

## Working with Local Students

Ermelinda Delavina and Daniel Schaal

This session focused on working with local students. All participants in this session felt that engaging the students at one's own college or university in mathematics research is important and worthwhile. However, this activity has its own unique set of challenges, as well as its own unique rewards. The discussion that this article summarizes focused on those unique challenges and rewards.

When many people think of undergraduate research in mathematics they immediately think of the well-known REU (Research Experiences for Undergraduates) programs. These programs are funded by the National Science Foundation and are advertised nationally. Highly talented undergraduate students from around the country apply to these programs and the organizers of the REU programs usually have a large pool of very qualified students to choose from. The programs generally run for eight to ten weeks in the summer, so the participants have a considerable block of time to devote solely to research without other demands on their time. The participants in these programs often achieve results publishable in mainstream mathematics journals.

A faculty member that is working with undergraduate students from his or her own institution may face difficulties not faced by the director of an REU. The most obvious of these is funding. Finding funds to compensate students and faculty for their time can be a major challenge at many institutions. Recruiting qualified students can be a problem. A particular institution may not have many students with the academic background needed to investigate some research topics and it may be difficult to motivate the students to try original research. The research may occur during the academic year when both the students and the advisor have many other duties. If the research occurs in the summer the students might need to have summer jobs, so total devotion to the research might not be possible. Under these circumstances, it is often the case that the research does not lead to results publishable in a mainstream mathematics journal. The participants in the session had suggestions for each of these potential problems.

Much of the discussion involved funding issues. The participants all agree that if a student is devoting a considerable amount of time to a project, it is nice to be able to compensate the student financially, especially if the student is working on research in the summer instead of taking on a summer job. Likewise, a faculty member that spends the summer advising students instead of teaching summer

---

Received by the editor December 27, 2006.

courses is also deserving of financial compensation. It was mentioned that there are several possible sources of funding for research with local students. If the advisor already has a grant or is applying for a grant to fund personal research, it is often possible to request additional funds to support one or more undergraduate students to participate in the research. If the grant is from the National Science Foundation, it is possible to request funds for a Supplemental REU to provide support for local students. At many institutions there are several possible sources of internal funding. A research office often has money dedicated to supporting faculty research and research involving students is usually encouraged. Department Heads and Deans might have discretionary money that can be used to support student research. It is sometimes even possible to utilize work-study money where working on research with the faculty member is the student's job. Finally, many local undergraduate research programs function successfully with no funding at all. As long as the students and faculty members are willing to devote their time to the project no funding is needed. This is especially common for research that occurs during the academic year.

It was noted in the discussion that a faculty member might not be able to find local students capable of solving the type of the problems investigated at the REU programs. A general consensus was that independent investigation was beneficial to students at all levels of ability and that faculty interested in advising students should work with the students that they have. If no local students are qualified to work on a particular topic of interest to the faculty member, then the faculty member should choose a topic appropriate for the students. This might mean investigating problems that are not deep enough to be published in a mathematics journal if they are solved. This may mean investigating solved problems where the solutions are unknown to the students or trying to apply a known result in a new way. This may also involve reading some recent journal articles. It was mentioned that the ability to read higher mathematics is a valuable skill not often learned in a traditional curriculum and a skill very beneficial to students considering graduate school. Several participants in the discussion noted that there is a considerable gap between the mathematics taught in an undergraduate classroom and the research conducted at an REU. These participants stressed the importance of projects designed to bridge this gap.

There was a consensus that the types of investigations mentioned above are very valuable for the students involved and that the advisors should choose the most ambitious projects that still give the students a reasonable chance of success. There was however a difference of opinion about what these projects should be called. Some participants in the session felt that the term undergraduate research should be reserved for investigations of original problems of publishable quality. It was felt that when lesser projects were called undergraduate research it could give undergraduate research a bad reputation. Other participants disagreed with this idea. They noted that other disciplines use the term "student research" very loosely. A chemistry student helping to set up a research experiment, a biology student gathering data to be analyzed and a psychology student researching a topic in the library were given as examples of activities often referred to as research in other disciplines. Regardless of what we call it, it was agreed that projects that go beyond what is taught in a typical classroom and require the students to do

some independent investigation are of great value to the students and should be encouraged.

A goal at most REU programs is for the students to publish research articles in mathematics journals. While this often occurs when faculty work with local students, this may not be a reasonable goal depending on the students involved and the topics of investigation. It was mentioned that many institutions publish a collection of research articles by the local students and there are also a number of national journals devoted exclusively to undergraduate research. These journals do not have as high of a standard as mainstream research journals and give the students a chance to learn the art of writing mathematics. Another excellent goal is for the students to prepare a short talk based on their investigation and present this talk at a mathematics conference.

Finally, it was mentioned in the discussion that there are several distinct advantages to working with local students. The most obvious is the length of time that a research project can last. While REU programs are usually limited to one summer, a research project with local students could last for a few years. REU directors choose participants based on an application, letters of recommendation and possibly a phone interview, but rarely know the students on a personal level. The potential for a personality conflict definitely exists. Faculty member working with local students can select students they know well and with whom they have already established a good working relationship. This also allows faculty members to tailor the projects to fit a particular students strengths and interests.