

## What We Have Learned From Our Undergraduate Research Program

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During the 2002 – 2003 academic year, while we were first year faculty members at Sam Houston State University, we invited undergraduate students to volunteer to prepare and present talks for the meeting of the Texas Section of the Mathematical Association of America (MAA) which would be held on the SHSU campus. We were overwhelmed by the enthusiasm of our students, and by the nine volunteers that we had for that first meeting. Since then, we have had students present papers at one other meeting of the Texas Section of the MAA and two Math Fests, and have also had students present posters at EURECA (Exhibit of Undergraduate Research and Creative Accomplishments) on the Sam Houston State University campus and at the Joint Mathematics Meetings in 2004.

Our students have never received course credit or been part of an organized research program, but they have continued to work on projects, ranging from historical and biographical accounts of mathematics and mathematicians to attacking “real” research problems with energy and vigor. Two of the students have submitted their work for publication, and others are headed in that direction. As expected, our students have learned a great deal of mathematics and history. However, we have also learned many things, some of which are mathematical, but some of which are not. The following is a sampling.

We have learned that allowing and encouraging students to undertake this sort of project – just asking them to assemble a fifteen-minute talk – and allowing them to choose the topic will allow them to find an aspect of mathematics which inspires them. For instance, we had a student whose topic for the last meeting of the Texas Section of the MAA was “Hispanic Mathematicians”. This allowed the student to seek out and find role models – many of whom are working in Texas, and at least one of whom attended her presentation. This provided the student with extra motivation and drive. The fact that she also won an award for best talk in her session didn’t hurt either. We have also had students give talks about African-American and female mathematicians and this has always inspired them.

We have learned that our students will continue to volunteer and participate in these activities, even after seeing the amount of work and stress involved in preparing a presentation and giving a good talk. We were a little afraid after the first conference that we would have fewer volunteers. This was far from true! During the first year, nine students gave presentations at the Texas Section Meeting and five students gave talks at Math Fest. During the second year, four students presented posters at the Joint Meetings, thirteen students gave talks at the Texas Section Meeting, and eight students attended Math Fest, all of whom presented!

We have learned that our students will come through and give wonderful presentations, no matter how discombobulated they seem prior to their presentations. We have had

students who were Kings and Queens of Procrastination, and those who could not make it through a practice presentation without giggling, stand in front of a room of mathematicians and give phenomenal presentations – better than any practice version! We have learned to relax a little, and let the students prepare in their own way, while still having very high expectations and holding them to strict deadlines.

We have learned that holding soup and soft drink sales in the atrium of the math building (with a side of bake sale) can bring in money for most of the expenses required for an in-state trip to a conference. This works especially well if your students have families willing to help them cook!

We have also learned that there are many other sources of funding that can be used to take students to meetings. Among these are our dean, the Mathematical Association of America Diversity Initiative, and the Tensor Foundation. It surprised us that often when we asked for money, we received money. Many university administrators, especially our dean and chair, believe that it is important to get students involved in the mathematical community, and they are willing to spend money to allow this to happen.

Because we have been able to take many students to meetings, we have learned that our students can be dispersed throughout a large number of sessions at a conference. After sending the students on a divide and conquer mission, they are now asked to report back to each other and to other members of the mathematics club and mathematics community at the university about interesting presentations that they saw. This gives other members of the community access to their experiences, although not as fully as if they had attended themselves. During student reports given after Math Fest 2004, we learned that a certain teaching method worked “only when the teacher knows the students intimately, as they do here – not ‘intimately’...but this would work here”. The method being discussed involved having a course with no exams – clearly a suggestion for our faculty.

We have also learned that starting an undergraduate research program is harder than maintaining one. Two years ago, when we started our program, our students had never been to mathematics meetings and had never given talks on mathematics. During our students’ practice talks, we learned that Pythagoreans did not eat beans, that “Euler was a little bit wacko”, that Martha Euphemia Lofton Haynes, the first African-American woman to earn a Ph.D. in mathematics, had a husband “who was a big man in a big building.” We have also learned that students can give a fifteen-minute talk in seven minutes one day and thirteen minutes the next. As our undergraduate research program has continued to develop, we have recruited new students. Working with these new students has been much easier than the first group because the veterans now help the rookies with their presentations.

We are not the only ones learning things from this experience. One student had a family member (her aunt) accompany her to the 2004 Joint Mathematics Meetings in Phoenix. Her aunt learned that neighborhoods don’t have houses, groups aren’t always made up of people, and “Lie” is pronounced “lee” not “lie” and is not a falsehood.

Most of all, we have learned how much fun it can be to watch enthusiastic students study mathematics. We have learned that our students are intelligent, motivated, dedicated, and willing to work as hard as we are. They are curious and want to know more than we can teach them in a class. They ask great questions, and spend hours and hours thinking about the answers. They are ready, willing, and able to do the work if they have the support.