Carrying a moderate research activity Carnegie classification, UST has a total enrollment of approximately 10,000 students and an admissions rate of 86.6 percent. Located in St. Paul, Minnesota, UST also is primarily residential; is majority undergraduate; and offers arts, sciences, and professional education.

Located in Ewing, New Jersey, The College of New Jersey (TCNJ) is a public institution classified as a master’s college, with a medium student population (approximately 7,400) and very high undergraduate enrollment. This school has arts, sciences, and pre-professional education programs; an admissions rate of 49 percent; and a low transfer rate.

The University of the South (informally known as Sewanee, in Sewanee, Tennessee) is a private, very small institution (enrollment approximately 1,700) with a baccalaureate college classification. It is an institution focused on the arts and sciences, and is highly residential. Sewanee had an admission rate of 64.5 percent at the time of this study (it is now 43 percent) and a very low transfer rate.

**Description of Instrument**

The survey instrument built on previously published work (Jones and Davis 2014) on faculty perspectives about undergraduate research. Specifically, the authors surveyed faculty about their perceptions of their influence on how undergraduate students participated in URSCA experiences across diverse institutional contexts. Beyond collecting basic demographic information such as gender, race, and academic discipline, the questionnaire also assessed faculty members’ attitudes about and experiences with URSCA. For example, items asked faculty members to provide information about their own research and scholarly activities and to report on the extent to which they included undergraduates in their own research program. Faculty members also were asked about their motivations for and barriers to participating in URSCA.
Statistical Analysis

Chi-square tests of independence or Fisher’s exact tests were used to compare the frequencies of different responses to a survey question by different categories of respondents. Fisher’s test was used when 20 percent or more of expected cell frequencies were less than five (Cochran 1954) for the overall test or in post-hoc pairwise contrasts. The Fisher’s test may be somewhat conservative when used with row or column totals that are not fixed, but the loss of power is slight, especially with tables that are larger than two rows by two columns (Ruxton and Neuhausser 2010). The analyses were done in R v. 3.3.1, with the crosstable function in the gmodels package and, for contrasts needed to further analyze an overall significant Fisher’s test, the pairwiseNominalIndependence function in the rcompanion package (R Core Team 2016). Probability values were adjusted with the Bonferroni adjustment for multiple tests. Sample sizes differed for some tests because not all respondents answered every question on the survey. Note that the chi-square test estimates the probability of obtaining the value of the test statistic \( \chi^2 \) by chance alone, whereas the Fisher’s exact test directly calculates the probability of getting the observed proportions of the data in each category under the null hypothesis that the proportions are the same; thus, there is no test statistic for the Fisher’s exact test.

Results

Overall Respondent Profile

The survey was offered to all full-time faculty members at each institution, and the overall response rate was 25 percent. There were a total of 239 responses, with 36.4 percent from TCNJ, 36.0 percent from UST, and 27.6 percent from Sewanee. The responses were pooled across institutions in the analyses presented below in order to have sufficient sample sizes, and because the three institutions were similar in being primarily undergraduate and having strong URSCA cultures. Also, respondents from the three institutions did not vary significantly in the proportion that mentored URSCA (77 percent), tenure status (77 percent tenured), or race (10 percent nonwhite). They differed somewhat in terms of gender and type of scholarly and creative activity, but these differences were not statistically significant (see Table 1). Overall, 53 percent of the respondents were women and 47 percent were men, but somewhat more Sewanee respondents were men (60 percent). Compared to TCNJ and UST, a higher proportion of Sewanee respondents were in the arts and literature, with relatively fewer doing quantitative research (see Figure 1).

Participation in Mentoring URSCA

Out of the 239 respondents, 77 percent reported that they had participated in mentoring URSCA. Most of these (47.5 percent) usually had one or more students per semester. Fewer (29.8 percent) mentored less than one student per year. Of those who had not participated, 15 percent responded that they wanted to participate, 6 percent expressed no interest, and 1.5 percent reported that they did not engage in scholarly or creative activity. The only significant difference in demographic characteristics between participants and nonparticipants was the type of scholarly or creative activity they did (see Table 2). Participants were most likely to be those who used purely quantitative methods or multimethods that included quantitative methods, and the lowest participation rate was for respondents who did nonempirical research. This difference was statistically significant (see Figure 2). Women and men, white and nonwhite, and tenured and tenure-track respondents participated at similar rates (see Table 2).

<table>
<thead>
<tr>
<th>Descriptor (sample size)</th>
<th>( \chi^2 )</th>
<th>df</th>
<th>P</th>
<th>Significance level*</th>
<th>Percentages of respondents across all three institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engage in URSCA (239)</td>
<td>3.70</td>
<td>2</td>
<td>0.16</td>
<td>ns</td>
<td>Yes = 77%; No = 23%</td>
</tr>
<tr>
<td>Research type (234)</td>
<td>15.03</td>
<td>8</td>
<td>0.06</td>
<td>ns</td>
<td>See Figure 1</td>
</tr>
<tr>
<td>Gender (234)</td>
<td>5.79</td>
<td>2</td>
<td>0.06</td>
<td>ns</td>
<td>Women = 53%; Men = 47% (The University of the South: 60% men)</td>
</tr>
<tr>
<td>Race (224)</td>
<td>1.95</td>
<td>2</td>
<td>0.38</td>
<td>ns</td>
<td>White = 90%; Nonwhite = 10%</td>
</tr>
<tr>
<td>Tenure (225)</td>
<td>0.62</td>
<td>2</td>
<td>0.73</td>
<td>ns</td>
<td>Tenured = 77%; Untenured = 23%</td>
</tr>
</tbody>
</table>

Note: *Bonferroni adjustment for five tests; P = 0.01 for significance at the 0.05 level; ns = not significant
Perspectives on Mentoring URSCA: Participants versus Nonparticipants

Respondents who had participated in mentoring differed significantly from nonparticipants in three key perspectives about URSCA (see Table 3). A significantly greater percentage of participants than nonparticipants agreed with the survey statements that said they knew how to involve undergraduates in their research and that mentoring URSCA should be considered in personnel decisions like tenure and promotion. A significantly smaller percentage of participants than nonparticipants agreed with the survey statement that undergraduates could not contribute to faculty research. Participants and nonparticipants did not differ significantly in other perspectives on URSCA. Both groups enjoyed their scholarly/creative activity, and a majority of respondents in each group agreed with the statement that they conducted research primarily for themselves, although a large minority in each group agreed with the statement that they did it primarily for students. Finally, close to half of participants and nonparticipants agreed with the survey statement that they did not receive enough credit for their work with undergraduate students.

Perceived Barriers to Mentoring URSCA: Participants versus Nonparticipants

All respondents were asked to rate the importance to them of six potential barriers to their engagement in URSCA.

TABLE 2. Chi-Square Tests of Independence or Fisher Exact Tests (FET) That Compare Categories within Selected Demographic and Academic Characteristics for Their Frequencies of Participation or Nonparticipation in Mentoring URSCA

<table>
<thead>
<tr>
<th>Respondent characteristic (sample size)</th>
<th>$\chi^2$</th>
<th>df</th>
<th>P</th>
<th>Significance level$^a$</th>
<th>Frequencies of participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research type (234)</td>
<td>n/a</td>
<td>4</td>
<td>$3.86 \times 10^{-5}$</td>
<td>***</td>
<td>See Figure 2</td>
</tr>
<tr>
<td>Gender (234)</td>
<td>0.02</td>
<td>1</td>
<td>0.89</td>
<td>ns</td>
<td>Female = 77.4%; Male = 78.2%</td>
</tr>
<tr>
<td>Race (224)</td>
<td>n/a</td>
<td>1</td>
<td>0.28</td>
<td>ns</td>
<td>Nonwhite = 68.2%; White = 78.7%</td>
</tr>
<tr>
<td>Tenure (225)</td>
<td>0.06</td>
<td>1</td>
<td>0.80</td>
<td>ns</td>
<td>Tenured = 79.2%; Tenure-track = 0.8%</td>
</tr>
</tbody>
</table>

Note: *Bonferroni adjustment for four tests; P = 0.016 for significance at the 0.05 level; ns = not significant; *** P < 0.001
of the respondents agreed or strongly agreed with all of the motivators that were included. The motivator that had the highest rating was “it is good for students,” followed by caring about future generations of scholars and enjoying it. The lowest rated motivators were “to advance my own research” and because graduate students were not available (see Table 6). The authors explored more fully the responses to the “advance my own research” motivator to learn if the responses differed by type of research. For this chi-square test, the neutral, disagree, and strongly disagree categories were collapsed into one category of “do not agree.” The distribution of responses for those who did nonempirical research was very skewed toward “do not agree” when compared to the other research types ($\chi^2 = 17.68; p = 0.02; df = 8$). This result should be interpreted with some caution, however, because 27 percent of the expected cell frequencies were less than five, so the $\chi^2$ test might not be valid. One cell had an observed value equal to zero, so the Fisher’s exact test could not be used. However, when the respondents who did nonempirical research were removed, there were no longer differences among research types ($\chi^2 = 2.34; p = 0.89; df = 6$) (see Figure 3).

**Discussion and Conclusions**

This study was undertaken to determine the factors that influence faculty members’ participation in URSCA across various institutional contexts, scholarly disciplines, gender, race, and tenure status, in order to identify strategies that may enhance the quantity and quality of URSCA mentoring. The data suggest several ways by which institutions that want to promote URSCA may encourage participation by their faculties. Because there were no differences in
gender, race, or tenure status with regard to those faculty members who participated and those who did not, these strategies are not targeted to particular faculty demographic groups. The three institutions in the survey differed little in their faculties’ responses, even though the institutions were diverse in some respects (e.g., size, private or public). Notably, however, they were similar in being strongly undergraduate-focused, with developed URSCA cultures. There were only three institutions in the study. It would be of great interest to deploy this survey more widely, including at larger research universities, which also would allow consideration of the connection between undergraduate and graduate student mentoring.

There are five significant lessons learned from this study. First, as in previous studies (e.g., Baker et al. 2015; Jones and Davis 2014), most faculty members who responded to the survey, regardless of whether or not they participated in URSCA, perceived lack of time as a significant barrier to their participation. Institutions should find ways to relieve this time burden by finding ways to credit URSCA in overall faculty workloads. The three institutions in this study have all addressed this need with a variety of approaches. For example, at TCNJ faculty members earn in-load teaching credit for an aggregated number of undergraduate research credits earned by the students (Osborn and Morrison 2008; Paul 2004). Most faculty mentors at Sewanee have students work in pairs or groups, which helps the students and also decreases the amount of time it takes to work with them. Course-reassignment is provided at UST for one course per semester to all tenure-track and tenured faculty in the laboratory sciences, in recognition of the unique and additional time requirements inherent in doing experimental laboratory

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**TABLE 3. Chi-Square Tests of Independence or Fisher Exact Tests (FET) That Compare Respondents Who Did or Did Not Participate in Mentoring, in Terms of Perspectives on Research and URSCA**

<table>
<thead>
<tr>
<th>Perspective [sample size]</th>
<th>$\chi^2$</th>
<th>df</th>
<th>P</th>
<th>Significance level*</th>
<th>Participants</th>
<th>Nonparticipants</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoy scholarly and creative activity. (238)</td>
<td>n/a (FET)</td>
<td>4</td>
<td>0.06</td>
<td>ns</td>
<td>96%</td>
<td>85%</td>
</tr>
<tr>
<td>I primarily conduct research for myself. (232)</td>
<td>6.43</td>
<td>4</td>
<td>0.17</td>
<td>ns</td>
<td>54%</td>
<td>68%</td>
</tr>
<tr>
<td>The main reason I conduct research is for the benefit of my students. (234)</td>
<td>n/a (FET)</td>
<td>4</td>
<td>0.20</td>
<td>ns</td>
<td>37%</td>
<td>27%</td>
</tr>
<tr>
<td>The costs of conducting research outweigh the benefits. (233)</td>
<td>7.47</td>
<td>4</td>
<td>0.11</td>
<td>ns</td>
<td>21%</td>
<td>17%</td>
</tr>
<tr>
<td>I know how to involve undergraduates in scholarly and creative activity. (234)</td>
<td>n/a (FET)</td>
<td>4</td>
<td>2.1 x 10^{-30}</td>
<td>****</td>
<td>85%</td>
<td>43%</td>
</tr>
<tr>
<td>An undergraduate student cannot contribute to my research. (231)</td>
<td>n/a (FET)</td>
<td>4</td>
<td>5.2 x 10^{-30}</td>
<td>****</td>
<td>7%</td>
<td>28%</td>
</tr>
<tr>
<td>Research involving undergraduates should be considered in personnel actions (e.g., promotion, tenure). (231)</td>
<td>n/a (FET)</td>
<td>4</td>
<td>1.2 x 10^{-6}</td>
<td>****</td>
<td>85%</td>
<td>56%</td>
</tr>
<tr>
<td>I do not receive enough credit for my work with undergraduates. (221)</td>
<td>1.75</td>
<td>4</td>
<td>0.78</td>
<td>ns</td>
<td>49%</td>
<td>44%</td>
</tr>
</tbody>
</table>

*Note: *Bonferroni adjustment for eight tests; $P = 0.00625$ for significance at the 0.05 level; ns = not significant; **** $P < 0.0001$
readiness (Jones et al. 2016). Another related perception among nonparticipant faculty members was that they did not know how to involve undergraduates in scholarly and creative activity. In the case of students without the background necessary to participate in URSCA, institutions can encourage academic departments to embed research into existing courses or design comprehensive undergraduate research and creative experience models (Awong-Taylor et al. 2016; Davis and Jacobsen 2014). Indeed, all three of the

TABLE 4. Chi-Square Tests of Independence or Fisher Exact Tests (FET) That Compare Respondents Who Did and Did Not Participate in Mentoring URSCA, in Terms of Their Perceptions of the Importance of Potential Barriers

<table>
<thead>
<tr>
<th>Barriers—importance of: (sample size)</th>
<th>χ²</th>
<th>df</th>
<th>P</th>
<th>Significance level</th>
<th>Participants</th>
<th>Nonparticipants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of access to undergraduate students (234)</td>
<td>n/a (FET)</td>
<td>4</td>
<td>0.07</td>
<td>ns</td>
<td>6%</td>
<td>12%</td>
</tr>
<tr>
<td>Students are not prepared for research (236)</td>
<td>11.15</td>
<td>4</td>
<td>0.03</td>
<td>ns</td>
<td>37%</td>
<td>61%</td>
</tr>
<tr>
<td>Lack of time (238)</td>
<td>n/a (FET)</td>
<td>4</td>
<td>0.39</td>
<td>ns</td>
<td>63%</td>
<td>72%</td>
</tr>
<tr>
<td>Lack of funding (236)</td>
<td>2.78</td>
<td>4</td>
<td>0.60</td>
<td>ns</td>
<td>31%</td>
<td>43%</td>
</tr>
<tr>
<td>Not receiving credit toward personnel actions (226)</td>
<td>6.03</td>
<td>4</td>
<td>0.20</td>
<td>ns</td>
<td>31%</td>
<td>32%</td>
</tr>
<tr>
<td>Lack of department support (229)</td>
<td>n/a (FET)</td>
<td>4</td>
<td>0.18</td>
<td>ns</td>
<td>13%</td>
<td>24%</td>
</tr>
</tbody>
</table>

Note: *Bonferroni adjustment for six tests; P = 0.008 for significance at the 0.05 level; ns = not significant

TABLE 5. Ranking of the Importance of Six Potential Barriers to Mentoring URSCA as Perceived by Respondents Who Have Not Participated in Mentoring (n = 49)

<table>
<thead>
<tr>
<th>Barrier rank (1 = most important)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of access to undergraduate students</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>11</td>
<td>25</td>
</tr>
<tr>
<td>Students are not prepared for research</td>
<td>20</td>
<td>15</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Lack of time</td>
<td>23</td>
<td>15</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Lack of funding</td>
<td>4</td>
<td>13</td>
<td>18</td>
<td>5</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>No credit toward personnel actions</td>
<td>1</td>
<td>3</td>
<td>9</td>
<td>20</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Lack of department support</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>13</td>
</tr>
</tbody>
</table>

research with undergraduates. These approaches can be adopted as best practices at many more institutions.

Second, also congruent with other studies, many nonparticipant attributed their lack of participation to student factors, such as “students are not prepared for research” and “an undergraduate student cannot contribute to my research.” In fact, students who want to participate in undergraduate research but have not yet done so feel that they lack
institutions included here have effective examples of early exposure to research, from a summer program for incoming first-year students at Sewanee to first- and second-year research-based courses at UST (Chaplin, Manske, and Cruise 1998) and TCNJ. In addition, institutional offices for undergraduate research or centers for teaching can sponsor workshops or discussion groups in which faculty experienced in URSCA can mentor nonparticipating faculty members (a “mentor the mentor” program). Research shows that the quality and quantity of mentorship is critical to the success of URSCA (Jones and Davis 2017; Shanahan et al. 2015). These studies, along with workshops available through the National Research Mentoring Network (https://nrmnet.net), can provide a basis for programs to train both faculty and peer student mentors.

Third, among faculty participants, lack of funding was seen as a significant barrier. Student researchers are more likely than their faculty counterparts to need to repeat research work to correct methodological errors. In some

### TABLE 6. Percentage of Agree and Disagree Responses by URSCA Mentors to Statements about What Motivates Them to Engage Undergraduates in Scholarly and Creative Activity (n = 182–184 respondents)

<table>
<thead>
<tr>
<th>Motivator</th>
<th>Strongly agree / agree</th>
<th>Strongly disagree / disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is good for the student</td>
<td>97%</td>
<td>0.5%</td>
</tr>
<tr>
<td>I care about the future generation of scholars</td>
<td>87%</td>
<td>1%</td>
</tr>
<tr>
<td>I enjoy it</td>
<td>86%</td>
<td>1%</td>
</tr>
<tr>
<td>It helps me feel better about my job</td>
<td>77%</td>
<td>3%</td>
</tr>
<tr>
<td>To advance my own research</td>
<td>68%</td>
<td>2%</td>
</tr>
<tr>
<td>There are no graduate students to help with my work</td>
<td>64%</td>
<td>22%</td>
</tr>
</tbody>
</table>

*Note: *Some responses were neither agree nor disagree.*

### FIGURE 3. Responses by Faculty URSCA Mentors with Different Types of Research/Creative Activity to the Statement that a Motivation for Mentoring URSCA Is That It Can “Advance My Own Research”

- neutral/disagree
- agree
- strongly agree
disciplines in which experiments depend upon expensive disposable chemicals and supplies, for example, this can result in higher costs for collecting the same data. Institutions can relieve this cost barrier with funds specifically targeted for undergraduate researchers. At UST, for example, federal student work-study can be used to fund student research collaborators, a practice used by some other institutions as well, such as George Mason University (Nazaire and Usher 2015). Both TCNJ and UST have built research funds into their annual science department budgets, providing a dependable, if modest, source of revenue for faculty-student research. Institutions also can seek external funding from sources that fund undergraduate education; for example, the National Science Foundation and the Jessie Ball duPont Foundation fund Sewanee’s summer program. Ramirez and colleagues (2015) suggest several nontraditional sources of funding, such as industry partners, event-based partnerships, and contracted research and service learning opportunities, like those developed at Loyola Marymount University.

Fourth, although most faculty did not rank “not receiving credit toward personnel actions” as a highly important barrier to their participation in URSCA, most agreed that it should be considered for tenure and promotion actions, and almost half agreed that they did not receive enough credit for working with undergraduates. The “credit” can be interpreted as credit in their teaching load or credit with regard to personnel actions and prizes. Institutions can add language to their faculty handbooks or other faculty evaluation guidelines that clearly articulates their priority for faculty involvement in URSCA. At TCNJ, for example, this language is present in the college-wide tenure and promotion document, with more specific language in many departments’ written standards for scholarly work.

At the institutional level, this process will be facilitated by having full agreement within the faculty about counting URSCA mentoring for tenure and promotion. This study’s data showed that nonparticipants were significantly less likely to agree that it should be counted, so increasing the participation rate is an important step toward the faculty gaining credit for URSCA mentoring.

Finally, it was found that faculty members who participated in nonempirical research did not agree that advancing their own research was a motivator for participating in URSCA, and a lower fraction of these faculty members participated in URSCA. Conventional wisdom says that collaborative research in the arts and humanities is difficult to impossible. However, in 2008 the Council on Undergraduate Research supported undergraduate research in the arts and humanities with the addition of a Division of Arts and Humanities, and a host of supporting programs (Council on Undergraduate Research 2018), and several schools offer models worth investigating, such as the Albright Creative Research Experience (ACRE) at Albright College (Albright College 2018; Gilliams et al. 2008). At TCNJ, specific efforts have been made to nurture participation by arts and humanities faculty-student teams during the Mentored Undergraduate Summer Experience (an internally funded eight-week residential program), and there have been many successful projects in the visual arts, music, film, and the humanities.

Faculty mentoring of undergraduate research and creative activity that is widespread across many disciplines and contributes to faculty scholarship is essential for building an institutional culture that values and supports this high-impact practice. Its benefits for students is clear, so it remains for it to more broadly benefit the mentors. The strategies suggested by the data of this study—building URSCA mentoring into faculty workload and tenure and promotion guidelines, improving students’ research readiness with course-based research, offering faculty development in research mentoring in all disciplines, and seeking creative sources of dedicated funding—will all contribute to an institutional culture that fully supports this essential form of faculty-student engagement.

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Janet A Morrison

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Janet A. Morrison, professor of biology at TCNJ, held the inaugural Barbara Meyers Pelson ’59 Chair in Faculty-Student Engagement (2015–2018) and is a former department chair. She was founding director of faculty-student scholar and creative collaborative activity at TCNJ and was its first director of the Mentored Undergraduate Summer Experience. She also was principal investigator on an NSF Undergraduate Research and Mentoring in the Biological Sciences (URM) grant, which funded a program of research and mentoring aimed at preparing underrepresented students to pursue a PhD; this program has now been expanded to all science departments at TCNJ. She was a CUR Councilor in the Undergraduate Research Programs Division and currently is a Councilor in the CUR Biology Division. With a PhD in ecology and evolution from Stony Brook University, Morrison has spent more than 25 years conducting plant ecology research solely with undergraduate collaborators, most recently with NSF RUI funding for work on overabundant deer and invasive plants in suburban forests.

Nancy J. Berner earned a PhD at Stanford University, is professor of biology at Sewanee, and holds the William Henderson Chair in biology. She is a former department chair, interim associate dean, and associate provost and currently serves the university as provost. She established Scientific Sewanee, an annual poster session of undergraduate science research, which, as Scholarship Sewanee, has been expanded into one-day celebration of URSCA across campus. Using funds from a NSF-funded research grant, Berner piloted Research Bridge, an early-career research experience for underrepresented students, in her laboratory, which has been expanded to encompass all areas of scientific research through additional external programmatic funding. She has conducted amphibian ecological physiology research with undergraduate collaborators and coauthors for more than 25 years.

Jill M. Manske is a professor of biology at the University of St. Thomas and chair of the Department of Health and Exercise Science. She holds a PhD in immunology and a master’s degree in public health. Manske regularly teaches undergraduate courses in immunology, emerging infectious diseases, global health, and women’s health. Her research interests include basic science and pedagogy. Her most recent publications have been on maternal influenza vaccination, science and society, and science pedagogy. Manske has served as associate chair of the Department of Biology, chair of the College of Arts and Sciences Faculty, director of the Women’s Studies Program, director of the Division of Science and Mathematics, and chair of the Health Professions Advising Committee at UST. She was a member of the Education Committee of the American Association of Immunologists, a visiting research fellow at the University of Minnesota’s Center for Infectious Disease Research and Policy, and is an Association of American Colleges and Universities STIRS (Scientific Thinking and Reasoning Skills) Fellow. She served as Councilor in the CUR Biology Division and as a program reviewer for CUR’s program review service.

Rebecca M. Jones is an associate professor of chemistry and faculty member of the STEM Accelerator at George Mason University. She received her PhD in inorganic chemistry from the University of Cincinnati in 2004 and then joined the faculty of Austin Peay State University. While earning tenure at APSU, she managed an
existing internal funding program and Research Forum, which ultimately led to the creation of the Office of Undergraduate Research in 2010. She served as director until January 2012, when she relocated to George Mason to help launch the Office of Student Scholarship Creative Activities and Research (OSCAR). Her programming and assessment work contributed to Mason receiving the CUR Award for Undergraduate Research Accomplishments in 2015. In summer 2015, she transitioned to the College of Science, where she teaches general and inorganic chemistry and pursues research interests such as best practices in STEM education, gender issues in STEM, and the role of the research mentor in undergraduate research experiences.

Shannon N. Davis is associate professor of sociology at George Mason University, where she teaches research methods, sociology of the family, and sociology of gender. She received her BA in sociology from the University of North Carolina at Asheville and her MA and PhD in sociology from North Carolina State University, followed by a postdoctoral fellowship at the University of North Carolina at Chapel Hill. Davis regularly mentors undergraduate and graduate students in her field and received the OSCAR Mentoring Excellence Award in 2012 in honor of her efforts. Her research interests are focused on understanding the reproduction of gender inequality in institutions, specifically in families and in higher education. Her research has documented how undergraduate research is experienced by students and faculty members, including as an avenue for reducing the leaky pipeline for women and students of color.

Pamela W. Garner is professor of childhood studies in the School of Integrative Studies at George Mason University. She received her doctorate in educational psychology from Texas A&M University. She completed postdoctoral training in developmental psychology at the University of Houston and the University of Texas Health Science Center. Garner has studied the social emotional development of young children for more than 20 years, and she is a past associate editor for the Early Childhood Research Quarterly. She also is the author of more than 60 articles, published with both undergraduate and graduate students.
A Global Conversation: 
Reflections from the First World Congress on Undergraduate Research

Julio Rivera, Carthage College
Maher Khelifa, Bushra Abu Hamdah, Aisha Mohammed Al-Hamadi, Qatar University
Emma S. Zdgiebloksi, Drexel University

Abstract
The authors reflect on the outcomes of the first World Congress on Undergraduate Research, held at Qatar University in Doha, Qatar, on November 13–15, 2016.

Keywords: collaborative research, global dialogue, international research, undergraduate research

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The inaugural World Congress on Undergraduate Research was held at Qatar University in Doha, Qatar, on November 13–15, 2016. This was the first opportunity for the Council on Undergraduate Research (CUR), the Australasian Conference of Undergraduate Research (ACUR), and the British Conference of Undergraduate Research (BCUR) to cosponsor an event in partnership with Qatar University. The congress was an important step in advancing the internationalization of undergraduate research, scholarship, and creative activity (URSCA). More than 200 participants from higher education institutions in Australia, the Americas, Europe, the Gulf region, and the Middle East participated in the event and joined the larger international conversation and collaboration around URSCA.

In the following, participants share their experiences and reflections on the event.

The Staging of the First World Congress on Undergraduate Research: From Conception to Reality (Maher Khelifa, Qatar University)

My personal connection with undergraduate research goes back to my undergraduate days, where I was exposed to research methods and statistics, and was required to complete a graduation research project by the end of my fourth year. Following graduation, feeling empowered by this experience, I applied to graduate school. My personal experience was key in consolidating my belief in the added value of undergraduate research, in the ability of undergraduate researchers to conduct meaningful research, and in the role played by undergraduate research in motivating students to pursue graduate studies.

When I started teaching, I immersed my undergraduate students in scientific research. The quality and significance of my students’ research compelled me to find a showcase for their work. Therefore, in 2001, I staged the first Undergraduate Students Research Symposium at Zayed University in Dubai. The success of this symposium led to the dream of staging an international conference for undergraduate researchers.

This dream was realized during the April 2014 National Conference on Undergraduate Research (NCUR) in Lexington, Kentucky. The proposal of an international conference on undergraduate research was discussed with Elizabeth L. Ambos (executive officer, CUR), Julio Rivera (then CUR president), and Stuart Hampton-Reeves (BCUR president; see Figure 1). This was followed by a range of video meetings that included individuals such as Angela Brew (ACUR).

The early meetings centered on issues of conference feasibility, viability, aims, and scope. Deciding to stage a congress rather than a typical conference was a defining moment of the discussions. Bringing together faculty mentors, students, and staff with a focus on building lasting international
collaboration was identified as a major goal of the event. Qatar University took the lead in local arrangements, performing the myriad tasks required to host participants and providing the venue, staffing, and logistical and technical support needed for a successful congress.

CUR advertised the event to its U.S. network and facilitated participant submissions by linking its conference submissions platform to the congress website so that abstracts in both English and Arabic could be submitted, and reviewers could receive abstracts. CUR suggested panelists and moderators for the discussions at the congress and contributed to the post-event survey of participants.

BCUR played a major role in disseminating information about the congress and liaising between the host and the European institutions. BCUR constructed and drafted the themes for the Congress, secured abstract reviewers, developed the Congress schedule, and helped with Congress material, acting on behalf of all BCUR and European delegates during the congress. ACUR’s role was consultative in nature, participating in decision-making and assisting with the dissemination of information about the congress throughout Australia.

The first World Congress hosted approximately 200 participants, including students and faculty representing 56 institutions, 11 countries, and 4 continents. The event allowed students and faculty to discuss topics related to the major themes of the congress: climate change, environment and sustainability, global health, the global and the local, information and technology, war and peace in the twenty-first century, and the world we live in and the world we make. Feedback indicated that participants enjoyed the congress and its cultural experience, especially meeting students from other parts of the world, forming new friendships, and creating research networks and collaboration opportunities. The event was an excellent opportunity for Qatar University students to meet student researchers from other countries, to discuss their own research, to share their culture, and to address misconceptions that might be held about the region. As suggested by the literature on undergraduate research and student conference participation (Garde-Hansen and Calvert 2007; Hathaway, Nagda, and Gregerman 2002; Hersh, Hiro, and Asarnow 2011; Hill and Walkington, 2016; Hunter, Laursen, and Seymour 2007; Mabrouk 2009; Kneale et al., 2016; Spronken-Smith et al., 2013; Walkington, Hill, and Kneale 2017), the student feedback and reflections from conference surveys reflect similar positive outcomes for student participants. Students reported that their congress participation allowed them to connect with others, increase their self-confidence, heighten their ability to take risks, and connect with people from other countries.

The congress offered a unique forum for representatives of undergraduate research organizations from four continents to meet and share best practices. They discussed the creation of an international body, the World Congress of Undergraduate Research Councils, that would oversee, regulate, and promote undergraduate research around the world.

The Doha Declaration (see Figure 2) and the creation of the World Congress of Undergraduate Research Councils are historic and significant milestones for the future development and progress of the global undergraduate research movement. The momentum generated by this Congress underlies the Second World Congress on Undergraduate Research that will take place on May 23–25, 2019 at Carl von Ossietzky University of Oldenburg, Germany, which
has opened its abstract submission portal and is working on the event’s organizational details.

**Friendships with People of Different Backgrounds (Bushra Abu Hamdah, Qatar University)**

As a student at Qatar University, I was the head of the committee of volunteers for the conference. We started recruiting volunteers two months prior to the start of the conference. Working with the volunteers presented many challenges, from coordinating schedules and dealing with people of different backgrounds to learning to listen to criticism as well as helpful suggestions. Working with this committee taught me how to solve problems, make decisions, and become more responsible, leading to friendships with people from different backgrounds. In spite of the hard work and tough times, the positive comments about my work made me happy.

The research I presented was on culture and emotion. I worked on the project the previous year studying the emotions of Arabs and non-Arabs. This was the first time I presented research at an academic conference with professors and students from different universities. The discussion of my research was very interesting because it touched on the culture and the religious side of everyone. Since the attendees’ backgrounds varied, they discussed their emotions and what they would do in different situations from their perspective. At the end, I received very encouraging and strong comments about my research and was touched by the attendees’ admiration.

Getting to meet people from different cultures is a very common thing to happen in Qatar, but making friends who come from non-Arab backgrounds is rare. At the congress, I made new friendships, got to know new people, and had the opportunity to see their achievements. I won’t forget the professors who came to the conference who are special in their field and love their students and their jobs, yet are very humble and modest. I am still in touch with some students and professors whom I met at the conference. It was an unforgettable experience and one that has changed me personally for the better.

**An International Journey (Aisha Mohammed Al-Hamadi, Qatar University)**

The World Congress on Undergraduate Research was an international journey and a great opportunity for each undergraduate participant, and I was delighted to be part of it. Presenting my research at the first World Congress was a big honor for me. After being accepted to present, I worked harder on my presentation so it would match the level at the congress.

There was frequent student and faculty interaction during the three days of the congress, and the collaborations were rich with knowledge and learning opportunities. Those living in Qatar interact with different cultures every day, but what made this different is that it was with students from all around the world. The interaction was cultural, and there was an interaction between different disciplines. From my perspective, the interaction between disciplines was most powerful and had a strong impact on me, because it brought to light how students from different disciplines have various points of view on one subject. The questions that were asked after each presentation were especially interesting, because they allowed for discussion and exchange of ideas. The poster sessions were a great time to learn about new research, and they gave students the time to exchange their ideas and thoughts, ask questions, and have deeper discussions.

Participating in the congress was a great learning experience. It was the first time for me to present research at a conference. The experience boosted my self-confidence and my ability to deal with tension, and increased my presentation skills as well as my interest in doing research in the future. Although I knew the congress would be a great experience, I did not imagine that I would be recognized for my research and win the prize for best Arabic presentation. There were many other amazing researchers, but when they announced my name, I was really delighted. It encouraged me to take more opportunities and to always believe in myself.

**The World Around Us (Emma S. Zdgiebloski, Drexel University)**

Of all the places in the world I wanted to visit, I had never really considered the Gulf region. If someone had asked me to point out Qatar on a map, I would not have had the slightest clue where to start. The journey began with an email from CUR. I had participated in the 2016 NCUR, which was held in Asheville, NC, so I was familiar with CUR’s work encouraging undergraduate research in the United States.

Since coming to Drexel University, I have remained committed and engaged in research. As an undergraduate research fellow in the Lebow College of Business, I worked on my own faculty-guided research, and I assisted with other faculty projects within my college. When I received the email about presenting at the World Congress on Undergraduate Research in Doha, I had already presented my research at two conferences. Eager to do it again, I applied to the WCUR and, with the help of Suzanne Rocheleau in Drexel’s Office of Undergraduate Research, the trip to Qatar was arranged.

For the months prior to my trip, I Googled Qatar tirelessly. I was shocked by the impossibly tall buildings and the rich cultural history of the area. I was not sure what I expected when I boarded the plane to Qatar, but I was excited to present again and experience a new culture and geography.
The first excursion offered by WCUR was a trip to the Museum of Islamic Art. I later learned the museum was designed by I. M. Pei, who coincidentally also designed one of Drexel’s buildings. I had never seen such a focused collection of Islamic art and artifacts. When we left the museum that night, the city around us had transformed. All lit up, Doha looked like a city straight out of the future—incredibly modern and impossibly vast.

Later that evening, I dined at the Diplomatic Club with the other presenters and the conference facilitators. I remember meeting so many people from the United States and Qatar, and was impressed by how friendly and welcoming everyone was. The women from Qatar University asked a lot of questions about our lives in the United States, and we in turn asked them about their lives in Qatar. We later took our shoes off to walk along the beach as the lights from The Pearl, a densely populated island in Doha, shone on the water.

I met so many amazing women at the World Congress from all over the world. We traveled around in a group, making sure to support everyone’s presentations. I think my favorite memory from the daytime portion of the congress was a presentation by Tanaz Dhondy, who had traveled from Australia. She was an engineer, and her presentation was on concrete reinforcements. I had never had much of an interest in concrete or its reinforcements, but Tanaz’s presentation was so well done and so interesting that I found myself following along and collecting questions to ask at the end. I think that’s what undergraduate research does—it generates interest and engagement that isn’t necessarily limited by university or discipline. Tanaz’s enthusiasm for her research was infectious, and I walked out of her presentation knowing a whole lot more about concrete.

While in Qatar, I was, at times, overwhelmed with hospitality, and no two people were more hospitable than two other WCUR attendees: Rana Al-Disi and Mariam Yasser Nofal. Both were accomplished biomedical researchers and won the best poster award for their work. But aside from their academic achievements, I was astounded by how friendly and engaged the two women were. When we went to the Souq Waqif (a large standing market in Doha), Rana and Mariam made sure we visited all the “good” shops and taught us how to negotiate prices. Toward the end of the night, they found a place that sold kunafa and made sure we all got to try the sugary cheese pastry. Rana and Mariam took us on tours of the campus and brought us to a full-moon party held by the Astronomy Club.

When it was time to present my own work, I was happily surprised by the level of engagement of those who came to see my poster. I was asked many questions and given several good ideas for how to continue my work. I have since used the critiques and suggestions to make my research better and more well-rounded.

I was sad when it was time to leave Qatar. My experience at both the congress and the cultural activities surrounding it was unlike anything I have ever experienced, and I sincerely hope that the next congress will give other students the opportunity to obtain a deeper understanding of their work, the work of their peers, and the world around them.

Learning from Each Other (Julio Rivera, Carthage College)

When several of us imagined the World Congress in early 2014, we had some grand visions and ideas for bringing students and faculty together for a “special international meeting,” a “Congress.” As time moved on and reality set in, our focus had to shift to the concrete aspects of building a meeting. Our visions took a back seat to promoting the congress, counting the registration numbers, and testing the website logistics. Happily, that all changed upon our arrival in Doha and Qatar University; suddenly many of our early visions became real along with new possibilities for the future of URSCA in an international context.

One of the gathering’s most significant outcomes was the Doha Declaration, issued at the conclusion of the Congress (see Figure 2). Here CUR, BCUR, ACUR, and Qatar University affirmed URSCA across all disciplines and supported the internationalization of URSCA. This statement immediately became the touchstone for the 2019 Congress at the University of Oldenburg in Germany. Planning this next congress will lead to stronger communication and collaboration among its partners.

Whenever I travel, I enjoy the people I meet and the places I explore. However, I experienced a deeper enjoyment in Doha as I watched the cultural exchange between students from different countries and different cultures. This exchange happened almost immediately and continued throughout the congress, first focusing on student work and then expanding to students’ sharing the ordinary aspects of their lives. The atmosphere had a special intensity as faculty and students from vastly different cultures listened to each other. There was a deeper outreach among participants, possibly due to the setting as well as a structure that allowed significant amounts of time for casual interactions and discussions outside of the paper and poster sessions. For a while, I thought this perception was just mine alone, but it was common among the authors herein as well as so many other participants with whom I have talked since the congress.

I think that this congress is one of the most important things that the community has done to advance the international URSCA movement. Qatar University was an outstanding
host, and the location was part of what made the congress unique and successful. I encourage readers to talk to students and faculty who attended the congress to learn their perspective and hear about their experiences. The congress was successful beyond expectations, and it opens new undergraduate research opportunities in the coming years. I look forward to the next congress in May 2019 at Carl von Ossietzky University of Oldenburg in Oldenburg, Germany.

References


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I have engaged dozens of students in independent studies over the last five years. Most undergraduate students have a functional literacy because they know how to read, write, and speak, but few students have adequate “performances of understanding” (Perkins and Blythe 1994) in their disciplinary major before graduation. The centrality of student self-knowledge (Baxter Magolda 2010) can be addressed in academic classrooms, but I find one-on-one independent studies with a student especially engaging when I serve as a vernacular language guide or theory interpreter to a student growing more adept at reading and talking about peer-reviewed journal articles in my office. Sometimes, when the semester-long discussions culminate with an undergraduate research poster at the university student center, the student gains further agency in using the language of the discipline and showing what they know to a host of other people with different backgrounds and perspectives. Such human interactions cannot really be taught, only experienced. These social constructions of meaning making are called learning episodes.

My first goal when establishing an independent study with a student is to find common ground for negotiating a mutually rewarding topic. This means I listen well to who my student is and wants to be and what he or she is thinking about at the orientation meeting, so I can offer some piece of my scholarship related to his or her interest. Question posing and question framing become key processes of my inquiry-based pedagogy (Ubbes 2008). I probe gently with “whys” during the first meeting but prefer to ask more “what,” “when,” and “how” questions to empower the student as the storyteller who can coauthor the independent study.

My second goal is to give each student a learning space for talking about what seems important in the reading that day. I focus on setting up a teaching-learning environment where the student grows comfortable personalizing and theorizing what he or she knows and does not know, including what the learner might like to find out for the next week. I explicitly talk about the reading, writing, and talking processes of learning a discipline with its specialized vocabulary and use questions to help the student think deeply. Can he or she talk easily from a reading or is a writing prompt needed to help think about the reading? Can the student write some questions for an author and then discuss what he or she wants to know about the author’s theory, model, or research study? In short, a constructivist-developmental pedagogy is used to support the cognitive, social, and affective maturation of the student as thinker. Co-construction of self-knowledge and disciplinary knowledge often involves the use of technology as a cultural tool for negotiating a performance of understanding with words, images, numbers, rhythms, and body language (Ubbes 2008).

My third goal is to model a relational pedagogy (Ubbes 2008) as I encourage the learner to tell stories about the reasons for selecting a particular major, the potential venues for work experiences, and the individuals who serve as significant mentors to him or her. Because the weekly interaction is all about mutual meaning-making, I reciprocate with a story or two about my research and weave it into the discussions. A student may need support in accomplishing a career goal by applying for a scholarship, finalizing a resume, or negotiating a summer job interview. A relational pedagogy can help students develop a vocational path through self-authorship as they move from an absolute knower into a transitional knower or from a transitional knower into an independent knower (Baxter Magolda 2010). Building a relationship with me as mentor, scholar, and learner means that the independent knower now joins the profession as a collaborator and constructor of knowledge. Knowing when, how, and with whom to use that knowledge creates a contextual knower—an academic scholar.
Community College Pipeline Programs: Creating Successful Pathways to the Research University

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As public universities in Michigan play a key role in developing and retaining high-achieving students in the state, it is vital to ensure that community college students view the University of Michigan (UM) as an option for their future studies. The Michigan Community College Summer Research Fellowship Program (CCSFP), part of the Undergraduate Research Opportunity Program (UROP) at UM, provides a unique opportunity for community college students to engage in research. The program is tailored to recruit and retain a diverse student population, including historically underrepresented students, first-generation college students, student veterans, women in science, and students from lower income backgrounds. The primary purpose of CCSFP is to connect high-achieving community college students with research opportunities and mentors at UM and encourage them to apply and transfer to UM after their summer research experience on campus. This pipeline program provides potential transfer students from community colleges with an integrated transition program to help them make a successful academic, social, and personal transition to the university.

The program design and activities include:

- 10 weeks of full-time work with a UM research sponsor
- A fellowship stipend (maximum $4,000)
- A two-day orientation, with a tour of the campus and resources
- Weekly enrichment research and professional seminars (on research methods, research ethics, networking, multicultural issues in research, growth mind-set, and student learning techniques)
- Four Journal Club meetings facilitated by graduate students
- Reflection Blog assignments and community service opportunities
- Brown Bag meetings with selected faculty and guest speakers
- Research skills and professional workshops (on SPSS, STATA, NVivo, and lab safety)
- Access to advising on application and admissions procedures, financial aid options, and transfer accreditation
- Opportunities to meet and network with a variety of campus leaders, faculty, alumni, students, and administrators
- Tours and field trips (to research labs, campus museums, and libraries)
- Participation in UROP’s Annual Summer Symposium

Throughout the program, students make important connections on campus as they are exposed to the social, cultural, professional, and academic environment at the university and its wide variety of resources. Every summer, CCSFP fellows worked closely with a committed team of peer advisers, who meet with them throughout the summer regarding their research experience, faculty mentor relations, and transfer plans. The great success of the program is largely due to key cross-campus collaborations with the Office of Undergraduate Admissions and the Office of Financial Aid, among other departments. CCSFP also has partnerships with a wide range of community colleges in the state, including faculty, advisers, and student groups at these schools. The transfer rates of students participating in the program is approximately 80 percent, with graduation rates of 98 percent for the past four years. The university is investing in increasing the number of transfer students coming from community colleges. The impact and benefits of CCSFP serve as a recruiting tool and a retention and integration approach for a diverse group of talented students. The program hopes to expand its transfer initiatives to a broader population of community college students and promote collaboration with community colleges at a national level.
The present study determined the contribution of the NMDA receptor to impulsive choice in a delay discounting paradigm. We found that MK-801 and memantine impair stimulus control (i.e., decreases preference for a large reward even when its delivery is immediate). These results challenge previous research showing that NMDA antagonists, like MK-801 and memantine, selectively alter impulsive decision making in animals. Justin Yates is an assistant professor in the Department of Psychological Science at Northern Kentucky University. Benjamin Gunkel is currently a research technician at the University of Kentucky. Katherine Rogers, Kerry Breitenstein, and Anthony Johnson are employed. Mallory Hughes is a graduate student at Western Kentucky University. Sara Sharpe is a graduate student at Eastern Kentucky University. The students conducted this research from March–June 2016. Mallory Hughes and Anthony Johnson were enrolled in PSY 492: Research in Psychology. Benjamin Gunkel, Katherine Rogers, and Sara Sharpe were paid research assistants. Kerry Breitenstein volunteered to work in the lab. The research was supported by a Kentucky Biomedical Research Infrastructure Network (KBRIN) Investigator Development Award (NIGMS grant 8P20GM103443-14) and a Northern Kentucky University Faculty Project Grant.

This paper studied experimentally the effect of polarized optical injection on a multi-transverse mode vertical-cavity surface-emitting laser (VCSEL), in which the polarization of optical injection is orthogonal to the dominant polarization of the VCSEL. We obtained high frequency, tunable microwave signals through polarization switching and frequency locking caused by dual beam injection in the multimode regime. The measurements show that multi-transverse mode regime is more effective than single transverse mode regime for microwave generation. Our results will be of use for dynamics in semiconductor lasers and for generation of microwave signals for wireless access networks and radio-over-fiber technology. Hong Lin is professor of physics at Bates College. Five students participated in the project from fall 2014 to 2017 as thesis students and summer research assistants: Salim Ourari (’18), Tianyao Huang (’19), Aashu Jha (’17), Andrew Briggs (’15), and Niccolo Bigagli (’17). Briggs and Jha are in graduate school in electrical engineering at the University of Texas at Austin and Princeton University respectively. Bigagli is in graduate school in physics at Columbia University. Ourari is a senior majoring in physics and will attend graduate school in electrical engineering at Princeton University. Huang is a rising senior and plans to apply to graduate school in 2018–2019. The research was supported by the Bates College Faculty Development Fund and the Bates College Faculty-Student Summer Research Fund.
Erythritol, a non-nutritive polyol and the main component of the artificial sweetener Truvia®, may have potential as an organic insecticide, given its harmful effects on several insects but apparent safety for mammals. However, for erythritol to have practical use as an insecticide in agricultural settings, it must have neutral to positive effects on crop plants. This study examined the dose-dependent effects of erythritol on corn and tomato seedling growth and seed germination. Our results suggest erythritol may have damaging nontarget effects on certain plant crops when used daily at the typical doses needed to kill insect pests. Furthermore, if erythritol’s damaging effects extend to certain weed species, it also may have potential as an organic herbicide. Sara Scanga and Jessica Shinn-Thomas are associate professors of biology at Utica College. Two of the student coauthors were working on related research with Shinn-Thomas prior to enrolling in BIO325: Botany in the spring 2017 semester, which requires that students conduct original research; the four students developed this idea to satisfy this course requirement. All four students graduated in spring 2017. Bilal Hasanspahić will be attending the University at Buffalo Medical School. Edin Zvorničanin will be attending SUNY Upstate Medical School. Jasmina Kozenjić is attending Salus University Pennsylvania College of Optometry. Andrew Rahme is applying to law school.


The objective of the study is to gain insight into interdisciplinary care by developing a computational metric to identify similarities, related concepts and differences in physician and nurse work. Fifty-eight physician discharge summaries and the corresponding nurse plans of care were transformed into Unified Medical Language System (UMLS) Concept Unique Identifiers (CUIs). MedLEE, a Natural Language Processing (NLP) program, extracted “physician terms” from free-text physician summaries. The nursing plans of care were constructed using the HANDS® nursing documentation software. The physician’s and nurse’s terms were compared using the UMLS network for relatedness. We reveal the relationships between the care provided by each professional that is specific to the patient level. Andrew Boyd is assistant professor of biomedical and health information sciences at the University of Illinois at Chicago (UIC). Karen Dunn Lopez is assistant professor in the UIC Department of Health Systems Science. Camillo Lugaresi is now employed at Google, and Abhinaya Balasubramanian is now employed at Yahoo. Sabita Acharya is a PhD student at UIC. Khawllah Roussi is a biochemistry major in UIC’s College of Liberal Arts and Sciences.


Colorimetric sensors arrays use the color responses from multiple sensors to identify and quantify analytes. Chemometric analysis is usually performed to analyze and classify the colorimetric information gained from the arrays. However, very few studies have been conducted to compare the performance of several different chemometric classification methods with colorimetric sensor arrays. The present study compared the performance of seven different classification methods to identify and quantify over 600 acidic and basic sample analytes using Red Green and Blue data from a sensor array. It was found that out of all seven classification methods, linear discriminant analysis was the most effective with greater than 99 percent accuracy. Michael Kangas and Christina Wilson are postdoctoral fellows at Doane University. Raychelle Burks is an assistant professor at St. Edward’s University. Billy Garver is an adjunct instructor of mathematics, Andrea Holmes is a professor of chemistry, and Miles Mayer is an adjunct instructor of chemistry at Doane University. Jordyn Atwater is currently employed in the science workforce and will apply for medical school in 2019. Rachel Lukowicz is currently in a PhD program in neuroscience at the University of Oregon. Shana Havenridge completed a master’s degree in applied math at Glasgow University in Scotland. This research was supported by grants from the National Science Foundation, the National Institute of Health-INBRE, DoD-SBIR, and NSF-IRES.

Duke T, Farruggia SP, Germo GR. “I don’t know where I would be right now if it wasn’t for them”: Emancipated Foster Care Youth and Their Important Non-Parental Adults. *Children and Youth Services Review.* 2017; 76: 65–73. doi: 10.1016/j.childyouth.2017.02.015. (University of Illinois at Chicago)

Research has identified the benefits of having non-parental adults for older youth in foster care, but less is known about the characteristics of these relationships, as well...
as the processes that support the foster youth as they transition from care to independence. The study included a group of 99 young adults, who recently emancipated from care in a major U.S. city. They reported having an important non-parental adult (VIP). Sixty-three VIPs were also included in this study. The youth participated in a two-hour in-person interview followed by a survey; the VIPs underwent a phone interview. These results call for the foster care system to take steps in helping youth build relationships with the non-parental adults in their lives. Susan Farrugia is assistant vice provost of undergraduate affairs and affiliated faculty in psychology at the University of Illinois at Chicago. Gary R. Germo is assistant professor in the Department of Human Services at California State University, Fullerton. Taylor Duke performed this research as a fourth-year student and is currently in medical school at the University of Illinois College of Medicine.


The present study examined mnemonic discrimination in 5- and 6-year-old children, 8- and 9-year-old children, 11- and 12-year-old children, and young adults. Participants incidentally encoded pictorial stimuli and subsequently judged whether targets (i.e., repeated stimuli), lures (i.e., mneonically related stimuli), and foils (i.e., novel stimuli) were old, similar, or new. Compared to older age groups, younger children were more likely to (1) incorrectly identify lures as “old” (rather than “similar”) and (2) fail to recognize lures altogether, especially when lures were more mnemonically distinct from targets. These results suggest age-related improvements in pattern separation and pattern completion during childhood. Leslie Rollins is assistant professor of psychology at Christopher Newport University (CNU). Elisabeth Cloude is a 2016 graduate of CNU and is currently a student in the Applied Cognition and Human Factors doctoral program at North Carolina State University.


Oxides undergoing reversible electrochemical cycling of Mg²⁺ ions would enable novel battery concepts beyond Li⁺, capable of storing large amounts of energy. However, materials showing this chemical reactivity are scarce. These findings open the door for the use of similar nanocrystals in Mg batteries provided that electrolytes with suitable anodic stability are discovered, thereby identifying novel routes toward electrode materials for batteries with high energy. Chungjoong Kim is in the Department of Materials Science and Engineering at Chungnam National University. Ryan D. Bayliss is a senior research scientist at Corning. Tiffany L. Kinnibrough, Saul H. Lapidus, and John W. Freeland work for the Argonne National Laboratory. Jordi Cabana is associate professor of chemistry and Gene M. Nolis is a graduate student at the University of Illinois at Chicago (UIC). Abdullah Adil worked on this research as a third- and fourth-year UIC student and as the recipient of a UIC Chancellor’s Undergraduate Research Award and Liberal Arts and Sciences Undergraduate Research Initiative funding. He is now employed as a research intern at the NIH. This work was supported by Joint Center for Energy Storage Research, DOE, NSF, National Research Foundation of Korea, UIC Chancellor's Undergraduate Research Award, and LAS Undergraduate Research Initiative.


The present study examined the iron release kinetics from the main iron storage protein, ferritin, in the presence of various chaotropic agents. The data indicate that iron mobilization by the non-enzymatic FMN/NAD(P)H system is limited by the concentration of FMNH₂ and is independent on the type or amount of chaotropes present. Diffusion of FMNH₂ through the ferritin pores is an unlikely mechanism for ferritin iron reduction; rather, an iron mobilization mechanism involving rapid electron transfer through the protein shell is proposed. We cautioned researchers about proper interpretation of the iron mobilization kinetics from ferritin using the FMN/NAD(P)H system and pointed out that these kinetics are highly dependent on the amount of dissolved oxygen and the concentration of reagents used. Fadi Bou-Abdallah is a professor of chemistry at SUNY Potsdam. Artem Melman is an associate professor of chemistry at Clarkson University. Paolo Arosio is a professor of molecular biology at the University of Brescia. Tyler Wilkinson graduated from Clarkson University in 2016 with a bachelor’s degree in chemistry. Lindsay Johnson graduated from SUNY Potsdam in May 2017 with a bachelor of science in biochemistry. She is currently employed at Regeneron Pharmaceuticals in Albany, NY, as a biotech production specialist II. She worked on this project in her senior year for research credits. This work was supported by the National Institute of Health, Award Numbers R15GM104879 (F.B.A.) and NSF award CHE 1150768 (A.M.).