

Puerto Rico Louis Stokes Alliance for Minority Participation

A Summary of:

“Puerto Rico Louis Stokes Alliance for Minority Participation: 1999-2000, 1998-99 and 1997-98 Annual Progress Reports.”

Submitted to the National Science Foundation by the University of Puerto Rico Resource Center for Science and Engineering. By Dr. Ana C. Piñero.

Focus

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

Overview

Founded in 1991, The Puerto Rico Louis Stokes Alliance for Minority Participation (PR-LSAMP) is one of several nationwide initiatives sponsored by the National Science Foundation to increase the number of minority students that receive a baccalaureate degree in science, math, engineering and technology (SMET) fields. The National Science Foundation awarded two five-year grants (1991-1996 and 1996-2001) to implement this initiative to the Resource Center for Science and Engineering of the University of Puerto Rico. Thirteen campuses of four major higher education institutions on the Island are members of the PR-LSAMP alliance. The Resource Center serves as the umbrella organization of this alliance, promoting the maximum collaboration of all institutions. The major goal of the Resource Center is to transform the teaching/learning process in SMET disciplines for ALL students in Puerto Rico. The center of PR-LSAMP has been the revision of the undergraduate SMET curriculum and the incorporation of teaching strategies that have proven successful in improving student academic

POPULATION

According to National Science Foundation data, 202,607 baccalaureate degrees were awarded nationwide in 1997 in science, mathematics and engineering fields. Of these, 11,187 were awarded to Latinos. Graduates from PR-LSAMP institutions represented one-fourth of the 11,187 degrees awarded to Latinos that year. In the nine years that the program has existed (1991-2000), PR-LSAMP institutions have awarded a total of 23,525 BS degrees in the different SMET disciplines. Of these, 7,809 were in Life Sciences, 6,074 in Engineering, 3192 in the core sciences (Chemistry, Physics and Mathematics) and the others in science related fields, such as Computer Science.

performance. Jointly with the curriculum revision, PR-LSAMP offers direct student services to undergraduate students, such as mentoring and research opportunities, to enhance their skills, increase their motivation to remain in SMET careers and strengthen their qualifications for graduate studies.

Key Findings

Since the goal of PR-LSAMP is to increase the effectiveness and efficiency of the undergraduate SMET programs, evaluators measured: SMET enrollment, SMET graduation rates, the Index of

Course Efficiency (i.e. the number of times students must take a course to pass it with at least a C) and the number of BS graduates that go on to graduate school and obtain a Ph.D. in an SMET area.

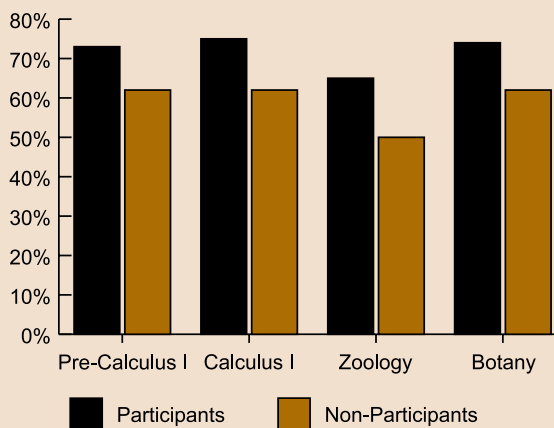
The major accomplishments of PR-LSAMP since its beginning in academic year 1991-92 have been:

- ◆ Participating institutions nearly doubled their enrollment in science, math, engineering and technology fields, from 12,572 in 1991 to 23,476 in 2000.
- ◆ The number of science, math, engineering and technology BS degrees awarded by PR-LSAMP institutions grew 62% (from 1,709 in 1991 to 2,771 in 2000).
- ◆ The average graduation rate at institutions of the University of Puerto Rico System increased from 48% to 62% in science. For example, the graduation rate for engineering at UPR-Mayaguez Campus increased from 53% to 81%.
- ◆ From 1993-98, 17% (202 out of 1,169) of the Latinos who obtained a Ph.D. in a natural science field, nationwide, received their bachelor's degree from a PR-LSAMP institution.
- ◆ From 1993-98, 11% (37 out of 332) of the Latinos who obtained a Ph.D. in engineering, nationwide, received their bachelor's degree from the University of Puerto Rico.
- ◆ The Index of Course Efficiency (ICE), which measures the number of times students on the average must repeat a course to obtain a satisfactory grade, was reduced in the most difficult SMET courses, from an average of 2.3 to 1.7.

To complement PR-LSAMP strategies, colleges and universities on the Island developed additional strategies to enhance student performance in SMET courses. The following strategies had documented performance outcomes:

- ◆ Professors at Inter American University-Bayamon developed Web pages for their courses and posted information such as the course syllabus, study guides, exercises and practice exams. As a result, student performance increased. When evaluators

Grade Distribution for Participants and Non-Participants in Use of Web-Based Materials in SMET Courses at UIA-Bayamun



considered four pre-calculus courses of about 30 students each, they found that, with the innovation in place, 73% of students earned a grade of C or better in pre-calculus, compared to 62% without the innovation in place. In Calculus I, the same comparison was 75% to 62%, in zoology 65% to 50% and in botany 74% to 62%.

- ◆ University of Puerto Rico-Río Piedras used PR-LSAMP funds to build a high-tech classroom designed for active/cooperative learning and equipped with modern, audiovisual technology that facilitated the visualization of abstract concepts, as well as gathering, analysis and interpretation of data. The percentage of students making Cs or better in classes of 40 students held in the high-tech classroom increased from 40% to 70% from 1995-2000.
- ◆ University of Puerto Rico-Humacao implemented a program to increase and retain female students in its physics program. The program offered first year female students interested in physics: 1) academic and financial assistance; 2) a chance to work with female role models; and 3) a series of workshops in the use of scientific instruments and tools. Female enrollment in physics—which has the lowest female enrollment of all the sciences—increased by 42%.

- ◆ Six institutions are implementing cooperative learning in their SMET courses, and the grade distribution for participants is significantly better than for non-participants. As an example, 78% of the students at UPR-Río

Piedras enrolled in General Chemistry using cooperative learning obtained an A, B or C, while only 60% of students in traditional course sections obtained similar results.

Program Components

The core of the PR-LSAMP Program has been the transformation of the SMET undergraduate curriculum by: 1) shifting the focus from breadth of content to depth of understanding and 2) incorporating teaching strategies that have proven successful in improving student performance. PR-LSAMP and external funding sources supported several teaching and curriculum enhancements, including:

- ◆ A Study/Learning Skills Development Program (attached to specific SMET courses).
- ◆ Faculty and peer mentoring.
- ◆ Undergraduate research experiences.
- ◆ Pre-college to college and undergraduate to graduate transition programs (e.g. a two week residential program on a University of Puerto Rico campus for high school students interested in SMET majors).
- ◆ An SMET teacher preparation component.
- ◆ The use of technology in the learning process (e.g. on-line courses, computer-based learning, web-based materials and electronic laboratories).
- ◆ Incorporation of active learning strategies in SMET courses.
- ◆ Establishment of learning communities at the institution.

- ◆ Diverse assessment strategies to test for depth of understanding.
- ◆ Mentoring and academic tutoring.
- ◆ Integration of course and laboratory work.
- ◆ Use of application-oriented textbooks.
- ◆ Use of case studies to integrate theory and practice.
- ◆ Development of instructional modules.

In addition to reforming course content and classroom pedagogy, PR-LSAMP funds have been used for direct student support. Undergraduate SMET students have received stipends for:

- ◆ Participation in research activities (an average of 400 annual stipends).
- ◆ Travel expenses to present research projects at national forums.
- ◆ Academic excellence awards (178 stipends of \$800 each were awarded in 1999 alone to low-income students who demonstrated high academic performance).
- ◆ Serving as mentors to other SMET students (103 students have served as peer mentors).
- ◆ Peer tutoring in courses implementing cooperative learning.

Contributing Factors

Project Administration

One of the contributing factors to the success of PR-LSAMP has been its coordination by the Resource Center for Science and Engineering of the University of Puerto Rico. By nature, the Resource Center operates as a collaborative network among the major institutions of higher education in Puerto Rico, thus providing access to a broad pool of resources and promoting the optimization of efforts. The Resource Center forms partnerships with businesses and national reform leaders to help PR-LSAMP institutions develop educational strategies, objectives and benchmarks to measure program impact.

Network of Information Sharing

The Resource Center operates as a virtual organization. The human resources needed to achieve its goals are distributed among the diverse, institutional settings, while the strategic planning, coordination of efforts and communication, links across institutional boundaries allow for the orchestration of a coherent reform strategy. This network is flexible and adapts to the changing needs of participating institutions and faculty.

Education System Alignment

By working with all levels and visualizing the educational system as a K-16⁺ continuum, the Resource Center ensures that initiatives such as PR-LSAMP build on other reform efforts, and that all initiatives are harnessed into a coherent systemic reform strategy. The Resource Center coordinates other systemwide reform efforts at the K-12 level

(i.e. the Puerto Rico Statewide Systemic Initiative) and at the graduate level (i.e. the Experimental Program to Stimulate Competitive Research EPSCoR) of the educational pipeline. This articulation of efforts also allows PR-LSAMP students and institutions to gain access to additional funds for minorities in the science, math, engineering and technology fields.

External Funding

The National Science Foundation requires cost-sharing by participating institutions. For example, in 1999-2000, the Cooperative Agreement signed by the University of Puerto Rico (the leading institution in PR-LSAMP) and the National Science Foundation required for that year a \$2.29M contribution from participating institutions for a \$1.2M award from NSF. Participating institutions actively seek additional external funds to strengthen SMET education. In 1999-2000, a total of \$15.9M was obtained from different funding sources (i.e. USDE, NASA, NIH, USDOE) to develop and implement educational strategies to enhance the teaching/learning process at their institutions.

Technology and Pedagogy

PR-LSAMP programs used technology in a variety of ways to enhance student learning.

Mentoring

Peer and professional mentoring provided academic support and role models for Latino and/or first year college students entering fields in which they are historically under-represented.

Evaluator Comments

The evaluator noted that:

- ◆ In academic year 1999-2000, the number of baccalaureate degrees in SMET disciplines awarded by PR-LSAMP institutions remained flat and did not continue the upward trend of previous years.
- ◆ Although many faculty members are implementing new teaching strategies in their SMET courses to improve student performance, only a few professors are documenting performance outcomes in terms of grade improvements or test scores of current students under new teaching methodologies –vs- previous students taught with traditional teaching methods.

- ◆ Although a student tracking system was developed by PR-LSAMP to obtain data on how many BS, SMET graduates, the results are skewed toward students who remained in Puerto Rico because of the difficulty in getting responses from students who had moved to the U.S. mainland.

STUDY METHODOLOGY

The researcher used institutional and central administration data, with partial use of data from the new student tracking system. Student achievement outcomes from PR-LSAMP institutions are compared to related national outcomes provided by the National Science Foundation. Site visits and case studies complemented the quantitative data used in the study.

EVALUATION & PROGRAM FUNDING

The study was conducted by the University of Puerto Rico Resource Center for Science and Engineering as an annual requirement of the NSF to evidence program achievements. The National Science Foundation funds the PR-LSAMP program, with participating institutions contributing a significant share in institutional funds. PR-LSAMP institutions actively seek money from other federal and local government agencies and from the private sector, specifically local research and development companies. Some of the sources of external funding are the National Institutes of Health, the U.S. Department of Education, other National Science Foundation programs, NASA and the U.S. Department of Energy.

GEOGRAPHIC AREAS

The administration of PR-LSAMP is headquartered at the University of Puerto Rico Resource Center for Science and Engineering, located at the Río Piedras Campus. PR-LSAMP institutions are located across the Island in Arecibo, Aguadilla, Bayamon, Cayey, Gurabo, Humacao, Mayaguez, Ponce, Río Piedras, San German and San Juan.

CONTACT INFORMATION

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Note: The Puerto Rico Statewide Systemic Initiative is one of eight SSI nationwide projects currently funded by NSF. In 1979, the NSF started the Experimental Program to Stimulate Competitive Research (EPSCoR) in response to national concerns regarding inequitable geographic distribution of research funding. Broadly put, EPSCoR's mission is to improve the quality of science and increase the ability of scientists in eligible states to compete successfully for federal funds. For additional information on EPSCoR please consult James Hoehn, Annual Report FY 2000: Experimental Program to Stimulate Competitive Research. August 2000. Arlington, VA. National Science Foundation.