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The advantages for Ph.D.s of supervising team-based undergraduate research projects (opinion)

Submitted by Phillipe Wernette on June 5, 2018 - 3:00am

Many academic institutions are pushing to increase the number of undergraduate students engaged in research. But the traditional approach of pairing one student with one faculty member limits the number of students who can participate, given faculty time and resources. And in my own work as a graduate student interested in a tenure-track faculty position, while several people stressed the importance to me of engaging undergraduate students in research, nobody offered much guidance about how to do that effectively.

In fact, to a graduate student, the thought of mentoring undergraduate students can evoke panic or even terror for any number of reasons. For me, such anxiety stemmed from advice that many faculty members at multiple universities across different disciplines had given me: “The purpose of graduate school is to finish your research and defend your thesis. Don’t worry about extracurricular activities and undergraduate mentoring, because it will only hinder your progress.”

Yet while I understood the merit in not slowing down progress to my Ph.D., I found it difficult to accept that graduate school could not offer more in preparation for a future tenure-track faculty position, which demands regularly balancing a rigorous schedule of teaching, research and academic service and outreach. How does a graduate student gain the experience required to be competitive for academic positions while only focusing on their dissertation research? The answer came to me through an unexpected chance to mentor undergraduate students in research.

Beginning in fall 2015, Texas A&M University established two programs [1], the Aggie Research Scholars Program and the Aggie Research Leadership Program, aimed at expanding undergraduate research opportunities across all its colleges by integrating graduate students as research mentors. But the initial challenge for many graduate students and postdocs, including me, was how to effectively mentor even just one or two undergraduate students and still maintain the required teaching and research productivity.

Then my adviser presented a new approach: selecting between three and eight students to collaborate as a team on a single shared research project. A faculty member would mentor one or more graduate students or postdocs, and each of the graduate students or postdocs would then mentor one or more teams of undergraduate students.

The two teams I mentored consisted of five to seven students, and each one met for two hours each week. We used each weekly team meeting to review progress from last week, address challenges encountered and formulate our tasks for the upcoming week. Students were not limited to specific disciplines but had a wide variety of backgrounds. We found that one way to ensure that the research teams were productive and engaged was to develop projects that are relevant across multiple fields.

As team leaders, we were also encouraged to have undergraduate research teams conduct publishable research beyond our own thesis projects. In that way, projects were likely to relate to the team leader's research, but undergraduates were not simply doing our research for us. Focusing on collaborating with students from many different backgrounds to address a complex and multidisciplinary problem on the periphery of our thesis provided important experience for us as team leaders and for all the team members. While many students communicated frequently with other faculty and students within their discipline, the interdisciplinary research teams allowed graduate students the experience of communicating with students in other fields, a skill that translates well to managing teams in academic and nonacademic careers.

Dealing With the Challenges

Once a project was proposed, the first challenge was how to select successful and productive students. What criteria define a "successful" student researcher? Should students have met prerequisites to be on a team? Although grades and test scores are commonly used as measures of academic success and potential, we found that meeting with each student to gauge their specific interest in the project and how it would help them in the long run was significantly more effective in identifying students who would be productive and engaged.

Many faculty members tend to stray away from mentoring first- and second-year students in undergraduate research opportunities for a variety of reasons. Such students are traditionally viewed as too green -- that they require intensive training before they can produce any results. Faculty members tend to prefer juniors and seniors for traditional undergraduate research opportunities because those students presumably have at least some prior knowledge or skill valuable to the project goals.

But we found that first- and second-year students also represent the biggest potential gain, because they can continue on a project for much longer than a third- or fourth-year student and can bring new experience to a project. In fact, many of the first- and second-year students can have the most valuable perspectives when it comes to identifying the potential knowledge gaps and issues with previous studies. They can help define and refine the specific research question and objectives for team research projects in addition to collecting, analyzing and synthesizing data. Pairing third- and fourth-year students on a team with first- and second-year students increases the likelihood that research teams have a diverse set of experiences with a fresh perspective, and it can promote peer-to-peer mentoring beyond the classroom.

Another immediate challenge with many first- and second-year students is their concern about not knowing much about the research project and not wanting to say something unintelligent. To combat that, we found it can help to emphasize the idea that the older, more experienced students all started out similar to the newer students at one point or another.

Numerous Benefits

Mentoring several diverse undergraduate research teams over multiple semesters has direct tangible benefits. During the two years I mentored undergraduate students, they presented 19 posters and seven papers at seven different conferences, from local to international. Teaching undergraduate students how to prepare quality posters and papers for presentation and to effectively communicate research to different types of audiences was one of the most substantial benefits for those students. At a conference of, say, community organizations, students might focus their presentations on management implications, while students at more discipline-specific conferences presented more technical details.

We found that, if done effectively, students presenting team-based research posters and papers outperformed their traditional undergraduate research counterparts. Several team-based posters and papers won first- or second-place awards over undergraduate and even graduate students

working in the traditional one-on-one research model. At conferences, it was common to hear audience members ask about an undergraduate's research topics, mistakenly assuming they were graduate students.

Encouraging undergraduate students to take the lead on publications of particular interest, while working with the rest of the undergraduate research team, can also help further develop those students' interest in graduate school. After graduation, many undergraduate students I worked with did, indeed, choose to apply to graduate schools throughout the United States and Canada, and many of them -- about half of my students -- received fully funded offers from multiple graduate schools. Those students have expressed to me that they believe one of the key deciding factors that helped set them apart when applying to graduate schools was their undergraduate research experience and the posters and papers associated with it.

Audience comments, student awards and multiple graduate school offers are all evidence that team-based undergraduate research can be more effective than the traditional one-on-one approach. Team-based undergraduate research represents an ideal opportunity for high-achieving students to distinguish themselves from the rest of the students applying for graduate school or other positions. Another direct benefit of team-based research is the ability for team leaders and team members to grow their professional network and build external collaborations much more rapidly than traditional research approaches.

The team approach also prepares students for life after academe. Very rarely will a student work by themselves in a future career. They are much more likely to have to collaborate with one or more other people who may have different backgrounds and personalities. Those entering a managerial position outside academe are likely to direct one or more teams of workers, each with their own group dynamics.

A common argument against mentoring undergraduate students is "mentoring undergraduate students is a good experience but does not help toward publications, so don't waste too much time with it." In other words, what is the direct benefit to the mentor in the mentor-mentee relationship with this research experience? What tangible products do the mentors have to show for their efforts?

For me, the difference is substantial: one research publication in press, one publication in review, one publication in final stages of preparation and 19 research presentations. Without the team-based research experience, those publications and presentations would not have been possible.

While mentoring undergraduate students in research can appear daunting, it can be one of the most eye-opening and beneficial experiences of graduate school. And, in fact, its benefits go beyond graduate school and can help prepare postdocs and graduate students for tenure-track faculty positions. Developing a fluid set of best practices for mentorship is a vital part of the learning process for team leaders in academe, as well as for those interested in nonacademic careers.

In sum, contrary to some traditional research mentorship advice, mentoring undergraduate students in team-based research has direct benefits to both mentor and mentee. Given the increasing pressure to publish and present research, faculty and graduate students should consider a team-based approach to research when trying to grow their presence, increase research productivity or simply gain valuable mentorship experience.

Section:
Teaching and Learning [2]

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