

Emerging Scholars Program

A Summary of:

“Success and Diversity: The Transition Through First-Year Calculus in the University” (November 1999) *American Journal of Education*. By Susan E. Moreno and Chandra Muller.

“Impact of the Wisconsin Emerging Scholars First-Semester Calculus Program” (July 1997) University of Wisconsin-Madison. By Steve Kosciuk.

“Increasing Minority Students’ Success in Calculus” (1995) *New Directions for Teaching and Learning*. By Martin Vern Bonsangue and David Eli Drew.

Focus

- Early Childhood
- Primary School
- Middle School
- Secondary School
- ✓ Postsecondary
- Extended Learning

Overview

The Emerging Scholars Program (ESP), modeled after the Mathematics Workshop at the University of California at Berkeley, aims to increase the number of college freshmen excelling in calculus who come from groups historically under-represented in mathematics-based disciplines, in particular women, Latinos, African Americans and students from rural areas. ESP is considered an “honors-level” program and it has been replicated by more than 100 colleges and universities across the country. At the heart of ESP are its discussion sections, which are linked to calculus lecture sections. ESP discussion sessions are longer than non-ESP discussion sections, and also have fewer students – usually a maximum of 24 as opposed to 40 in a non-ESP section. Students work individually or in small groups on specially crafted problems that are unusually challenging. ESP also provides a social support group among students with similar academic goals by planning activities that link social interests with scholarly ones.

POPULATION

In 1993, 7992 mathematics, science or engineering degrees were awarded to Latinos, 9549 to African Americans and 132,254 to whites. In 1994, 35% of African American and 38% of Latino freshmen in four-year colleges

intended to major in science and engineering, while only about 12% of African Americans and 14% of graduating Latinos earned a degree in mathematics, science and engineering.

From the program’s inception at the University of Texas at Austin in fall 1988 through fall 1995, 445 students participated in ESP, first-semester calculus sections. About 46.5% were Latino, 19.3% were African-American, and 32.4% were white. About 57.3% of the participants were men and 42.7% of the participants were women.

The University of Wisconsin-Madison evaluation also provided another snapshot of an ESP student population: During the fall semesters from 1993-1996, 169 students attended the ESP workshop, including 50% from minority groups, and 50% white students, most from rural backgrounds.

The California Polytechnic evaluation by Bonsangue and Drew compared a group of 133 Latinos and African American students who chose to attend ESP workshops with three groups of students in the same calculus section: a group composed of 187 African American and Latino students, a group with 208 white students and a group with 198 Asian/Pacific Island students.

Key Findings

The University of Texas at Austin evaluation indicated that ESP students were more successful than non-ESP students. Students who participated in ESP had odds of earning an A or B almost five times higher than non-participants. The differences between African American and Latino participants and non-participants were significant at the .01 level.

University of Wisconsin-Madison evaluators reported that ESP students were twice as likely to receive a B or better in calculus than their non-participating counterparts. The Wisconsin evaluation also suggested that the positive effects of ESP persisted: ESP students maintained higher success rates in second and third semester calculus than non-participants. But the same evaluators also found that participation in ESP had no visible effect on retention rates in mathematical-based fields of study.

At California State Polytechnic University, Pomona:

- ◆ ESP participants achieved a mean grade in calculus more than six-tenths of a grade point above non-ESP students (on a four-point grade point scale).
- ◆ Within three years after entering the institution, 52% of non-ESP students had withdrawn from the institution or changed to a non-mathematics based major, compared with 15% of ESP students.
- ◆ As a result of course failure, non-ESP students required an average of one quarter more to complete their three-quarter calculus sequence. Nearly half of non-ESP students required five or more quarters to complete a three-quarter calculus sequence, compared with 17% of ESP students. Ninety-one percent of ESP students who were still enrolled in a mathematics-based major after three years had completed their mathematics requirement in their major, compared with 58% of non-ESP students.
- ◆ Of Latino women still enrolled after three years, 86% of ESP students remained in a mathematics-based major compared with 52% of non-ESP participants from the same group.

“ESP helps me spend more time on math than I might on my own.”

— ESP student

Program Components

Universities adopt the following ESP components to fit their local resources, strengths and needs:

- ◆ Upon acceptance to a participating college or university, African American, Latino and Native American students who had the potential to declare mathematics-based majors received a letter and personal telephone call from a faculty member or student workshop leader inviting them to attend an informational meeting explaining the program. In addition, recruitment of students occurred at college and university summer orientation programs, during which, ESP staff informed potential students about the opportunity to participate.
- ◆ ESP discussion sessions were connected to freshman calculus lectures. ESP sessions met for longer than non-ESP sessions (six hours per week compared with two hours per week). ESP sessions also met for two hours at a time rather than one. ESP sessions, which typically included no more than 24 students, were smaller than average discussion sessions, which included up to 40 students. Peers – a graduate student teaching assistant as well as 1-2 undergraduate ESP alumni – led the discussion sessions. Specially crafted problems were distributed to discussion sessions encouraging students to explore the challenging aspects of mathematics.

- ♦ A connection between students' academic and social lives was fostered through organized activities in which ESP students are encouraged to participate, such as common meal time, workshops coordinated by local employers and concerts.
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Contributing Factors

Comprehensive Academic Advising

ESP staff advised students not only on academic matters but also on non-academic matters that could possibly derail a student's academic career. ESP staff kept themselves apprised of current academic and social supports available for students, and they helped students make informed choices about their academic careers.

Small Learning Communities

ESP discussion sessions became an integral part of the academic structure of the host schools. ESP students and staff alike never felt they were participating in a separate or adjunct program, but did feel they were part of a close-knit learning community.

Engaged Learners and Instructors

ESP's combination of academic and social outlets led to often lively discussions with students explaining their solutions to both academic and non-academic problems. Bonsangue and Drew, in their 1995 evaluation, found that there was often an informal element in ESP discussion sessions, with students munching popcorn or pizza while they worked. This setting fostered a high level of personal involvement from the ESP instructor, who was often the first to become aware of students' personal, financial or logistical problems.

Rigorous Curriculum

ESP instructors crafted problems that were exceptionally difficult, but still related to the current lecture sessions. As the group struggled together, their information exchange became unusually efficient and their love for mathematics and confidence in pursuing mathematical careers seemed to follow.

STUDY METHODOLOGY

The University of Texas, Austin, evaluation by Moreno et al. reviewed the records of 1565 students who had attended a calculus class with an associated ESP section. Of the students, 445 participated in the program. Students with quantitative SAT scores below 460 were excluded from the analysis. Calculus success was defined as students earning A or B in the course.

The Wisconsin University evaluation by Kosciuk analyzed scores of all first-semester freshmen, 18 or 19 years old, who were enrolled in the first semester calculus lectures. Success was defined as a B or above in courses and retention in the College of Engineering or in a science, math or technology major. Researchers compared 169 program participants with 3,871 non-participants. Researchers matched the participant and comparison groups in terms of race, ethnicity, gender, income level and prior achievement (through SAT scores). Results are significant at the .05 level.

The California Polytechnic evaluation by Bonsangue and Drew was the first longitudinal study of the effects of ESP on persistence and achievement of minority students enrolled in mathematics, science and engineering majors. Evaluators compared a group of Latinos and African Americans who had attended at least one ESP workshop to peers who were attending the same lecture sections of first-quarter calculus, but had not participated in the workshops. There were no statistically significant differences between minority students in the workshop and comparison group in four pre-college academic measures (SAT-Math, SAT-Verbal, high school

GPA and score on the precalculus placement exam). The two minority groups (workshop and comparison) had lower pre-college measures than their white and Asian peers.

EVALUATION & PROGRAM FUNDING

The evaluations were either published articles in education-related journals, or were funded by universities that host ESP. ESP is funded by the host colleges and universities. Within those sponsoring universities, often, ESP funding is shared by the Office of the Dean and math and science departments.

GEOGRAPHIC AREAS

ESP – or programs similar to it – are in place in more than 100 colleges and universities nationwide.

CONTACT INFORMATION

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