

Designing Biomedical Engineering Summer Programs for Undergraduates and High School Students: A Case Study of a Work-in-Progress

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Extended Abstract

This work-in-progress, qualitative study focuses on the design of a collaborative biomedical engineering-themed program, in which approximately 10-16 undergraduate students from across the United States in a Research Experience for Undergraduates (REU) program partner with approximately 16-32 urban high school students in a summer engineering-themed enrichment program (Summer Program) to communicate about biomedical engineering research. This week-long collaborative program is imbedded within two larger programs with separate but overlapping goals. The goal of the REU Program is to immerse undergraduates in biomedical engineering laboratories to conduct cutting-edge diabetes research in an effort to influence their long-term interests in science and engineering. The goal of the Summer Program is to bring approximately 100 diverse, high-achieving, urban rising juniors and seniors to a college campus to learn a variety of STEM-oriented programming, in an effort to influence their long-term interests in STEM fields and education.

The objective of the partnership between the REU Program and the Summer Program focuses on developing tier-mentorship experiences for both groups. A separate facet of the REU Program includes mentorship from graduate students who actively contribute to the development of the undergraduates in the REU Program. By including high school students as a group with whom the undergraduates can interact, the undergraduates gain the experience of acting as a mentor, in addition to being mentored. Similarly, by introducing the high school students in the Summer Program to undergraduates who are actively pursuing a field of study in which the high school students expressed an interest, the high school students gained a mentor who had valuable information about the college experience and, in particular, the experience of a biomedical engineering student to share.

Over the last two summers, the collaboration between the REU Program and Summer Program has involved communication between the undergraduates to the high school students of their research through a variety of tools, including lab tours, demonstrations, activities and discussions. The high school students and undergraduates then collaborate to develop activities and games about biological phenomena related to biomedical engineering to present to middle school students in a nearby summer program. The poster will include a schedule of the program and examples of the activities created by the undergraduates for the high school students and by the collaboration between the undergraduates and the high school students for the middle school students.

As this collaboration enters its third summer, the design of the week-long program has changed to reflect feedback from both the undergraduates in the REU and the high school students in the Summer Program. This paper and poster session will present an overview of the collaboration in the past two years, the redesign of the programming for this summer, the data sets that will be gathered before, during, and after the programming, and the anticipated use of the data sets.

Redesign of the Collaboration for Summer 2014

Changes to the collaboration are made using two tools: (1) feedback from the participants in the collaboration and (2) a set of principles for developing design activities.

Feedback from participants in the collaboration is based on post-surveys and semi-structured exit interviews conducted with the 2012 REU cohort, semi-structured exit interviews conducted with the 2013 REU cohort, and semi-structured interviews conducted with a random sample of the high school students in the 2013 Summer Program. For example, after the conclusion of the Summer 2012 program, several of the REU students reported that they felt a lack of engagement with the collaboration due to the overly-prescribed schedule, lack of the incorporation of their own ideas into the collaboration, and limited time to prepare. As a result, for the Summer 2013 program, we held a meeting about the collaboration and provided a schedule to the REU students at the start of their program that did not dictate how and what they should present to the high school students but made the expectation of the timeline clear so that the REU students had time to organize themselves. We also made the expectation clear that the REU students should focus on communicating their research to the high school students and discuss the social and historical impact of their work and its relation to diabetes. Otherwise, the choice of how to present their work was left up to the REU students. This led to substantially increased engagement, evidenced by more positive feedback about the collaboration from the REU students in the 2013 cohort.

Through surveys collected from both groups, we found that the lab shadowing and presentations made by the REU students about their research to the high school students were favored components of the collaboration. To capitalize on this interest from both sides, the lab shadowing day will be expanded to two days and occur earlier in the week, with high students rotating through many labs on the first day and partnering with a single REU student for the second day to better understand their research and to foster closer collaborations between the REU students and the high school students. The hoped-for result of these closer collaborations would mean that the REU students and high school students could then collaborate to communicate some aspect of the active research to either the high school students' peers in the Summer Program or local middle school students.

Finally, a recently-developed, soon-to-be-published set of five principles for engaging students in design activity will also guide our redesign of the program to help frame the focus of the program and design supporting activities so that the high school students and undergraduates are able to successfully collaborate to design activities for middle school students or other high school students. These principles will be included in the poster, along with illustrations of each principle through the newly-designed supporting activities for the collaborative program.

Anticipated Data Sets to be Gathered During Summer 2014

Post-surveys and semi-structured exit interviews are administered to the REU students every summer. To complement the data gathered from these sources, we will administer similar post-surveys and semi-structured exit interviews to the high school students. To examine whether our program has met our objectives, these semi-structured interviews and surveys will focus on three areas: (1) personal engagement with the collaborative program, (2) mentor-type relationships that emerge through the collaborative program, and (3) changes in interest in biomedical engineering as a result of the collaborative program.

Anticipated Use of the Data Sets

All data gathered will be used to redesign the collaboration further and to study mentor-type relationships that can develop between undergraduates and high school students and their effects on student engagement in STEM fields for subsequent years of the REU Program and Summer Program, which provide new samples of students every year. We do not intend to gather data from any population beyond the end of its respective program (for example, we do not anticipate that we will capture data about the Summer Program in the years that follow the Summer Program). As a result, long-term data on the effect of the collaborative program on career or educational goals will not be collected or analyzed.