

Low to No Cost Undergraduate Research: Mentoring Biology Students When Resources are Scarce

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Author Biography

Dr. Amanda L. J. Duffus is an Associate Professor of Biology and a Center for Excellence in Teaching and Learning Faculty Fellow at Gordon State College. She is actively involved in undergraduate research and mentors students not only by herself, but in conjunction with other faculty. Over the past 10 years, she has mentored over 40 students who have presented at regional, national, and international conferences and has published six peer reviewed journal articles with student authors. She is happily married with a son, owned by four cats, and is a budding karate student.

Undergraduate research (UR) is one of the Association of American Colleges and Universities high-impact practices (Kuh, 2008). These experiences take a variety of forms, including course-based undergraduate research experiences (C.U.R.E.s), and mentoring of individuals or small groups where the student takes charge of a project or small areas of a larger project. Unfortunately, there are limited funds available for undergraduate research at most teaching-intensive colleges, where obtaining external funding has been an issue. This situation will only get worse as declines in enrollment and state budgets further reduce funding to our institutions of higher education. As educators, we always aim to do our best for our students to prepare them for their post-degree lives, which is rendered more difficult under financial strain.

Goals of Activity

Our students face many road blocks in successfully completing their undergraduate studies. Providing authentic research experiences to undergraduates can be a way to engage students in their education and to expose them to different potential career paths. The mentorship that students receive from faculty can be extremely influential in their success as undergraduates and beyond. My goal is to help undergraduate researchers develop transferable skills (critical thinking, problem solving, academic writing, presentation skills, etc.) that will help them be successful in different career paths, such as graduate or professional school, industry, and so on. These practices and values fall in line with those presented by Reed (2018), have led to many successful student-faculty collaborations, and have produced a multitude of student-led presentations.

Description of Activity

In addition to my teaching duties, which do not include student-oriented research, I work with students in small group settings (lab meetings) and individually, where the students are responsible for a project or a small portion of a larger study. I require students to present their work to the lab group so that they can have a safe place to develop presentation skills and get feedback from the rest of the group and me. The undergraduate researchers with whom I work are required to write literature reviews to master the material and to explore the literature to see if there are other directions that they might want to go in their work. I give extensive feedback on the literature reviews, especially the early drafts, which the students must submit about a month before the final draft is due. I spend a lot of time with each student individually, which really adds value to the experience as I guide them through their educational journey and hopefully get them where they want to be at the end of their undergraduate career.

Getting students to professional conferences presents another funding obstacle. Many regional conferences are relatively low cost for students and also have travel awards that students may apply for. A great example of this is the Georgia Academy of Sciences (GAS, <http://www.gaacademy.org/>). The fee for student registration is typically about \$60, and there is a travel award that students may apply for. Despite these low

costs, many students still cannot afford to attend. In order to overcome the costs associated with professional conferences, one great way to promote UR is to have a research day or a STEM poster hour on campus. These research events can be formal or informal. At Gordon State College (GSC), we have an annual Undergraduate Research Symposium (URS) for our students. It is organized by a committee and is a day-long event that encompasses student research in all disciplines. The URS at GSC was started in 2011 and has been successful enough to be developed into a full-day event. There are both oral and poster presentations and these presentations are judged by faculty members, with the best presentations receiving awards.

Publishing with UR students can be especially problematic when no funding is available. Many scientific journals charge exorbitant publication fees, and relatively few have programs available to reduce the costs associated with publishing by students. Therefore, college level faculty development grants can be a great resource for paying for page fees. While we would like to think that publishing is not essential, it really does have the potential to help students further their academic careers, and it gives them an edge when applying for jobs.

One other major issue that can affect student interest and success is the subject matter and the area of expertise of the faculty mentor. In Biology and many other STEM disciplines, it is very rare that UR can be undertaken with few or no costs associated with the actual research itself. Some areas of biology lend themselves better to low/no cost research than others, and I was lucky to be able to use my background in evolution/genetics (undergraduate focus) to shift my research from viral ecology (which was the focus of my graduate degrees) to viral genetics and evolution. I also work with ranaviruses, which are globally emerging infections in amphibians, fish, and reptiles, so there is a lot of sequence data available and many unanswered questions that this data can address. More generally, in many areas of biology there are large publicly available data sets that might be used as a basis for research on questions related to a faculty member's interest. For example, see the database *Dryad*. There are also many different freely available bioinformatics and statistics programs that can be used, even by less skilled students, who can quickly develop mastery with a little guidance. I realize that some researchers refer to them as black boxes, but they are nevertheless used for both presentations and publications.

Reflection

Over the past 9.5 years, I have mentored over 40 individual students who have presented at conferences. Importantly, many of these students have pursued multiple projects with me. All in all, my student mentoring has led to over 60 student poster presentations at the GSC URS, regional, national, and international conferences/meetings; six student oral presentations at regional meetings; three student-led peer-reviewed publications; and three student-involved peer-reviewed publications. Many of these students have gone on to professional and graduate programs, and some have gone directly into the workforce. I know that their research experiences gave them the ability to make informed decisions concerning their careers. Low to no cost UR in STEM is extremely challenging, but very rewarding. Building meaningful collaborations with students and helping them develop their skills is something that we all should aspire to, whether in the classroom, small groups, or individually. While I understand that this is not possible for many faculty members at teaching institutions because of time constraints and access to research facilities, it is something to consider if you can. It has truly been the most rewarding part of my career so far.

References

- Kuh, G. D. (2008). *High-impact educational practices: What are they, who has access to them, and why they matter*. Association of American Colleges and Universities.
- Reed, D. E. (2018). Six steps for cultivating successful undergraduate research. *Bulletin of the Ecological Society of America*. 99(4), 1-5.