

EARLY CAREER

The Early Career Section offers information and suggestions for graduate students, job seekers, early career academics of all types, and those who mentor them. Angela Gibney serves as the editor of this section with assistance from Early Career Intern Katie Storey. Next month's theme will be BIG Math.



Aspects of Teaching and Research at Primarily Undergraduate Institutions

Synergizing Teaching and Research at Primarily Undergraduate Institutions Through Student Research

Jana Gevertz

When I went on the job market in 2009, I knew I wanted to work at a primarily undergraduate institution (PUI). Looking back at my cover letter, I see a number of comments that highlighted what I was looking for in a faculty position:

- “my desire to teach at an undergraduate oriented institution”
- “your [institution’s] commitment to educational principles that make the teaching role primary”
- “scholarly activity is encouraged [at your institution] both for the sake of scientific advancement and for undergraduate development.”

At the time I wrote this cover letter, I viewed these comments as being broadly aligned with the goals of all PUIs. As I started interviewing for positions, I became acutely aware of my naïveté in painting all PUIs with the same broad brush. I interviewed at some PUIs where search committee members politely confided that they felt their position was too teaching heavy for me, and others where I was told that my cover letter’s emphasis on teaching over research almost cost me the interview. I was getting a real-time lesson on the diversity that exists within PUIs, and how the expectations of teaching and research at a PUI can vary greatly from institution to institution.

Therefore, any advice article on aspects of teaching and research at a PUI benefits from providing context on the PUI itself. Since 2009, I have been a faculty member at The College of New Jersey (TCNJ), a public comprehensive institution with a strong liberal arts core that enrolls approximately 6,600 full-time undergraduate students. As far as PUIs go, TCNJ leans towards a more research-active institution, though I still view teaching as my main duty. Our default teaching load is three courses a semester (a “3-3 load”). As a point of comparison, you may find 2-2 loads at some private liberal arts institutions, and 5-5 loads at

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some four-year PUIs and community colleges. TCNJ also offers course release for research on a competitive basis, which can reduce the teaching load to 3-2. A fairly unique feature of TCNJ is that undergraduate research is recognized in our faculty workload, which combined with the structure of some of our lower-level mathematics courses, can result in research-active faculty teaching a 2-2 load. Thus, this article is written from the perspective of a faculty member working at a PUI that provides support for research activity, particularly when that research involves undergraduates. I'll call these "research-supportive PUIs."

Like at all academic institutions, success at a research-supportive PUI depends on striking that magical yet often-elusive balance between teaching, research, and service. One path to achieving this balance is to try *not* to view teaching and research as independent pillars of our work, but to instead embrace the role of the teacher-scholar. According to TCNJ, "teacher-scholars are deeply committed to pursuing their own scholarly and creative work and integrating this with their teaching when possible and/or appropriate" [TCNJ]. Many variants of this definition exist, but a shared feature is that teacher-scholars are committed to integrating their pedagogical and research activities in synergistic ways. This advice article will focus on achieving this goal via undergraduate research, though this is not the only avenue for blending one's teaching and scholarly work.

While my main goal for an undergraduate research project is for the student to have a transformative learning experience, over the years I have come to see how the benefits can extend far beyond the students involved in the project. I have seen how undergraduate research can support my broader research agenda and impact my approach to classroom teaching. But these benefits were not always clear to me. Early in my faculty career I struggled to design meaningful student projects. I have been in awe of some of my early-career colleagues who do an amazing job of designing undergraduate projects, but as an early career faculty member I think I was afraid of giving students the projects I was most interested in. The pressure of getting tenure and the slower pace of undergraduate research felt in conflict with each other. In other words, I was really viewing undergraduate research as separate from achieving my scholarly (and pedagogical) goals.

Today I look at things differently, as not only is my research program driven by me and my amazing collaborators, but it is also driven by my undergraduate mentees. While each PUI has its own mechanisms for supporting undergraduate research—and I am fortunate that TCNJ supports both academic year and summer research—I have found that I prefer mentoring undergraduates during the academic year. When I am in the middle of yet another chaotic semester and the urge to put my research on the back burner is strong, it is my undergraduate researchers that keep my head in my scholarly program. My

accountability to my research students maintains my accountability to my research program.

Simultaneously, I find that undergraduate research makes me more adventurous in the projects I pursue. My research-supportive PUI is not a "publish-or-perish" environment. And, unlike with graduate students, my mentees' graduation is not contingent on having a novel result. All these factors give me the freedom to take risks with my research projects, which over time has made my research more exciting to pursue, and more impactful to my field.

Undergraduate research also results in numerous benefits to my students. The most obvious benefits are conferred to the researchers themselves, as these students have opportunities to present their work, write up their results, and occasionally even publish in peer-reviewed journals (though I do not view publication as a requisite end goal). The less obvious group who benefits are the students enrolled in my courses. I have found that bringing aspects of my mathematical biology research into the classroom encourages student engagement with the course content. In my lower-level courses, I introduce relatable applications from pharmacokinetics, like predicting the amount of caffeine in the bloodstream after drinking Red Bull. In my upper-level courses, I use projects to engage students more deeply in real world applications. For instance, in Mathematical Biology students are required to read a research paper from the primary literature, replicate its analysis, reflect on its utility to the underlying biological problem, and propose a biologically grounded model extension. In Differential Equations, I have developed a project on the spread of SARS-CoV-2, and I have codeveloped a project on tumor response to an experimental cancer drug. Bringing research into the classroom can have a reciprocal relationship on one's scholarly record. Though I am not a scholar of teaching and learning, I have had the opportunity to publish on the Differential Equations cancer project in a peer-reviewed journal for exchanging ideas about teaching collegiate mathematics [BGH15].

While not all areas of research are equally easy to incorporate into the undergraduate classroom, faculty in any subdiscipline can introduce open questions from their field in course-appropriate ways. Students often have the misconception that "we know all of mathematics" and that their role is to master that knowledge. Exposure to unanswered questions and unproved conjectures can positively shift student perception of mathematics by showing them that the field is a living discipline full of research activity.

Bringing applications and/or open questions into the classroom can be empowering to students, as it allows them to see that they can be active participants in expanding the ever-growing body of mathematical knowledge. In fact, a large fraction of my 20+ undergraduate mentees became interested in mathematical biology research after exposure to the topic in one of my classes. Other students have found me through our department's website or through

conversations with their advisor, professors, or peers. Our department has also started formally advertising available projects in a “research lightning talk” event. This has been especially important for ensuring equitable access to research, as not all students are aware of what undergraduate research is, or how to pursue those opportunities.

In closing, undergraduate research offers a path to not only balance, but to enhance, the teaching and research roles of faculty members working at primarily undergraduate institutions. The more the interconnectedness between these two pillars of academic work can be realized, the more difficult it becomes to see where teaching begins and research ends. Our research can inform our teaching, our teaching can recruit students to our research, and those research students can bring new ideas to our research program and help maintain our research momentum. For me, this is probably one of the most compelling reasons to work at a research-supportive primarily undergraduate institution!

References

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Credits

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Bridging the Gap by Building Lasting Mentoring Relationships

Allison L. Lewis

In the summer of 2011, I was freshly graduated from my small, undergraduate liberal arts college. As one of just a few departing math majors who had enjoyed easy access to all of the offerings of the department and never questioned my belonging in the major, I was excited and confident about moving on to the next stage of my education. That feeling wouldn't last long. As I transitioned to my graduate program that summer, I very quickly felt lost and out of my depth. Within a few months, I found myself looking for an escape route.

We talk a lot about the importance of strong mentoring while our students are in college. And yet, we don't always think about how to continue these relationships once our students leave us. As we know, students attend PUIs for the intimate setting that they can provide. They get to know their classmates and professors on a personal level, get involved in research projects, and enjoy the benefits of a one-on-one advising relationship, all long before their counterparts at larger universities. This can give students at PUIs a sense of empowerment and confidence that can help to boost them into a career or along the road to graduate school. However, the ensuing transition to a large research university or the workforce can then be extremely jarring; these students are often accustomed to being recognized by their peers and instructors, engaging with professors frequently for advice, and having their belonging validated regularly. When they start out in this new and overwhelming environment, they feel unsettled and start to question their worth. (I speak from experience.)

To help students weather this transition, the importance of mentoring that stretches beyond their time on campus cannot be overstated. Students at PUIs can benefit greatly from building a solid support network while they are still in college: something that they can bring forward into the next stage of their careers and lean on when the road gets rough. This can be from a formal mentoring structure in which they choose to participate (one example of which I will discuss below), but can also be a more informal continuation of relationships that were initiated during their time in college. In the latter case, it is often up to us as instructors to recognize that our previous students may

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