Scientific Skill Acquisition and Identity of Visiting Scholars in a Research Experience for Undergraduates (REU) Site

Cody Crosby, Margo Cousins, Laura Suggs, Mia Markey
Department of Biomedical Engineering
The University of Texas at Austin

Anita Patrick
STEM Education, Department of Curriculum and Instruction
The University of Texas at Austin

Abstract

This paper describes a preliminary analysis of a summer Research Experience for Undergraduates (REU) Site sponsored by the biomedical engineering department at a large public institution in the southwest United States. Data were compiled from the 2018 and 2019 cohorts of the program. Twenty-four participants from different undergraduate majors and universities were selected from competitive applicant pools, paired with a research mentor in the department, and tracked over each program's duration. The participants were given a 37-question survey upon arrival and after the completion of the 10-week summer program (i.e., pre-test and post-test). These questions were broadly split among four categories to evaluate the participants' comfort with (1) scientific writing, (2) scientific presentation, and students' strength of association with the identities and careers of (3) researchers and (4) engineers. Students reported significant increases in their scientific writing skills and tended to identify more as researchers after the program. Conversely, students noted little change in their ability to present in a scientific setting and reported that their identity as engineers was not stronger. Separate focus groups with the visiting scholars and their graduate student mentors were conducted after the program to identify the strengths and weaknesses of the current iteration of the REU program. Possible improvements to the REU are proposed at the end of the paper.

Introduction

The Role of REUs in Biomedical Engineering Professional Development

Generally, undergraduate students affiliated with biomedical engineering programs will further discern their career path during the summer months along three main trajectories by (1) interning for a pharmaceutical or medical device company (industry); (2) participating in an undergraduate-targeted research experience (graduate/medical school); or (3) shadowing a medical professional (medical school). As such, REUs remain popular options for biomedical engineering students seeking to bolster their curriculum vitae for admittance to graduate and medical school. REUs have been shown to influence the career decisions of participating students (i.e., influencing the student's identity) and also positively impact the acquisition of technical and communication skills (Lopatto, 2007; Seymour, Hunter, Laursen, & Deantoni, 2004; Young, Cousins, Suggs, & Markey, 2017). It has been demonstrated that students who participate in a structured REU program are more likely to gain admittance to a Ph.D. program and tend to have a greater scholarly output (publications, awards, etc.) than students who did not participate in an REU program (Wilson et al., 2018).

Impact of Institutional Funding

REUs in the sciences are typically funded by one of two sources: (1) the National Science Foundation (NSF); or (2) the host university or department. As the number of REU sites has grown, federal funding has increasingly been assigned to institutions awarding masters and doctoral degrees (Barney, 2017). In a comparative analysis, it was determined that students participating in either a federally funded or university-funded program gained valuable research experience and remained open to a career in research (e.g., applying to graduate school). However, programs receiving federal funding "reported higher gains in research-based skills" (Follmer, Zappe, Gomez, & Kumar, 2017).

Since 2015, the Department of Biomedical Engineering at The University of Texas at Austin has operated a National Science Foundation (NSF)-funded REU site, "Biomedical Engineering Community of Undergraduate Research Scholars for Cancer" (BME CUReS Cancer). Simultaneously, the department has hosted students (i.e., visiting scholars) participating in the NIH Building Infrastructure Leading to Diversity: Southwest Consortium of Health-Oriented Education Leaders and Research Scholars (BUILD) program led by The University of Texas at El Paso (UTEP). BUILD specifically supports students from underrepresented populations from the southwestern United States (Arizona, New Mexico, Texas) and trains them to become biomedical researchers and leaders. Since the total number of BUILD visiting scholars assigned to the UT BME Site was relatively small in these two years, CUReS and BUILD visiting scholars were grouped upon their arrival on campus, thereby enriching each other's experiences and streamlining the administrative organization (Cousins, Demont, Suggs, & Markey, 2018). All subsequent analysis combines observations gathered from CUReS and BUILD participants.

REU Programming

CUReS and BUILD visiting scholars were assigned a faculty and graduate student mentor (an arrangement the authors have found highly effective in past iterations of this REU (Cousins et al., 2018)) and a corresponding laboratory upon their arrival on campus. During the ten-week program, these students spent most of their available time conducting high-level research in their assigned research group. The laboratory settings varied significantly based on the faculty investigator's research interest; "dry" laboratory settings focused on computation and optics, while "wet" laboratory settings focused on biomaterial design and synthesis, tissue engineering, and drug development. In the biomedical engineering department, the research areas are divided as follows: imaging/instrumentation (Track 1), cellular and molecular engineering (Track 2), computational engineering (Track 3), and biomechanics (Track 4). It is important to note that research in these laboratories often involves multiple tracks but are assigned a single identifier. From a pool of participating laboratories and available graduate mentors, 2, 7, 2, and 1 student were assigned to each track, respectively.

The visiting scholars also participated in three pre-program boot camps designed to acclimate the students, many of whom were rising sophomores, to the practices in a typical research setting

(Cousins et al., 2016; Young et al., 2017). The three boot camps, consisting of tissue culture, statistics, and the fundamentals of microscopy, were conducted on separate days. Additionally, the BME department supported weekly educational seminars throughout the program. Visiting scholars shared on-campus housing and participated in social events at their leisure.

Methodology

Most of the visiting scholars' activities were not directly observable to the authors, as CUReS and BUILD students primarily interacted with their graduate research mentor, assigned faculty member, and other members of their research group. As such, surveys and focus groups were employed to evaluate the visiting scholars' development at set time points and to evaluate the REU.

Pre- and Post-REU Surveys (Summative, Quantitative Evaluation)

In the first and last weeks of the program, all incoming visiting scholars were administered a 37-question electronic survey via Qualtrics, a service commonly employed by the University of Texas at Austin to ensure that students can provide anonymous feedback. The visiting scholars were presented Likert scales for each of the questions. The surveys, which have been employed in previous iterations of the program (Young et al., 2017), were designed to evaluate student scientific skill development and to gauge visiting scholars' identification as researchers and engineers.

To quantify and compare the students' responses, the survey questions were split into four broad categories and then analyzed separately (**Appendix A**). The survey participants were anonymized and then assigned an identifier code such that pre- and post-surveys could be directly compared. The experimental group consisted of the compilation from the past two years of the program–2018 and 2019. Analysis of the surveys was compartmentalized to analyze the REU students' progression in their ability to (1) write in a scientific manner (2) present in a scientific setting (e.g., a conference) (3) identify with the career goals and day-to-day life of a researcher and (4) identify with the career goals and day-to-day life of an engineer. Survey questions in the first and second categories were taken from the previously validated Scientific Communication Self-Efficacy Rating Scale (SCSE), developed at The University of Texas MD Anderson Cancer Center (Anderson et al., 2016). Survey questions in the third and fourth categories were adapted from a previous scale that attempted to quantify engineering identity in undergraduate students (Borrego, Patrick, Martins, & Kendall, 2018). Where indicated, data were analyzed with a multiple-sample t-test. Significance was assigned when the alpha was less than 0.05. All statistical analyses were performed with GraphPad Prism software.

Focus Groups (Formative, Qualitative Evaluation)

In the final week of the program, Anita Patrick and Cody Crosby, two graduate students in the STEM education and biomedical engineering graduate programs, respectively, met with the graduate student mentors (hereafter post-program mentor focus group) and REU students (hereafter post-program student focus group). Patrick and Crosby developed a series of questions to guide the conversation. The main goal of the focus groups was to identify the strengths of the current iteration of the program and what could be improved upon in future iterations. The post-program mentor focus group and post-program student focus groups were conducted on separate days.

Results

Survey Feedback

Writing in the Expected Scientific Style

This set of questions sought to assess whether the students thought they had more confidence in their ability to write in the expected (i.e., professional standard) scientific style. Students responded to 10 items on a 5-point scale-item scale (1=very insecure, 2=insecure, 3=neither confident nor insecure, 4=confident, 5=very confident). Each item was tested individually pre to post-program. Results revealed a statistically significant increase in students' ratings for 7 of the 10 items (**Figure 1**).

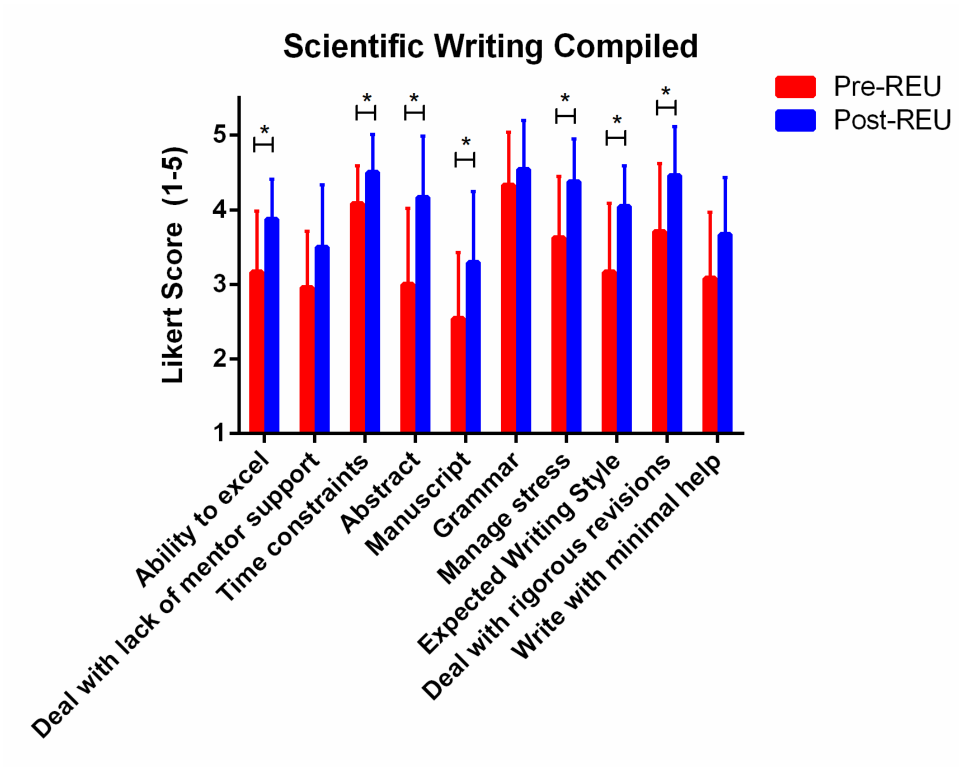

Figure 1. Pre and Post ratings of students' self-perceived ability to write in the expected scientific style

Presenting in the Expected Scientific Style

This set of questions sought to assess whether the students were increasingly confident in their ability to present in the expected (i.e., professional standard) scientific style. Students responded to 12 items on a 5-point scale (1=very insecure, 2=insecure, 3=neither confident nor insecure, 4=confident, 5=very confident). Each item was tested individually pre to post-program. Results revealed there were no statistically significant differences in students' ratings (**Figure 2**).

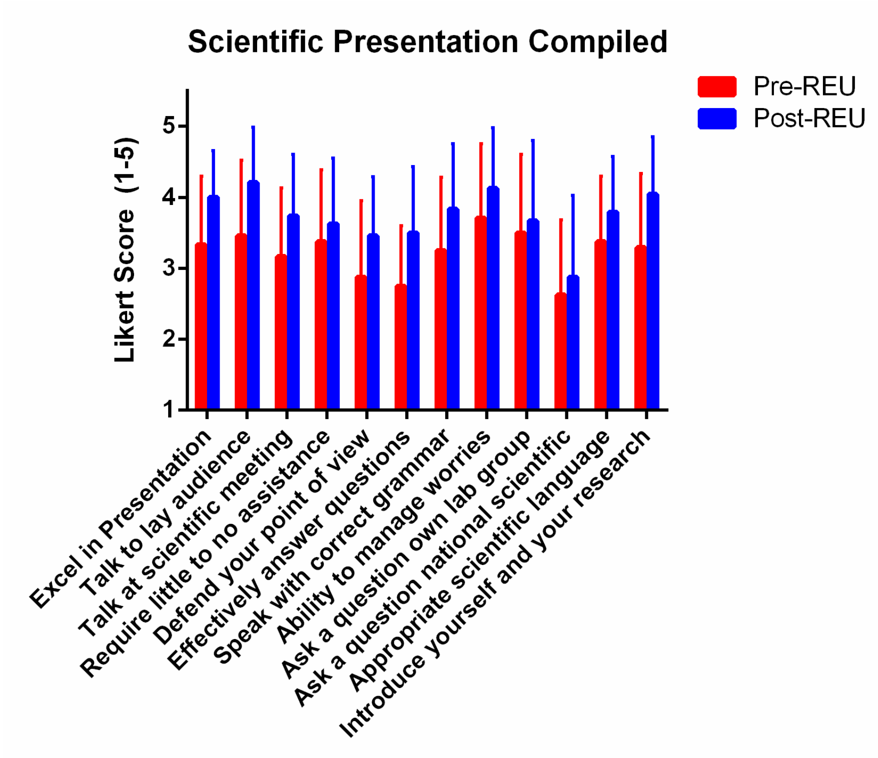

Figure 2. Pre and Post ratings of students' self-perceived ability to present in the expected scientific style

Association with the Identity and Responsibilities of a Researcher

This set of questions sought to assess whether the students increasingly associated with the identity and responsibilities of a researcher. Students responded to 4 items on a 5-point scale (1=strongly disagree, 2=disagree, 3=neither disagree nor agree, 4=agree, 5=strongly agree). Each item was tested individually pre to post-program. Results revealed a statistically significant increase in students' ratings for all 4 items (**Figure 3**).

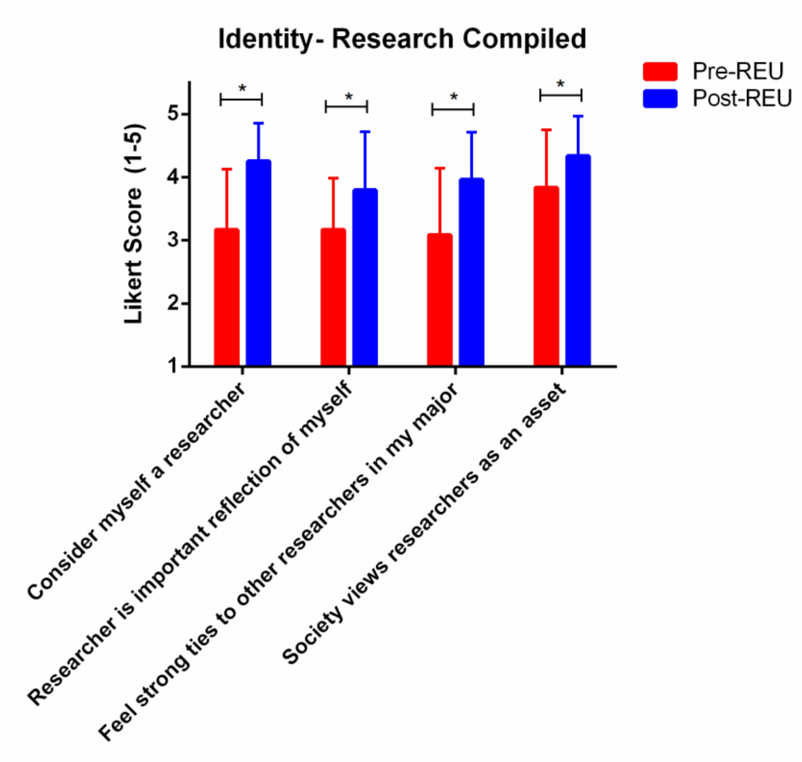

Figure 3. Pre and Post ratings of students' association with the identity and responsibilities of a research career

Association with the Identity and Responsibilities of an Engineer

This set of questions sought to assess whether the students increasingly associated with the identity and responsibilities of an engineer. Students responded to 9 items of which the response scale was 1=strongly disagree, 2=disagree, 3=neither disagree nor agree, 4=agree, 5=strongly agree for the first 8 items. For the last item, the scale was 1=not at all to 8=to a great extent. Each item was tested individually pre to post-program. Results revealed there were no statistically significant differences in students' ratings (**Figure 4**).

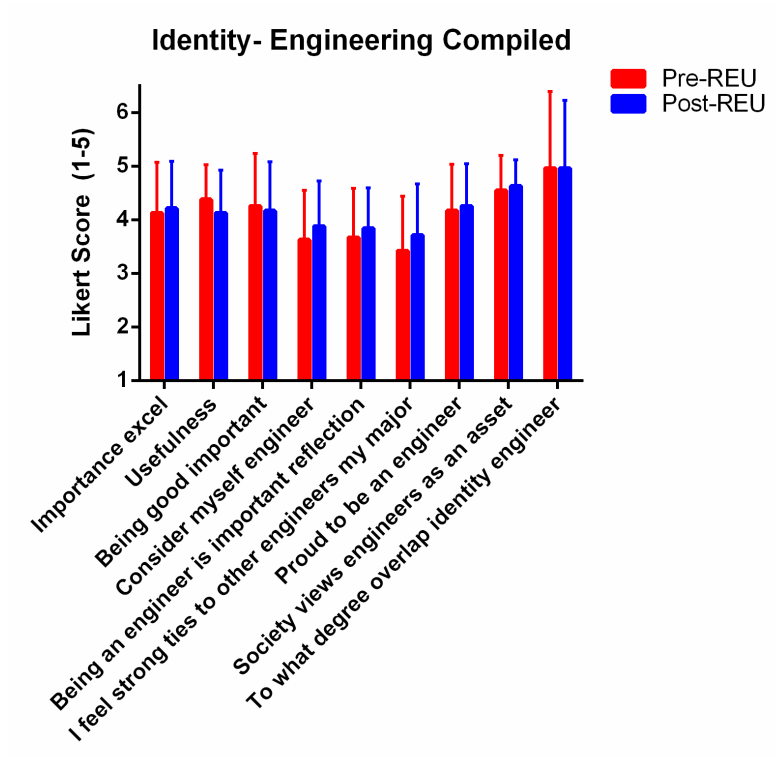

Figure 4. Pre and Post ratings of students' association with the identity and responsibilities of an engineering career

Focus Group Feedback

Feedback was gathered from both the participating students (in-person) and their graduate student mentors (in-person and via email).

Visiting Scholar Feedback

I. **Reason for applying to the CUReS/BUILD program**. The students appreciated the overall levels of organization (for example, the blog posts and website) and communication from the leading professors and administrative staff. Furthermore, the students were interested in cancer applications and appreciated that the REU did not require significant if any, prior research experience from the applicants. For two of the students, the chance to explore another university far removed from their home and home university was a significant attraction.

II. **Effectiveness of weekly seminars.** The students, overall, enjoyed the weekly seminars as it formalized an opportunity for them to gather as a cohesive group. The graduate student panel, in which graduate students discussed their experiences in graduate school and how to apply, was also appreciated. Students voiced that the mandatory logbooks were an excellent opportunity for reflection on the previous week's work. Yet not all feedback was positive. The students had two main criticisms: (1) the poster-making seminar was undermined by the different poster preferences of each lab, and (2) they would prefer even more information on the graduate school application process.

III. **Effectiveness of Bootcamps**. The students enjoyed the tissue culture and statistics boot camps, though they did not employ what they learned in a timely fashion and forgot most of what they had learned from the statistics boot camp. Uniformly, the students were highly critical of the microscope boot camp:

> *"The microscope boot camp was useless to us…what we learned could have been taught to us by our mentor much more quickly…furthermore, it was too broadly focused, and the presenter used too much jargon that we didn't know."*

IV. **Matching Process, Mentor Selection, and Progress Towards the Research Goal**. While it was difficult at points to garner responses during this set of interviews, every student expressed an opinion regarding their lab placement and their assigned mentor. These opinions were sometimes conflicting but could be broadly categorized into two perspectives:

a. **Lab Exploration:** this group of students wished to see a description of each lab's research and have an opportunity to interact with the PI and graduate students before lab assignment and mentor selection. These students were in the minority and acknowledged that this model might be difficult to implement, considering the REU's narrow timeframe (10 weeks).

b. **Pre-lab Assignment:** this group of students pushed for the publishing of an overview of each lab on the current REU site and to have an opportunity to rank the labs in order of their preference. Students appeared most dissatisfied when they were placed in a "dry," or computational setting when they had primarily "wet" lab interests.

V. **Evolution of Students' Identity as Researchers and Engineers**. In the quantitative survey data, it was noted that the participants tended to identify more as researchers by the conclusion of the program; however, their identification with the career and aspirations of an engineer changed little. Overall, the students, understandably, appeared to possess a dual identity. **Table 1** lists an example of this change from the exit focus group for the 2019 iteration of the program.

Table 1. Students' self-reported identity pre and post CUReS/BUILD REU Program 2019

REU Student	Identity Pre-REU	Identity Post-REU
1	Traditional engineer	More of a researcher
2	Engineer	An engineer who does research
3	Unsure	Engineer
4	Biomedical engineer	More knowledge of research still split on career tendency
5	Biomedical engineer	Engineer with a greater appreciation for research
6	Biomedical engineer	Engineer with a desire to work in a "wet" laboratory setting
7	Researcher	A researcher who has been exposed to engineering
8	Engineering mindset	Researcher's mindset with an increased focus on an analytical approach
9	Uncommitted to STEM	Sees the value of research, excited by translational opportunities
10	Researcher*	A more mature scientist
11	Researcher	A researcher with a more expansive knowledge of what it means to be a researcher
12	Engineer**	Engineer with a scientific foundation

*The student had prior REU experience
**Computer Science Major

Graduate Student Mentor Feedback

The responses from the graduate student mentors were limited and brief, which allowed for the condensing of their feedback into two broad categories. The graduate student mentors noted the following:

I. **Most Effective Program Practices**. The graduate student mentors largely agreed that the mentoring preparation sessions both helped them interact with their REU mentees and aided their professional development. Additionally, a short seminar given to the REU students on "work expectations" (i.e., the REU should be treated as a 9 to 5 job) helped the mentors manage their student's schedules. Many expressed that they would welcome a chance to participate in the program again.

II. **Least Effective Program Practices**. Some mentors wished they had increased faculty (PI) support during the mentoring period. Many expressed frustration that very few projects, especially in a "wet lab" setting, could be effectively conducted in a 10-week timeframe. Furthermore, the mentors wanted more time to help their students prepare meaningful posters for the closing poster symposium.

Areas of Program Improvements and Opportunities for Future Growth

Broadly, the students tended to increasingly self-identify as researchers who had improved their scientific writing skills, . but were not any more likely to self-identify as engineers and did not report any statistically significant gains in their presentation skills. We hypothesize that the students did not report gains in engineering identity because they had already developed strong engineering identities prior to the REU experience. In contrast, most of the students had had little if any experience in engineering research and so the REU experience was influential on their identities as a researchers. While students self-report ratings at the beginning of the REU experience suggested room for growth in both scientific writing and scientific presentation, we only observed significant gains in scientific writing. However, it should be noted that the post-REU evaluation was conducted at the end of the summer program, but before the most substantive scientific presentation experience, which was the poster session at the annual meeting of the Biomedical Engineering Society (BMES). It is also possible that the communication measures results indicate that more emphasis was placed on preparing abstracts and posters than on presenting posters.

The process that matches the student to the mentor could use substantial improvement. Both the REU students and mentors noted that they would benefit from having prior access to the lab projects and student interests, respectively. It is important to note that many of the students who participate in the program are rising sophomores and have not conducted research at any level before the REU. Therefore, their preferences are not based on prior experience and may not closely approximate their experience in the lab. Further compounding this difficulty is the limited availability of the mentor pool: typically, one mentor is selected from each lab that researches in the (broad) cancer field. Therefore, it is clear that the expectations for the "matching" process should be more clearly communicated to both the incoming students and the graduate mentors.

It also appears that many of the graduate mentors were instructed by their PI that they would have to participate in the program, which may have created additional stress at the beginning of the program. Mentoring an inexperienced visiting scholar who will not stay in the lab in future semesters can be a stressful, time-consuming experience. While some mentors find this ultimately rewarding and experience a sense of fulfillment (as seen in the focus groups), others view this mentoring as a drain on their limited resources. Ultimately, mentor assignment is the choice of the graduate students' supervising faculty; it may help if the opportunities for professional development are clarified in lab meetings before the mentor is assigned.

Most importantly, the role of the graduate student mentors needs to be clarified. Though the mentors noted that supervising the REU students required significant time investment, they also stated that they would prefer if this mentoring could occur in settings outside the lab, including the seminars. However, it should be noted that the graduate student mentors have a program-long invitation to join the seminars, though attendance remains low. In the next iterations of this REU, the roles and responsibilities of the graduate mentors should be presented upon their selection to the program.

Summary and Conclusions

This paper describes the skill acquisition and evolution of the identity of students who participated in a 10-week summer NSF-funded REU site in the biomedical engineering department at the University of Texas at Austin in 2018 and 2019. Participating student researchers believed they gained confidence in their ability to write in the expected scientific style. Furthermore, their self-reported identity became more intertwined with the responsibilities and goals of a researcher. In contrast, the students did not gain confidence in their ability to orally present at a scientific meeting or conference, and their identity as engineering students did not change meaningfully after the program.

From formative feedback, participating REU students noted that they had learned a great deal during the REU and, overall, stated that it left them better prepared to finish their current undergraduate program and begin their future career. Yet, they also advocated for increased participation in the student-lab matching process. This suggests that the students acquired valuable skillsets and enjoyed the REU experience; however, it remains clear that communication between the assigned lab and visiting scholars could be improved at the start of the program. Further, there was an apparent thematic disconnect between the graduate student mentors and their mentees, and conflicts about work expectations, professionalism, and graduate student involvement in the seminars and other REU activities emerged. Issues in this regard are areas of improvement for the program. Nevertheless, this REU had a largely positive impact and built real skills in the field of biomedical engineering for the BME CUREs Cancer and BUILD scholars. This preliminary work suggests improvements to this REU as continued development could further positively impact the next generation of biomedical engineers and leaders in the healthcare industry.

Appendix A

Evaluation of ability to write in the expected scientific style (emphasis, e.g., bolding, not included in the original version)

1. Please rate your level of confidence, even if you have never done it yet, in your ability to **excel in scientific writing tasks**, e.g., abstracts, manuscripts.
2. Please rate your level of confidence, even if you have never done it yet, in your ability to deal with a **lack of mentor support** in scientific writing.
3. Please rate your level of confidence, even if you have never done it yet, in your ability to complete a writing task in the **time allowed**.
4. Please rate your level of confidence, even if you have never done it yet, in your ability to **write and submit an abstract** to a scientific meeting.
5. Please rate your level of confidence, even if you have never done it yet, in your ability to **write the first draft of a manuscript** intended for publication by yourself.
6. Please rate your level of confidence, even if you have never done it yet, in your ability to **write using correct grammar.**
7. Please rate your level of confidence, even if you have never done it yet, in your ability to **manage any worries** you may have about your writing ability
8. Please rate your level of confidence, even if you have never done it yet, in your ability to write in the **expected scientific style**.
9. Please rate your level of confidence, even if you have never done it yet, in your ability to continue to revise a manuscript multiple times after receiving **negative feedback** from your mentor or reviewers.
10. Please rate your level of confidence, even if you have never done it yet, in your ability to **write with minimal help** because your skills are strong enough.

Evaluation of ability to present (orally) in the expected scientific style

1. Please rate your level of confidence, even if you have never done it yet, in your ability to excel in **presenting scientific material** (i.e., receive high praise for your presentations from your mentor or the audience).
2. Please rate your level of confidence, even if you have never done it yet, in your ability to give a **scientific talk to a lay audience** (e.g., high school students, cancer patients).

3. Please rate your level of confidence, even if you have never done it yet, in your ability to give an **oral presentation at a scientific meeting**.

4. Please rate your level of confidence, even if you have never done it yet, in your ability to **require little to no assistance** with your speaking and presenting skills.

5. Please rate your level of confidence, even if you have never done it yet, in your ability to **defend your point of view** convincingly in a scientific discussion, regardless of differing opinions from others.

6. Please rate your level of confidence, even if you have never done it yet, in your ability to **effectively answer questions** from the audience at a scientific meeting.

7. Please rate your level of confidence, even if you have never done it yet, in your ability to **speak using correct grammar** without rehearsing.

8. Please rate your level of confidence, even if you have never done it yet, in your **ability to manage worries** you may have about your pronunciation, accent, vocabulary, grammar, or style of speaking.

9. Please rate your level of confidence, even if you have never done it yet, in your ability to **ask a question or add a comment** during a meeting or discussion in **your lab** or research group.

10. Please rate your level of confidence, even if you have never done it yet, in your ability to **ask a question** in front of an audience after a presentation at a **national scientific** meeting.

11. Please rate your level of confidence, even if you have never done it yet, in your ability to use **appropriate scientific language** when speaking.

12. Please rate your level of confidence, even if you have never done it yet, in your ability to **introduce yourself and your research** concisely and effectively to other professionals.

Evaluation of student's self-identification with the identity and responsibilities of a researcher

1. Please rate the extent to which you agree with the following statement
    a. I consider **myself** a researcher.

2. Please rate the extent to which you agree with the following statement
    a. Being a researcher is an **important reflection** of who I am.

3. Please rate the extent to which you agree with the following statement.
    a. I feel **strong ties to other researchers** in my major.

4. Please rate the extent to which you agree with the following statement.

a. Society views **researchers as an asset**.

Evaluation of student's self-identification with the identity and responsibilities of an engineer

1. Please rate the following statement.
    a. Compared to other activities, **how important is it for you to be good** at engineering?

2. Please rate the following statement.
    a. In general, how **useful is what you learn** in engineering?

3. Please rate the following statement.
    a. For me, being **good in engineering** is important.

4. Please rate the extent to which you agree with the following statement.
    a. I consider **myself** an engineer.

5. Please rate the extent to which you agree with the following statement.
    a. Being an engineer is an **important reflection of who I am**.

6. Please rate the extent to which you agree with the following statement.
    a. I feel **strong ties to other engineers** in my major.

7. Please rate the extent to which you agree with the following statement.
    a. I am **proud to be an engineer**.

8. Please rate the extent to which you agree with the following statement.
    a. Society views **engineers as an asset**.

9. To what extent does your sense of who you are (i.e., **your personal identity) overlap** with your sense of what an engineer is (i.e**., the identity of an engineer**)? [Scale 1= not at all, to 8= to a great extent].

References

Anderson, C. B., Lee, H. Y., Byars-Winston, A., Baldwin, C. D., Cameron, C., & Chang, S. (2016). Assessment of Scientific Communication Self-efficacy, Interest, and Outcome Expectations for Career Development in Academic Medicine. *Journal of Career Assessment*, *24*(1), 182–196. https://doi.org/10.1177/1069072714565780

Barney, C. C. (2017). An Analysis of Funding for the NSF REU Site Program in Biology from 1987 to 2014. *Scholarship and Practice of Undergraduate Research*, *1*(1), 11–19. https://doi.org/10.18833/spur/1/1/1

Borrego, M., Patrick, A., Martins, L., & Kendall, M. (2018). A New Scale for Measuring Engineering Identity in Undergraduates. In *Proceedings of the 2018 ASEE Gulf-Southwest Section Annual Conference*.

Cousins, M., Demont, B., Suggs, L., & Markey, M. K. (2018). Coordinating Summer Undergraduate

Research Programs for Expanding Diversity and Impact : Opportunities and Challenges. In *Proceedings of the 2018 ASEE Gulf-Southwest Section Annual Conference*.

Cousins, M., Young, S. R., Dolan, E., Gonzales, L., Markey, M. K., & Suggs, L. J. (2016). A "Boot Camp" as in-laboratory introduction to research methods for a research experiences for undergraduates program. In *Proceedings of the 2016 Biomedical Engineering Society Annual Meeting*.

Follmer, D. J., Zappe, S., Gomez, E., & Kumar, M. (2017). Student Outcomes from Undergraduate Research Programs: Comparing Models of Research Experiences for Undergraduates (REUs). *Scholarship and Practice of Undergraduate Research*, *1*(1), 20–27. https://doi.org/10.18833/spur/1/1/5

Lopatto, D. (2007). Undergraduate Research Experiences Support Science Career Decisions and Active Learning. *CBE- Life Sciences Education*, *6*, 297–306. https://doi.org/10.1187/cbe.07

Seymour, E., Hunter, A. B., Laursen, S. L., & Deantoni, T. (2004). Establishing the benefits of research experiences for undergraduates in the sciences: First findings from a three-year study. *Science Education*, *88*(4), 493–534. https://doi.org/10.1002/sce.10131

Wilson, A. E., Pollock, J. L., Billick, I., Domingo, C., Fernandez-Figueroa, E. G., Nagy, E. S., … Summers, A. (2018). Assessing science training programs: structured undergraduate research programs make a difference. *BioScience*, *68*(7), 529–534. https://doi.org/10.1093/biosci/biy052

Young, S. R., Cousins, M., Suggs, L., & Markey, M. K. (2017). Developing science communication skills as a part of a summer Research Experiences for Undergraduates (REU) program. *ASEE Annual Conference and Exposition, Conference Proceedings*, *2017-June*(2002). https://doi.org/10.18260/1-2--27785

CODY CROSBY
Cody Crosby, M.S.E, is a Ph.D. candidate in the biomedical engineering department at the University of Texas at Austin. He has received several honors, including the Provost's Graduate Excellence Fellowship, Cockrell School of Engineering Fellowship, Ruth L. Kirschstein Fellowship (National Institute of Health T32), and NSF GRFP Honorable Mention. Mr. Crosby has published 7 journal articles, including three as the first author in JoVE, Journal of Tissue Engineering Part A, and Regenerative Biomaterials. He received his B.S. in Engineering from Harvey Mudd College and researched high entropy brasses and bronzes, producing one publication. He received his M.S.E. in Biomedical Engineering from the University of Texas and will begin an assistant professor of applied physics at Southwestern University in August 2020. Mr. Crosby's current research interests are in tissue engineering, stem cell research, 3D bioprinting, and engineering education.

ANITA PATRICK
Anita Patrick is a Ph.D. candidate in STEM Education in the Department of Curriculum and Instruction at The University of Texas at Austin. She has received several honors, including a Graduate Recruitment Fellowship and Continuing Dissertation Fellowship from the College of Education. Ms. Patrick has published three journal articles including a first author publication in the International Journal of Engineering Education. She has published in several conference proceedings including the ASEE Annual Conference & Exposition, AERA Annual Meeting, BMES Annual Meeting, and international Research in Engineering Education Symposium. Ms. Patrick received her B.S. in Bioengineering from Clemson University (2012), where she tutored undergraduate mathematics and science courses and mentored undergraduate engineering students. Before coming to UT, she independently tutored K12 and undergraduate mathematics and science. Ms. Patrick's current research interests include engineering education, identity centrality, equity, and career decision-making.

MARGO COUSINS

Margo Cousins, M.A., is an Academic Advising Coordinator and leads the academic advising team for Biomedical Engineering (BME) bachelor's, master's, and doctoral programs at the University of Texas at Austin since 2011. She oversees programming and advising activities aimed at improving student success and professional development for all BME students. Ms. Cousins also coordinates the department's National Science Foundation (NSF) Research Experience for Undergraduates (REU) Site *BME CUReS Cancer* weekly summer seminars. Her academic interests include implementing and measuring psychosocial interventions that have been demonstrated to improve success for targeted at-risk populations, such as social-belongingness, growth mindset, and self-efficacy. Ms. Cousins holds a Master of Arts in Higher, Adult, and Lifelong Education (HALE) from Michigan State University, and a Bachelor of Science in Biology from Washington State University. Her work has been recognized through staff excellence awards in 2019, 2011, and 2008, and the engineering outstanding first-year group facilitator award in 2017. She has worked in the Department of Biomedical Engineering at the University of Texas at Austin since 2005.

LAURA SUGGS

Dr. Laura Suggs is the T.U. Taylor Professor and Associate Chair of the Biomedical Engineering Department at the University of Texas at Austin. She earned her undergraduate degrees from UT Austin and her Ph.D. in chemical engineering with a concentration in biomaterials and tissue engineering from Rice University in 1998. She has been the recipient of the following awards: American Heart Association Beginning Grant-in-Aid and Grant-in-Aid; NSF ADVANCE Fellowship; NSF CAREER award; and she was recently elected to the American Institute for Medical and Biologic Engineering and the Royal Society of Chemistry. Her educational efforts have earned her recognition by the National Instruments Teaching Excellence Award and the ASEE Gulf Southwest Section Young Faculty Award.

MIA MARKEY

Dr. Mia K. Markey is a Professor of Biomedical Engineering and Engineering Foundation Endowed Faculty Fellow in Engineering at The University of Texas at Austin as well as Adjunct Professor of Imaging Physics at The University of Texas MD Anderson Cancer Center. Dr. Markey is a 1994 graduate of the Illinois Mathematics and Science Academy. She has a B.S. in computational biology (Carnegie Mellon, 1998). Dr. Markey earned her Ph.D. in biomedical engineering (2002), along with a certificate in bioinformatics, from Duke University. Dr. Markey has been recognized for excellence in research and teaching with awards from organizations such as the American Medical Informatics Association, the American Society of Engineering Education, the American Cancer Society, and the Society for Women's Health Research. She is a Fellow of both the American Association for the Advancement of Science (AAAS) and the American Institute for Medical and Biomedical Engineering (AIMBE) and is a Senior Member of both the IEEE and SPIE. Correspondence concerning this paper may be sent to Dr. Markey at mia.markey@utexas.edu.