

## **SIMU: Summer Institute in Mathematics for Undergraduates**

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 under-represented minority backgrounds into some portion of the pipeline beginning at the undergraduate level and leading to advanced degrees in mathematics, or retain them once in the pipeline;
2. have achieved documentable success in doing so; and
3. are replicable models.

**Program name and location:** Summer Institute in Mathematics for Undergraduates (SIMU) at the University of Puerto Rico—Humacao.

**Program goal:** To increase the number of Latinos and Native Americans earning graduate degrees and pursuing careers in the mathematical sciences.

**Primary audience:** Hispanic/Latino and Native American, U.S. citizen and permanent resident undergraduates (especially juniors and seniors) interested in pursuing a graduate degree in the mathematical sciences.

**Number of participants served:** 1998: 27. 1999–2002: 24 per year. Total number served by the program from 1998–2002: 115.

**Program description:** SIMU was a six-week research program in the mathematical sciences for undergraduate sophomores, juniors, and seniors from across the U.S. and Puerto Rico. The program took place at the University of Puerto Rico—Humacao and was a National Science Foundation (NSF) Research Experience for Undergraduates (REU) site from 2000–2002; it also received significant funding from the National Security Agency (NSA). SIMU was the largest (serving twenty-four students per year) NSF REU program in mathematics.

SIMU was designed for Chicano/Latino and Native American undergraduates who

1. had completed at least two years of university-level mathematics courses (e.g., Calculus I–III, Differential Equations, Linear Algebra, etc.);
2. wanted to conduct undergraduate research in the mathematical sciences; and
3. were interested in pursuing a graduate degree in the mathematical sciences.

Each of the twenty-four students who participated in the 2002 SIMU program received a \$2200 stipend; round-trip travel to Humacao, PR; and room and board for the duration of the six-week program.

During the 2002 SIMU, each student

1. participated in a mathematical seminar under the direction of Professor Ricardo Cortez or Professor Victor Moll;
2. participated in a computational laboratory that was intertwined with the seminar;
3. completed an undergraduate research project designed by the seminar leader and done in collaboration with other SIMU students;
4. gave a colloquium talk and wrote a technical report on his or her research project;
5. attended a series of colloquium talks given by mathematicians and scientists who are leading researchers in their fields;
6. attended workshops whose focus was to develop skills and techniques needed for research careers in the mathematical sciences;
7. learned techniques to maximize a student's likelihood of admission to graduate programs as well as the likelihood of winning fellowships; and
8. participated in cultural and recreational activities in Puerto Rico.

After SIMU, each student had:

1. an opportunity to attend the conference of the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS), the Joint Mathematics Meetings, and other forums where they were able to present their undergraduate research;
2. the opportunity to continue the professor-student and peer relationships developed with their seminar leader, and other professional mathematicians and students involved in SIMU.

**Years of operation and current status:** The program operated 1998–2002. The option of restarting the program is under consideration.

**Documentable effectiveness:** The figures below are as of 2005, and are not entirely complete due to a few students not responding to questionnaires. Please note that the total number of students served by the program, 115, is not the same as the total number enrolled for all five years of the program because some of the students attended SIMU more than once. Also, the numbers for the same cohort of students may not always agree because some students stopped responding to the follow-up questionnaires, so that it might be known that a student entered a Ph.D. program but the student's current status is unknown.

**SIMU 1998**

- 27 students participated
- Over 70% had no prior research experience

- 12 were accepted into mathematics Ph.D. programs
- 8 were accepted into mathematics, education or computer science masters programs
- 3 were accepted into other Ph.D. programs
- 3 have completed a Ph.D. in mathematics
- 1 has completed a Ph.D. in physics
- 10 have finished masters degrees in mathematics
- 3 are still in mathematics Ph.D. programs
- 2 are still in other Ph.D. programs

#### SIMU 1999

- 24 students participated
- 70% had no prior research experience
- 13 were accepted into Ph.D. programs in the mathematical sciences
- 4 were accepted into engineering, mathematics or education masters programs
- 7 have finished masters degrees in mathematics
- 7 are still in mathematics Ph.D. programs
- 2 are still in masters degree programs

#### SIMU 2000

- 24 students participated; 4 had not graduated as of January 2003
- 75% had no prior research experience
- 10 were accepted into mathematics Ph.D. programs
- 6 were accepted into engineering, mathematics or education masters programs
- 1 was accepted into another graduate program
- 4 have finished masters degrees in mathematics
- 9 are still in mathematics Ph.D. programs
- 2 are still in masters degree programs

#### SIMU 2001

- 24 students participated; 1 has not graduated yet
- Over 70% had no prior research experience
- 16 were accepted into Ph.D. programs in the mathematical sciences
- 3 were accepted into masters programs in mathematics, engineering or computer science
- 2 have finished masters degrees in mathematics
- 14 are still in mathematics Ph.D. programs
- 2 are still in Masters degree programs

#### SIMU 2002

- 24 students participated
- Over 78% had no prior research experience
- 19 of 24 presented posters on their research at the Mathematical Association of America undergraduate poster session at the Baltimore Joint Mathematics Meetings in 2003
- 12 were accepted into Ph.D. programs in the mathematical sciences
- 2 were accepted into masters programs in mathematics, engineering or

education

**Other evidence of success:** Post-program surveys of participants showed that the students' educational experience was positively affected by SIMU. For example, 78% of the students had not worked on undergraduate research prior to SIMU but 96% of the students wanted to work on undergraduate research after SIMU; 96% of the students said that SIMU was either "successful" or "very successful" in familiarizing them with mathematics experimentation and research protocols and techniques; 92% of the students said that SIMU "increased significantly" or "increased" their desire to pursue a graduate education in mathematics or science.

**Program cost:** Approximately \$9,000 per student per year for the six-week summer program and the post-program experiences.

**Replicability:** The program model is a well-defined one that could reasonably be replicated for different target audiences. The SIMU co-directors believe that the program model is especially suited for groups that are underrepresented in the mathematical sciences. Indeed, there is a program in the works at California State Polytechnic University—Pomona that will borrow from the SIMU model, as has the Mathematical Association of America's National Research Experiences for Undergraduates program.

**Issues of which replicators should be aware:** The commitment to the program by the staff needs to be very high in order for the program to be effective. In particular, potential program organizers should be aware of the high time and effort required to organize and run a program such as SIMU.

**Contacts for further information:** See the [SIMU website](#) or contact the co-directors at the [SIMU e-mail address](#). The co-directors can also be contacted directly:

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