of service, a faculty member will devote a portion of their time to writing grant proposals.

### Teaching

Research universities can be either public or private. While the distinction does not affect one's life on a daily basis, it can have a large effect on the university's priorities. Public universities often have a more stable source of funds (though there are exceptions), but they are also subject to the political whims of the state government.

At public universities like the University of Kentucky, the undergraduate students tend to come from nearby geographical areas. Because they are more affordable, schools like ours typically serve students from a broader range of socioeconomic backgrounds. We often have students who are very capable, but are coming from schools where they have not been challenged. As a result, they have not yet acquired the skills to "be a student." For such students, college is the first time that they have struggled in a classroom, and they don't know what the expectations are. Students also frequently have responsibilities outside of the classroom, such as regular family obligations or a job. In first-year classes like calculus, it is potentially more important to teach good study habits than it is to teach L'Hôpital's rule. Public universities like the University of Kentucky also have students from competitive high schools with sophisticated STEM programs, who come to take advantage of the resources of a research-oriented department. These students may arrive prepared for sophomore- or junior-level mathematics courses, or even courses at the graduate level. Indeed, the existence of graduate courses is one of the potential draws for such students, giving them the opportunity to learn math at an advanced level and firsthand experience with the life of a graduate student.

### Service

Every department has a fixed amount of work that needs to get done outside of the classroom. Someone needs to do graduate admissions, someone needs to coordinate outreach programs, someone needs to supervise teaching assistants, someone needs to revisit the core curriculum, and so on and so forth. One of the benefits of a larger department is that faculty have more space to choose the service that appeals to them.

For example, we both have an active hand in the University of Kentucky Math Lab, with Chris as director and Dave as a frequent research mentor. The UK Math Lab has been running since the spring of 2018, with an average of four research groups per semester making use of it. The math lab gives undergraduates a year-round research experience, where they work closely with professors, graduate students, and postdocs on an open problem. For a participating faculty member, this requires coming up with a research problem that is both within reach of a bright undergraduate and a means to teach some interesting piece of mathematics, and the willingness to take time out of an already busy schedule. Our lab has had a positive community-building effect among the undergraduate mathematics majors. They have a place where they can ask questions and raise concerns about their experiences at the university, and take the next steps of their careers.

The world of higher education is broad and can be difficult to navigate. There are many different ways to be a mathematician, and the tenure-stream position at a research-oriented public institution is but one of them. While we hope to have shed some light on this part of the mathematical world, we encourage you to talk to people and learn about other parts as well.





David Jensen

**Christopher Manon** 

#### Credits

Author photos are courtesy of Kaelin Cook-Powell.

### How to Prepare for a Career at a Teaching-Oriented Institution

### Sarah Crown Rundell

Are you passionate about mathematics and interested in sharing your passion with undergraduates? Are you interested in mentoring and advising undergraduates? Are you interested in close interactions with students in the classroom and outside the classroom at department and campus events? Are you dedicated to continually learning and trying new pedagogical techniques and reflecting on ways to improve your teaching? If you answered "yes," perhaps you're interested in preparing to teach at a teaching-focused institution. In this article, my suggestions stem from my experiences as a student and faculty member at small liberal arts institutions, although I'll try to make my suggestions apply more broadly to teaching-oriented institutions as a whole.

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### **Obtain Teaching Experience**

Many institutions that place an emphasis on teaching are particularly interested in job applicants that have some prior teaching experience. If you are a graduate student, you may have the opportunity to be a TA for a course, and this experience can be a good starting place. Some institutions allow graduate students to be the primary instructor for a course, which would be ideal if you are interested in being at a teaching-oriented institution as it will likely provide you with the opportunity to write your own lesson plans and get student evaluations based on your own teaching. If you are a graduate student and are not able to be the primary instructor of a course, you might be able to participate in other programs that would provide you with teaching experience, such as teaching at a math camp for high schoolers.

### **Be Able to Explain Your Research to Nonexperts**

Depending on the size of the department in which you end up working, you may be the only person in your particular research area, and your institution may expect you to be able to explain your research to other faculty members across the college and to undergraduates in your department. As part of your job interview, you may be asked to give a research talk to faculty and undergraduate majors in the department. It's thus important to reflect on how you might go about explaining your research to nonexperts in your field and perhaps to someone who isn't a mathematician. You should be able to explain your area within mathematics and give intuitive examples that someone outside the field could understand. Depending on the situation and context, you may need to eventually be more precise and rigorous with your explanation, but I think it's best to consider your audience and gear most of your talk or explanation to that audience level. For instance, I teach in a joint mathematics and computer science department, where each faculty member is in a different research field. So when I prepared for my phone interview, I thought of a short description of my research geared toward that audience. When I gave my research talk during my interview, at the beginning I provided the necessary background, along with examples for definitions and key background results, and before stating my results, I motivated the results with examples.

It was only near the end of the talk that I moved into stating my results as I might have done to a group of researchers in my field. As a faculty member at Denison University, I often am asked by undergraduate students what my research is about, and during formal reviews, I need to be able to explain my research to colleagues in different disciplines across the campus. So it's been important for me to be able to explain my research in a nontechnical way.

# Think of Possibilities for Undergraduate Research Projects

At many teaching-oriented institutions, faculty are expected to provide experiences for students to do undergraduate research projects. These projects may be during the summer and/or during the academic year. If you're interested in working at a teaching-oriented institution, I would encourage you to reflect on how you might engage with undergraduates on research projects. Are there ways that an undergraduate could be involved in your current research projects? Are there other problems within your field that would be reasonable undergraduate research projects? For instance, I might not be able to have a student do a project in my area of topological combinatorics, but I could find a reasonable undergraduate project in combinatorics, where the student could jump into the project with a minimal amount of coursework (or no related coursework, other than a certain level of mathematical maturity). There are also programs, such as REUF (Research Experiences for Undergraduate Faculty) sponsored by AIM (American Institute of Mathematics), where faculty from across the country can come together over the summer to learn about a new research field, work together with other faculty on a research project, and then be able to mentor undergraduate research projects in that field.

## Openness and Willingness to Teach a Variety of Math Courses

Often at teaching-oriented institutions, you will be expected to teach a variety of mathematics courses, even some that you may not have taken when you were a student. When applying for a job at a teaching-oriented institution, I think it's important to look at the course offerings for that institution and think of how you might be able to support the program. What classes would you be particularly interested in teaching? Are there offerings that you could teach that aren't currently being offered? In the job description, did the institution say that they're looking for someone in a particular field or who could teach particular courses? If those courses are currently outside of your expertise, are you willing to learn the material to teach those courses? I believe demonstrating knowledge of the program, showing enthusiasm for the ways you could support and enhance the program, and openness to learning and teaching any course in the curriculum will strengthen your application. These qualities demonstrate that you have passion and enthusiasm for mathematics as a whole, that you'll be flexible and open when it comes to teaching assignments, and that you're motivated to support and help the department to grow.

# Think of Ways to Contribute to the Department and the Institution

If you're interested in applying for jobs at small liberal arts colleges, you will likely be expected to be committed

to service activities within your department and to the college as a whole. As you prepare to apply for a particular job, I think it's important to consider how you might support the department. For instance, are there particular committees within the department that sound interesting to you that you would like to be involved with if you get the job at that institution? Are there other initiatives that you could start that might work well in the department? For instance, does the institution offer a math club? Do they offer a women in math club? Does the department need support in creating a newsletter? Does the department need support in helping students learn about job opportunities after graduation and/or about study abroad opportunities? Do they need support in taking undergraduates to math conferences? Showing enthusiasm for getting involved in the life of the department and a knowledge of the offerings within the department I believe is viewed very positively when applying for a position.

When applying for a job at a small liberal arts college, especially for a tenure-track position, you should consider how you might become involved in the larger campus community. You should think about how to get involved in campus service in ways that are meaningful to you. For instance, I realized early on in my career that I was passionate about academic integrity, mentoring students, and my spiritual life, so I have tried to find ways of being involved at my institution that are related to these interests and support the broader campus community. You may not be able to be involved with some faculty committees immediately or until you have tenure, but there may be other ways to start to get involved. For instance, at Denison University there is a seminar series for faculty in the natural sciences, and so a new faculty member might be encouraged to try to participate in organizing the series. Once you begin to meet faculty outside of your department and learn what programs and initiatives are happening on campus, it will be easier to see how you might become involved at the college level.

#### **Maintaining a Research Program**

At a teaching-oriented institution where you don't have any colleagues in your field and you don't have much time for research, it will be more difficult to maintain a research program. So you should be prepared to answer questions about these challenges on your job interviews.

In terms of staying active in research, you could determine if there are colleges or universities near the institutions that you're applying to which have researchers and seminars in your field. You could also see whether the institutions that you're applying to have travel support for conferences, and what sorts of external funding you might be able to apply for. If it looks like it may be difficult to maintain a research program in your field, you might consider looking into summer programs and workshops that help faculty learn about a new field of research and network with others.

At a teaching-oriented institution, it can be difficult to maintain a research program during the semester in the midst of teaching obligations and service obligations to the college. In addition to trying to attend a seminar in your field at a nearby location, some faculty at teaching institutions find it helpful to block off a weekly time to talk to collaborators via an online meeting platform. Setting aside a regular time can help make doing research a priority and keep your research moving forward, even if you're only able to spend a small amount of time preparing for these meetings with collaborators.

### **Consider Applying for a Postdoctoral Position**

Depending on your experience with teaching as a graduate student and on the type of teaching-oriented institution that you are interested in, you may find it helpful to consider applying for a postdoctoral position. There are even some teaching postdocs that are specifically focused on preparing you for a position at a teaching-oriented institution. Also, some of the highly selective liberal arts colleges expect applicants to be accomplished in their research as well as being dedicated, passionate, and excellent teachers. So it may make you a more competitive applicant to have more teaching experience and a more developed research program obtained through a postdoc position.



Sarah Crown Rundell

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