

University of Iowa

Department of Mathematics Graduate Program

If the U.S. is to retain its leadership role in science, technology, engineering, and mathematics (STEM) research and education in the 21st Century, it is important to identify strategies for further increasing the diversity of the nation's STEM workforce; see the National Science Board's report on *Broadening Participation in Science and Engineering Research and Education*. This is one in a series of AMS profiles of programs that

1. aim to bring more persons from underrepresented minority backgrounds into some portion of the pipeline beginning at the undergraduate level and leading to an advanced degree in mathematics, or retain them once in the pipeline;
2. have achieved documentable success in doing so; and
3. are replicable models.

The Department, the University and the State: The Department has 41 tenure track faculty members, 5 postdoctoral faculty, and averages five short term visitor appointments each year. The Department enrolls more than 7,000 students annually. The Department currently has 112 graduate students and 185 undergraduate majors. Typically, the Department graduates 12 Ph.D.'s per year. An integral part of the Department is the interdisciplinary Ph.D. Program in Applied Mathematical and Computational Sciences (AMCS). The University enrolls 29,000 students annually and is a member of the Big Ten Conference. The population of Iowa is three million people, fewer than 5% of whom are from underrepresented minority backgrounds.

Minority Graduate Student Enrollment in the Department: In 1995 the Department made a long-term commitment to substantially increase the number of its US graduate students from underrepresented minority groups (African American, Latino/a, Native American US citizens and permanent residents). Supported, in part, by five US Department of Education Graduate Assistance in Areas of National Need (GAANN) grants in eight years, the Department's US underrepresented minority graduate student population has grown from zero students in 1995 to twenty-four students currently. US minority students have accounted for 20-25% of the Department's graduate student population over the past six years. These percentages are among the highest at US majority institutions. The Department has done this while maintaining high average GRE scores and GPAs for entering students

The Department's Programs: The Department has built its programs with care and foresight. And although these programs were developed in the context of the Department's minority graduate student initiative, these programs have always been open to majority students. As a consequence the quality of education has been raised for all students. Some of the Department's programs are:

- A three-week intensive Summer Institute for incoming students
- Intensive faculty mentoring for all students

- Intensive formal peer mentoring for first year courses
- Intensive formal peer mentoring for Ph.D. Comprehensive Exams
- A new course, "Introduction to the graduate program"

Changes in the composition of the graduate student population have created a significant change in the Department's culture. Friendships and close working relationships have formed between minority students and their majority counterparts, and ethnic and gender inclusion has become the norm. This new environment is a successful recruiting tool, not just for underrepresented minority graduate students but for all students and also faculty. For example, 41% of the graduate students in the Department are now women.

Success: Eight of the Department's US minority students have been awarded the PhD since 1998. Three of these students earned their degrees in 2004-5, roughly 10% of the total number of doctoral degrees awarded to US minority students nationally in mathematics in this period. These Ph.D. recipients have taken a wide range of positions, ranging from tenure-track positions at four year schools to postdocs at Purdue University and Los Alamos National Laboratory. The Department expects that on average three US minority students will earn a PhD from them each year for the foreseeable future. In addition, retention rates have increased for all students. In May 2005 the Department received the Presidential Award for Excellence in Science Mathematics and Engineering Mentoring (PAESMEM) for its efforts in a White House award ceremony attended by Department Chair David Manderscheid and other members of the department.

Administration: As part of the Department's goal to institutionalize its minority graduate student initiative, the Department has made permanent changes in its administration. A first step in this direction was taken in 1995 when the Department created a new committee, the departmental Minority Student Recruitment and Development Committee (MSRDC), which oversees all aspects of the Department's minority program. As the program has developed, the Department Chair and the Director of the AMCS program have been given new responsibilities as has the Director of Graduate Studies.

Outreach and Transformation: The Department has built ties with several institutions in mathematics at the same time that it has provided leadership in minority graduate education in Iowa:

- Working together with the Department of Mathematics at Florida A&M University, the Department built a partnership—the Alliance for the Production of African American Ph.D.s in the Mathematical Sciences—with the departments of Mathematics at Florida A&M University, Alabama A&M University, Jackson State University, and Benedict College, as well as Departments of Mathematics, Statistics, and Testing and Measurement at the Iowa Regents institutions. The goal of the Alliance is to provide for a seamless transition for graduates of Alliance undergraduate institutions who wish to study mathematics and statistics at majority Ph.D. granting institutions. These efforts were supported, in part, by

- a three year grant from the NSF Division of Mathematical Sciences and are now supported by an EMSW21-MCTP grant.
- The Department entered into a partnership with the University of Puerto Rico-Mayaguez. This partnership includes several other campuses of the University of Puerto Rico, notably, the campus at Humacao.
 - The Department has a close working relationship with the Mathematics and Theoretical Biology Institute for undergraduates run by Prof. Carlos Castillo-Chavez of Arizona State University. Eleven participants in this REU have enrolled as graduate students in the Department.
 - The Department spearheaded the successful grant application to the NSF's AGEP (Alliance for Graduate Education and the Professoriate) program in support of increasing the number of doctorates awarded US underrepresented minority students in science, technology, engineering, and mathematics graduate programs at the three Iowa State Regents Universities: Iowa State University, The University of Iowa, and the University of Northern Iowa
 - The Department led the formation of the Heartland Mathematics Partnership. The Partnership is a consortium of the mathematics departments at twelve area colleges and universities and the Department of Mathematics at the University of Iowa. The goal of the Partnership is to increase the number of US citizens who earn a PhD degree in the Mathematical Sciences.

Program Cost: In addition to the grant support mentioned above, the Department also gets support from the Sloan Foundation Minority Ph.D. Program. The College of Liberal Arts and Sciences at the university provides some funds for recruiting, and the Graduate College has provided some fellowship support. The principal cost of the program, however, is faculty time.

Replicability: The Department has given a great deal of thought about how to replicate its success. Members of the faculty have lectured widely on the program and are very willing to work with other departments to help them develop successful programs tailored to their needs. The Department of Mathematics at the University of Iowa sees five phases to successful replication:

1. A core of three or four senior faculty dedicated to the program is necessary to start. There should also be the support of the Department Chair. The senior faculty should be willing to do the intensive mentoring necessary.
2. A critical mass of minority graduate students should be established. This can be accomplished by intensive recruiting and, preferably, fellowship support to attract students. Numerous fellowship grant opportunities, both internal and external, are available, and most administrations are very willing to provide matching funds, if needed.
3. The Department should have reasonable expectations as there will no doubt be growing pains as the program is established.
4. Cultural change within the Department should take place. The Department should be willing to look at, over time, their practices in graduate education, and compare them with best practices.

5. The final stage is institutionalization. In this stage leaders of the effort reach out to other faculty once the program is working. The whole Department is transformed and then reaches out to other departments.

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