Center for Undergraduate Research in Mathematics (CURM)

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In the past, there have been two main types of undergraduate research projects in mathematics: multiple-week summer REU's and individualized projects at the student's own institution. Both of these can be great programs. A good summer REU will allow an undergraduate to work with other students on challenging research problems by immersing himself/herself in a topic without having to worry about other concerns. Also, there are typically discussions about preparing for and succeeding in graduate school, and many REU's expect their participants to present their research at a conference and write a final paper describing their research results. However, competition for a position at a summer REU is fierce. I direct an NSF-funded 8-week summer mathematics REU at Brigham Young University (BYU), and in 2006 we received 91 applications (85 of whom were non-BYU undergraduates) for 8 available positions. Another option for undergraduate students is an individualized capstone project at their own institution. This can be a very beneficial program by preparing students to make the transition from structured course work to open-ended research on one challenging problem. But there are some difficulties with this option. These projects are often done during the students' senior year and are supervised by a faculty member who is willing to help but is often very busy teaching 3 or 4 courses along with committee work and his/her own research. In addition, these projects usually occur too late for the undergraduate to take full advantage of the experience. Decisions about whether to attend graduate school and where to apply should be made early in their senior year, so they can take more advanced courses to help them prepare and not miss the deadlines for applications. And opportunities for students to give conference presentations where they also get to experience the professional community are often missed.

There is a new avenue to do undergraduate research that incorporates benefits of these two programs while eliminating some of the difficulties. This new alternative is founded in the Center for Mentoring Undergraduate Research in Mathematics (CURM) which is funded by a $1.26 million grant from NSF and by BYU. CURM promotes undergraduate research on a national level by: (1) training faculty members as mentors for undergraduate research projects; (2) having these faculty members mentor undergraduate students in research groups that consist of 2-4 students and 1 faculty mentor who work together as a team on one research project during the academic year; (3) advising faculty members at other institutions on how to establish consistent funding to support undergraduate research at their own institution; and (4) preparing undergraduate students to succeed in graduate studies in mathematics. To accomplish these objectives, CURM provides about 15 mini-grants a year ranging from $12,000-$20,000 to faculty mentors who apply for and are accepted into the program. These mini-grants consist of financial and organizational support for these professors' undergraduate research groups. Specifically, the grant provides $5,000 for the professor to reduce

his/her teaching assignment, $3,000 stipend for each undergraduate student, and some funds for supplies.

The research groups funded by CURM usually start their research during the beginning of the fall semester with the students committing 10 hours/week to the research project for two semesters. Typically, the entire group (2-4 undergraduates and 1 professor) meets at least one hour a week and the students meet and work together at least three hours a week. The rest of the time each individual student work on his/her research problem. In a way, the students' undergraduate research project is a like part-time job they do during the semester. So, we provide a $3,000 stipend for each student in the group ($1,000 to be paid at the beginning of each semester, $500 to be paid after the undergraduates attend and present their research during the CURM spring research conference, and $500 to be paid after the research group has submitted a final research report). By having students work together in groups, they tend to motivate each other and also they learn to become more independent of the faculty mentor. Of course, the faculty mentor needs to be actively involved with the group and our experience is that he/she wants to be. However, many of them will be at institutions with a teaching load of 3-4 courses/semester. Hence, we provide $5,000 for the professor to buy out one course from his/her teaching load during the academic year in order to free up time to spend working with these mentored groups.

In addition to this financial support, CURM provides training for the participating professors as mentors for undergraduate research projects. We accomplish this through a two-day summer pre-workshop, a mid-year meeting, and a culminating spring research conference. In June, before the faculty members begin mentoring their students in the undergraduate research group, the participating professors attend a two-day summer workshop at BYU. The purposes of this workshop are to discuss some logistics for the program, present some ideas about effectively working with undergraduate research groups, and present some avenues to help undergraduates prepare for graduate school. There are specific presentations and discussions on "Effectively mentoring undergraduate research" with handouts designed for the mentors' students. In January, we hold a mid-year discussion meeting during a national professional conference during which we receive reports on how each research group in progressing. In addition, there are discussions concerning topics that the mentors will address in the following semester, such as "How to help undergraduate students present quality talks at a conference," "Where undergraduate students can publish research papers," "How to get support from your institution to continue to do undergraduate research mentoring," etc. CURM has a National Advisory Board of experts in undergraduate research in mathematics, and we invite members of this board to attend this meeting. In March, we hold a Spring Research Conference at BYU for students and their faculty mentors from these undergraduate research groups. The conference consists of three components: Friday sessions in which the student participants are motivated and intellectually stimulated to continue to study mathematics and prepare for graduate school; Friday sessions in which the participating professors report on their research groups, evaluate the effectiveness of the program, and discuss issues concerning future undergraduate research; and Saturday sessions in which the student participants present their research with written feedback and guidance from faculty judges. CURM provides funding for travel and lodging for the professors and students to participate in the workshop and the research conference.

Applications for a CURM mini-grant are due March 15, and the application form and more information are available online at http://curm.byu.edu/.