

**PR-LSAMP 2004-05 ANNUAL REPORT
YEAR 4 OF PHASE III**

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I. Introduction

The Puerto Rico Louis Stokes Alliance for Minority Participation Phase III is an alliance of the University of Puerto Rico, Inter American University, Pontifical Catholic University of Puerto Rico, and the Polytechnic University of P.R. Created in 1991 it aims at increasing the number of STEM BS graduates, and the number of BS graduates that enroll in graduate school and eventually complete a PhD in a STEM field. To achieve this goal, PR-LSAMP works at improving the effectiveness and efficiency of undergraduate STEM education by transforming the teaching and learning culture of the participating institutions.

During Phase III (2001-06), PR-LSAMP has developed and is implementing the following activities:

1. An assessment system to measure effectiveness of the General Physics course and of interactive web-based modules to master hard to teach concepts in Physics.
2. Development of electronic modules to enhance STEM students' conceptual understanding of basic concepts in three introductory science courses (General Physics, General Biology and General Chemistry). All three modules communicate with each other to reinforce the integration of concepts from the three disciplines and to test their mastering of specific interdisciplinary concepts.
3. Development of Information Technology skills so STEM students are able to evaluate, learn and use information technologies.
4. Expose STEM faculty members to successful teaching and learning strategies to enhance students' learning, through an Annual Best Practices Conference.
5. A Pre-College to College Bridging Component to motivate high school students to pursue STEM careers.
6. A research and mentoring program to provide undergraduate STEM students with key skills and guidance to improve their preparation and motivation for graduate studies
7. An Undergraduate-to-Graduate Bridging Component to enhance students' academic preparation for graduate studies.
8. A Bridge-to-the-Doctorate Program to increase the number of PR-LSAMP baccalaureate degree holders that continue and complete graduate degrees in STEM fields

II. Major Accomplishments of Phase III, Year 4 (2004-05)

1. In the Fall of 2004, 28,299 students were enrolled in STEM fields at PR-LSAMP institutions.
2. In academic 2004-05, 3,106 baccalaureate degrees were awarded in STEM disciplines.
3. Seventeen percent (17%) of the Hispanics who received a PhD nationwide in a natural science field, from 1998 to 2003, received their BS degree from a PR-LSAMP institution.
4. Almost 15 percent (14.7%) of the Hispanics who received a PhD nationwide in engineering, from 1998-2003, received their BS degree from a PR-LSAMP institution.
5. The University of Puerto Rico awarded a total of 31 PhD degrees in STEM fields in academic year 2004-05.
6. A third Cohort of BDP Fellows began graduate studies in August 2005. Cohort #1 of Bridge-to-the-Doctorate Fellows (10 students) successfully completed their first two years of graduate studies and they are ALL enrolled in a PhD Program at UPR-Rio Piedras. Nine of the BDP fellows were awarded fellowships either from AGEF, GANN, EPSCoR or NASA and the tenth is a Teaching Assistant in the Chemistry Department. The twelve BDP Fellows in Cohort #2 at UPR-Mayaguez completed their first year of graduate studies and are now enrolled in their second year. PR-LSAMP has awarded 34 fellowships through the BDP Program.
7. In academic year 2004-05, PR-LSAMP awarded 326 stipends (\$260,800) to undergraduate STEM students to participate in research experiences. Also, 270 stipends (\$54,000) were awarded by PR-LSAMP to researchers to cover laboratory materials for PR-LSAMP participants.
8. One hundred and sixty (160) high school students participated in workshops and field trips sponsored by PR-LSAMP Pre-College to College Bridging Component, to strengthen their academic preparation and motivate them to pursue careers in STEM fields.
9. One thousand eleven (1,011) STEM students participated in workshops offered through the PR-LSAMP Mentoring Program at the different institutions. Seventy-seven (77) upper level undergraduate STEM students served as peer mentors.
10. Three hundred and forty nine (349) STEM students (247 undergraduates and 102 graduates presented their research projects at the annual Puerto Rico Interdisciplinary Scientific Meeting (PRISM), to an audience of 840 faculty members and students.
11. Fifteen undergraduate STEM students received PR-LSAMP travel stipends (\$7,807) to present their research projects in national conferences.
12. The National Institute of Standards and Technology provided \$21,132 to three undergraduate STEM students to participate in research experiences at their main site with nationally recognized scientists.
13. PR-LSAMP institutions secured \$28.3M in external and institutional funds to implement educational projects geared at strengthening STEM education at their institutions.
14. Pfizer Corp awarded eight fellowships to Pharmaceutical Sciences majors.

15. PR-LSAMP received a \$25,500 supplemental award from NSF to participate in the FaST and SULI Programs in National Laboratories, a collaborative effort between NSF and DoE.
16. One hundred and fifty (150) STEM faculty members from 11 institutions attended the PR-LSAMP 2004 Annual Best Practices Conference to improve students academic performance.

III. Participants and Collaboration with Other NSF Programs

Participating Institutions

The participating PR-LSAMP institutions in Phase III are: The University of Puerto Rico System (www.upr.edu); Inter American University System (www.inter.edu); Pontifical Catholic University of Puerto Rico (www.pucpr); and Polytechnic University (www.pupr.edu).

PR-LSAMP Staff

The UPR Resource Center for Science and Engineering serves as the umbrella organization in this alliance, promoting the maximum collaboration of all institutions and synergy of efforts. The Project Investigator is Dr. Manuel Gómez, Director of the UPR Resource Center for Science and Engineering. The Co-PI and Coordinator at the Central Administration is Dr. Ana C. Piñero, the Associate Director for the UPR Resource Center for Science and Engineering. She is responsible for the overall administration of the project and for the close articulation of PR-LSAMP with other systemic endeavors, such as PR-AGEP, PR-EPSCoR, PR-Distance Learning, Title V-USDE, and the Institute for Continuing Education for Math and Science Teachers. The Assistant Coordinator is Prof. Javier Figueroa, who is also the Coordinator of the BDP Program, and implements the Bridging, Mentoring and Professional Development Components. The Management Coordinator is Mrs. Ana Feliciano, responsible for the administrative and budgetary aspects of the project, and the Secretary, Ms. Liz Bultrón. They are all located at the UPR Resource Center for Science and Engineering main facility at the UPR-Río Piedras Campus.

The Dean of Science and the Dean of Engineering at the participating institutions are responsible for directly overseeing the implementation of PR-LSAMP strategies, and articulating them with other STEM reform initiatives at the institution. In institutions where the organizational structure does not provide for a science or engineering dean, the academic dean oversees the implementation of PR-LSAMP activities. A STEM faculty member is appointed at each institution by the dean to serve as the PR-LSAMP Liaison Officer, responsible for the on-site implementation of the program. The PR-LSAMP Liaison Officers are:

Dr. Noemí Cintrón, UPR-Río Piedras (Biology)
Dr. Jeannette Santos, UPR-Mayaguez (Engineering)
Dr. Denny S. Fernández, UPR-Humacao (Biology)
Prof. Luis Pérez, UPR-Cayey (Physics)
Dr. Migdalia Sotomayor, UPR-Aguadilla (Biology)
Dr. Maiella Ramos, UPR-Arecibo (Chemistry)
Dr. Orlando González, UPR-Bayamón (Biology)
Dr. Lizette Roig, UPR-Ponce (Chemistry)
Dr. Rafael Canales, UIA-Bayamón (Mathematics)
Dr. Gaddier de Jesús, UIA-Metro (Biology)
Dr. Carmen Ascencio, Pontifical Catholic University (Biology)
Dr. Kay Berkling, Polytechnic University (Engineering)

Information on the PR-LSAMP staff is found in the web page (www.prlsamp.org).

Other Collaborating Organizations

The Universidad Central del Caribe Medical School and the UPR Medical Sciences Campus provide students with research opportunities, particularly to biology and chemistry majors. The National Institute of

Standards and Technology (NIST) of the U.S. Department of Commerce and the Smithsonian Institute provide students with research experiences during the summer.

Collaboration with Other NSF Sponsored Programs

The Resource Center for Science and Engineering (RCSE) of the University of Puerto Rico serves as the coordinating unit for this alliance, promoting the maximum collaboration of all institutions and synergy. The RCSE coordinates all major STEM systemic educational reforms on the Island, therefore, it provides for an integrated, systemic strategy to increase participation of Puerto Rican students in the STEM pipeline. At the K-12 level, the RCSE is implementing a Distance Learning Program for K-12 Science and Math Teachers. The first of its kind in Puerto Rico, the program makes use of distance learning technologies, and one of its key features is the integration of high-level learning computer technologies (mind tools) to train participants in the use of these tools to enhance the teaching and learning process. The project is currently being implemented in 80 schools, covering all educational levels and has impacted more than 1,500 teachers. The RCSE also provides content and pedagogical training to science and math teachers in the public school system, through the Institute of Continuing Education for Math and Science Teachers. Approximately 550 science and math teachers from 50 public schools benefited last year from this initiative.

At the undergraduate level, in addition to PR-LSAMP, the RCSE completed the implementation of the Puerto Rico Advanced Technological Education (PR-ATE), funded by NSF. The goal of the project was to improve undergraduate education in the field of Electronics. PR-ATE was implemented at three PR-LSAMP institutions: UPR-Humacao, UPR-Bayamón, and UPR-Aguadilla. The thrust of the program was to align the undergraduate electronics curriculum with the national standards in Electronics. In this third and last year of the project the results achieved include: Ten web-based modules were developed to enhance the Electronics curriculum (English and Spanish versions); the development of a cadre of experienced module developers at each of the institutions, and the effective incorporation of technology to enhance the learning process.

At the graduate level, RCSE coordinates the Puerto Rico Experimental Program to Stimulate Competitive Research (PR-EPSCoR), co-funded by NSF. PR-EPSCoR is strengthening the Puerto Rico scientific community by increasing the number of competitive researchers and building a sustainable infrastructure for competitive research at the main research universities. PR-EPSCoR has been fundamental in improving the quality of research training in the Island's main STEM Ph.D. programs by providing research opportunities to students in areas that are critical to local as well as national interests, and by providing fellowships to graduate students and supporting post-doctoral positions. In addition, the NSF sponsored Alliance for Graduate Education and the Professoriate (AGEP) provides fellowships to doctoral STEM students and has in place an effective Mentoring and TA Training Program. AGEP fellows serve as mentors to undergraduate PR-LSAMP participants and to BDP Fellows. Another project is Partnerships for Innovation (PFI), which aims at developing entrepreneurial skills in undergraduate STEM students and development of new PhDs of relevance to innovation: Materials Science, Computational Science and Engineering, and Medical Biotechnology.

The coordination of these systemic initiatives by the RCSE has promoted the articulation of the pipeline as a unified and coherent effort, fostering a shared vision, the transfer of educational strategies, the cross-fertilization of efforts and the pooling of resources among all levels of the pipeline, leading to a synergistic effect that is critical for achieving lasting change. In prior years, the RCSE coordinated the following projects that successfully completed their implementation cycle: Puerto Rico Statewide Systemic Initiative (PR-SSI); Puerto Rico Collaborative for Excellence in Teacher Preparation (PR-CETP), and the Puerto Rico Graduate Teaching Fellows in K-12 Education (GK-12).

IV. Activities and Findings for Year 4 of Phase III

Activity #1:

Measuring Students Mastering of Concepts and Skills in Introductory Physics Course, and Development of Interactive Web-based Modules to Master Difficult Physics Concepts – Prof. Luis Pérez, UPR-Cayey

Description of Activity #1:

Activity #1 aims at:

- (1) The development of an assessment system to measure effectiveness of the General Physics course.
- (2) The development of a series of short digital videos for demonstrations and lab activities
- (3) Design and development of modules that make use of the inquiry method for students to master hard to learn Physics concepts.
- (4) Design and development of a website for the project.
- (5) Training of faculty members on the use of the materials developed for the project and in the creation of their own educational materials

Findings for Year 4:

(1) An assessment system to measure effectiveness of the General Physics Course

Credible assessment of student learning is critical for determining the effects of education reforms, providing feedback on the instructional materials development process, and understanding the effects and impact of new instructional materials on student learning and achievement. The assessment tools incorporated into this project are based on current education research and provide reliable and valid information that is leading to a better understanding of how student learning can be enhanced and how instructional practice can be improved.

To measure student learning, the student initial cognitive state has been measured along three domains: concepts, processes and attitudes. Standardized instruments, most of them developed and widely accepted by the physics community, are being used for each domain. The on-line assessment system, developed locally at UPR Cayey, organizes test data and results into four profiles: student, course section, institution and semester (including data and results for all institutions who took the test online during a particular semester and year). Also, the system organizes and analyzes the data gathered for several years on the administration of a particular test. The idea is to identify patterns at different levels.

The system has nine assessment instruments: three concept-based, five process-based, and one to measure student's expectations in physics. During this year, the Formal Reasoning Test, developed by Antone Lawson from Arizona State, was translated and incorporated into web format. This tool was incorporated to get a more complete profile of students' formal reasoning skills before and after instruction. This instrument was administered to several UPR Cayey and UPR-Rio Piedras course sections. A fourth concept based instrument in Electricity and Magnetism has been translated and will soon be incorporated into web format. Next year, an instrument on Basic Math Skills will be translated and incorporated into the web to study if there is a positive correlation between basic math skills and student performance on the conceptual tests.

In terms of test administration there are two important findings; first, of the six hundred and sixty six students (666) that have taken the Force Concept Inventory test online, thirty five (35) of them took it twice and in both instances, almost every one of them, got the same percent of correct answers (~25%). This result shows the reliability of the test and the strong attraction of test distracters (associated with alternate models commonly found among students – as demonstrated by previous research). Secondly, the test was administered to almost three hundred (300) UPR Cayey students using paper and pencil, and the average student profile is similar to the one gathered with the online version of the test. This result indicates that the responses are not affected by the change of delivery media, a result that is very important for those that are planning to use online testing.

Simple correlation studies show that there is no correlation between the results of the FCI and the results from the Expectations test. It seems that student's positive attitudes toward physics have no effect on student performance on the FCI pre test. Currently, project staff is working on the correlation between Force Concept Inventory post test results and the pre test results from Formal Reasoning and Expectations.

As of today, a total of seventeen professors (mostly in physics and computer science) from UPR-Cayey, and UPR-Rio Piedras are using the Online Assessment System. Although STEM faculty members from other PR-LSAMP have been oriented on the use of the system, it is during Year 5 of the PR-LSAMP Phase III (2005-06) that a strong dissemination and training program will be conducted to increase the number of users. Special emphasis will be placed on activities targeted at helping biology, chemistry and mathematics faculty to use the system.

(2) The development of a series of short digital videos for demonstrations and lab activities

Video is a very powerful tool to study two-dimensional motion. During Year 3, a new set of digital video clips was created to study and understand two-dimensional motion: such as, projectiles and motion in a circle, and oscillatory motion. During Year 4, these videos were used in interactive class demonstrations, laboratory experiments and students' special projects. Different video analysis tools have also been evaluated and incorporated into the project. Programs such as, VideoPoint and Logger Pro, are being used for the on campus use of the videos (in and out of class) and other freeware tools are being used for those that make use of the videos online. The freeware tools allows the students to study the video carefully, take position and time data, calibrate the video, organize the data in tables and build position versus time graphs. From the graphs students make inferences about the functional relationship between the variables, the type of motion and the forces. The project website also has a simple tool to do regression analysis of data taken from the videos whose functional relationship can be described by a line. With this tool students can build a mathematical model for constant velocity motion. The tool will be enhanced to include other types of regression.

The tools and the short video clips are available to students and faculty through the project's website <http://ciberciencia.cayey.upr.edu/fisica3011>. Nineteen (19) short video clips in flash format are available in the website section "Videophysics". Students can explore the different videos and select the one to be used for his/her special project. The video analysis tools and twelve (12) video clips are available in the website section "Tools". In this section, the student can choose a video clip and learn the basics of motion analysis: take the data, calibrate the video and build a graph of position versus time. Students and faculty can use these tools anytime and anywhere. During Year 5 the tools will be enhanced and new videos incorporated.

(2) Development of Modules for Students to Master Hard to Learn Physics Concepts

The module on "One Dimensional Motion", dealing specifically with the concepts of position, velocity and acceleration incorporates several of the video clips produced during the first and second years. The module can be used in a PC, in a network environment, or in a DVD player. Also, the project staff completed: 1) a

three-page student handout that includes the purpose of the module (to assist students develop the basic concepts scientists use to describe quantitatively the motion of an object that can be modeled by a particle); instructions on how to use the DVD (and the other electronic materials); the importance of adhering to the study time and of taking notes, and how to complete the exercises in the student manual as part of their independent study; 2) a twenty-one page student manual with exercises to measure student learning, and 3) a thirty-page teacher manual with the answers to all the exercises included in the student manual.

The “One Dimensional Motion” module was pilot tested during the first semester of the academic year 2004-05. A controlled experiment was designed where 100 students studied the topic of “One Dimensional Motion” using two different electronic learning environments in two different computer laboratories. One of the laboratories required a DVD player with audio and headphones. Fifty students were randomly selected to participate in each of the two groups. The learning materials for the control group were available through a local area network, and were developed by a private company specialized in the preparation of materials to improve science and math teaching and learning, especially in introductory courses. A locally generated assessment instrument was used to measure student learning. A time variable was constructed that measured students total working time in the two different learning environments. Study results showed that the students’ performance on the test was greater for those using the DVD module, when time is taken into consideration. A size effect was calculated and showed that students using the DVD obtained 30 percentile points more than the ones using the other learning materials.

A second study was conducted to measure student satisfaction with both learning environments. Twenty nine students that used the DVD and thirty four students that used the other materials completed the survey. The major findings are: (1) a greater percentage of students considered that the DVD was more user friendly, (2) no significant difference in opinion on the level of difficulty of the exercises on the student manual, (3) a greater percentage of students reported to have problems with the other learning materials, (4) more students indicated that the other learning materials are useful for students seeing the material for the first time, and (5) explanations, images and sound quality (DVD) was considered good by 40% of the students and excellent by 45%.

The results of both studies indicate that the new materials are more effective and appealing to the students than the ones previously available and used. This is the first pilot test and the results are indicating that this new approach can improve student’s academic performance and the students positive attitudes toward science learning.

By the end of October 2005, the module will be available using streaming video, which means that students will be able to have access to it anytime and from anywhere using the campus website (www.cayey.upr.edu).

Another module on “Curvilinear motion” will be completed by the end of October 2005. The idea is to generalize to two dimensions the concepts developed in the previous module and to introduce the acceleration theorem. The other module that is on the making is “Newton’s laws” with emphasis in the second law, and builds on and expands concepts covered in Activity #2.

(3) Development of a Website for the Project

The web site was created to organize and present in an interactive way the most important ideas and relationships of the course, and to share the materials and results of the project. It has the following elements: course syllabus, course materials using java animations, concept maps, working tools (unit conversion calculators, module to build graphs of data and do linear regression, module to take data of video clips), practice tests and exercises, and links to other sites of interest. It contains a total of thirty short

digital video clips of different types of motions (not including the ones in the section on “Materials”), and some of them can be analyzed online.

The section on “Materials” includes parts of the module on “One Dimensional Motion”. A sequence of short video clips, under user control, can be run to observe the motion and respond to one or two questions about it. The video was developed to give the student five seconds to think and respond, and then the answer is provided. The student must find out how to generate the correct answer. The site allows users to access the short videos and answer a series of questions that will guide them in the process of knowledge construction (concept or skill). Some video clips provide short explanations of the observed motion. More short video clips will be included in Year 5.

Also, students are doing simple experiments online using digital video and java animations. They are also working with animations that help them deal with common misconceptions. At present, the site is available only to the courses that are part of the project at UPR Cayey. During Year 5 the site will be published through different publishing engines to make it accessible to all PR-LSAMP institutions and LSAMP institutions nationwide, and to as many countries as possible. Also, a series of dissemination activities are planned for Year 5 and will include conferences and workshops about how to create the learning materials and how to use the website to help students learn some of the hard to understand basic concepts.

(4) Training of faculty members on the use of the materials developed for the project and in the creation of their own educational materials

UPR Cayey physics faculty has been trained in the use of the locally developed digital video clips to do physics laboratory activities. They learned to use VideoPoint to measure position and time of a projectile, and to analyze the data to determine the type of motion. These professors are using two video clips to study projectile motion with and without air friction.

A half day workshop for STEM faculty from all the participating PR-LSAMP institutions was conducted at UPR Cayey to show the theory behind the assessment system, the results gathered, their implications, and how they can use some of the tools available to assess students' learning in their courses. The workshop also provided them with information on other tools available designed specifically for chemistry and biology fields. A one-hour conference on the Assessment of the Physics Introductory Course was given at the PR-LSAMP 2004 Best Practices Conference to approximately 200 STEM faculty members. Fifty copies, in DVD format, of the One Dimensional Motion module (including the student and teacher guides), were distributed at the 2005 Annual PI Meeting sponsored by NSF.

During Year 5, a strong dissemination and training program will be established to increase the number of STEM faculty members using the COAS system. Special attention will be given to assist biology, chemistry and mathematics faculty members to use the system.

Activity #2:

Development of Electronic Modules to Expand Interdisciplinary Capabilities of STEM Students - Dr. Manuel Reyes, UPR-Río Piedras

Description of Activity #2:

Activity #2 aims at the design and implementation of computer modules for three introductory science courses: General Biology, College Physics and General Chemistry. The educational objective of each module is to develop or enhance conceptual understanding and critical thinking skills using a fictional yet plausible environment through which concepts from Biology, Chemistry and Physics can be explored. Each module contains three basic elements: an introduction, interactive activities, and assessment activities (exercises/conceptual test), so students have the opportunity to apply the concepts they have learned and measure their progress before taking the tests. The exercise section involves cognitive skills such as knowledge, application, analysis or synthesis. Many of the exercises provide some sort of feedback that varies with the users' responses according to pre-identified misconceptions. In cases where users show poor skills or lack of fundamental knowledge, the module will guide them through a problem solving analysis, and send them back to an applicable exercise. Students will go through these modules in synchronization with the class discussion and laboratories. All three modules will communicate with each other to reinforce the integration of concepts from the three main disciplines, so students will have the opportunity to test their mastering of specific interdisciplinary concepts.

Findings for Year 4:

The design, development and production of the four modules have been completed. Currently an editor is revising the modules for uniformity in writing style. Modules are being pilot-tested and users' recommendations are being incorporated, as applicable.

(1) Biology Module

The biology module introduces the students to the study of the photosynthesis process and consists of three sections: The first section takes place in Planet Earth and is intended to increase motivation; the second and third sections take place in a space station. The second section consists of three tutorials enhanced with animations, and leads to the third section, virtual experiments in a scientific laboratory. The interactive activity involves oxygen production, radiation manipulation and data collection. The purpose of the exploration is for the student to have a hands-on experience of the photosynthesis process and the measurement of photosynthetic yield. The module includes a test so students can monitor their progress

(2) Physics Module

The Physics module introduces students to the two-dimensional nature of rocket motion. Before they are introduced to this concept, students must master first fundamental concepts in Kinematics and Dynamics, so they have the knowledge required to understand the basic principles of Aerodynamics. The kinematics section includes two dialogues to increase students' motivation and discuss the principles and practice of scientific research; three tutorials to acquire conceptual background information and four virtual exploration activities that include instrument manipulation, control of variables, and data acquisition and processing. The main objective of the kinematics section is to guide students through the development of conceptual understanding of position, distance, displacement, speed, velocity, acceleration, and the corresponding mathematical descriptions.

The dynamic section includes two dialogs and two interactive exploration activities, one in vectors manipulations and the other that leads to the understanding of Newton Second Law. Both sections have

assessment activities (interactive exercises with feedback, a conceptual test given as pretest and a content test given as post test). In order to maintain the coherence and continuity of each section all the elements are integrated in a stand-alone computer module that can be used as a whole or by parts. The criterion for the assessment of knowledge construction is based on the students' ability to correctly apply the relevant concepts and the critical parameters needed for launching a space rocket. The two dimensional nature of rocket motion provides the groundwork for analyzing and understanding the principles and dynamics of sub-orbital rocket flight.

The ten interactive activities included in the physics module are available and ready for use either through the Internet or through a personal computer. These activities were used during the past two years by eight (8) professors of the Physical Science Department, impacting over 700 students.

(3) Chemistry Module

The chemistry module introduces students to the study of heat transfer and measurement. Heat transfer is studied in two parts, in physical processes and in chemical processes. The physical processes are discussed in the section dedicated to the water heater and electricity consumption; the chemical processes are discussed as the heat associated with the caloric content of foods and the combustion reaction related to the bomb calorimeter. The module includes five tutorials, twenty interactive exercises focused on the development of problem solving skills, two exploration activities that involve instrument manipulation and data collection and two interdisciplinary epilogs. The module intends to help student understand the concepts of heat, temperature, specific heat, heat capacity and to practice problem solving techniques involving numeric exercises. The module's illustrations are intended to increase user's motivation as he/she goes through the learning process.

(4) Interdisciplinary Module to Reinforce the Integration of Concepts from the Three Main Disciplines: Biology, Physics and Chemistry

All three modules (physics, chemistry and biology) are seamlessly integrated in a stand-alone computer module that studies the energy concept from the point of view of each of the three disciplines. The interdisciplinary module includes an introductory dialog that explains some interdisciplinary connections and leads to a simulation where the user can select between different energy sources: energy delivered through a combustion reaction (chemistry), energy from a solar source (photosynthesis), or energy used to move a car (kinematics and dynamic). The equivalency among these energy forms is explored in a simulation of a hybrid racing car in a speed test. The simulation includes visual and sound stimulation to increase user's motivation. At the end of the simulation the student receives a report that includes the maximum speed, the traveled distance, the time, and the fuel cost for the test. With this information the student can make interdisciplinary connections, understanding how concepts learned in a discipline relate to concepts learned in another.

Dissemination of Modules:

Beginning in October 2005 and throughout Year 5, the STEM faculty and staff involved in the development of the modules will disseminate to other PR-LSAMP institutions the modules developed. Workshops will be scheduled at each PR-LSAMP institution to train STEM faculty on the use of the modules and their integration into STEM courses.

Follow-up assistance will be provided to STEM faculty using the modules, mostly through electronic means.

**Activity #3:
Development of Information Technology Skills in STEM Students - Dr. Rafael Canales, UIA-Bayamón**

Description of Activity #3

The aim of Activity #3 is to develop electronic modules to assist STEM students on becoming fluent in information technology (**FITness**), so that they are able to evaluate, distinguish, learn, and use new information technology as appropriate to their own personal and professional activities. Emphasis will be placed in the development of the intellectual capabilities, so they develop research, filtering and analysis skills to make effective and more critical use of accurate and valid information. Training of faculty members from all STEM disciplines on the use and integration of the modules into STEM courses, will be conducted. Inter-American University-Bayamón is the lead institution in this initiative.

Findings for Year 4:

(1) Development of Modules

Thirty-seven modules are in different phase of development to develop information technology skills in undergraduate STEM students. Eighteen of the modules are already available at the following address: http://bc.inter.edu/modulos/AMP_modulos.htm. Although most modules cover all three FITness components (Information Technology Skills [ITS]; Information Technology Concepts [ITC], and Intellectual Capabilities [IC]), a specific objective was assigned to each exercise. Table 1 lists all modules by STEM area and Fitness objective.

**Table 1
Modules Developed by UIA-Bayamón
by Title, STEM Area, FITness Objective and Development Status**

Title	STEM Area	FITness Objective
Types of microscopes	Biology	ITS - Using the Internet to find information and resources
Recording Digital Sound	Information Technology	ITS - Using the Internet to find information and resources
Virtual Botany	Biology	ITS - Using the Internet to find information and resources
Working with Story Board	Information Technology	IC – Organize and navigate information structures and evaluate information
Safety in the Lab	Technology	ITS - Using the Internet to find information and resources
Historic facts in Engineering	Engineering	ITS - Using the Internet to find information and resources
Microsoft Equation 3.0	Chemistry	ITS - Using a word processor to create a text document
Cost-Volume-Profit Analysis	Engineering	ITS - Using a spread sheet to model process or financial tables
Database Design	Technology	ITS - Using a database system to set up and access useful information
Searching the Infotrack databank	Information Technology	ITS -Using a database system to set up and access useful information

Searching for Measuring Tools	Chemistry	ITS - Using instructional materials to learn how to use new applications or features
Knowing the Personal Computer	Technology	ITC – Computers
Programming Operators	Technology	ITC – Algorithmic thinking and programming
Programming a calculator using high level language	Technology	ITC – Algorithmic thinking and programming
How to develop a web portal	Information Technology	IC – Organize and navigate information structures and evaluate information
Planning a Multimedia Presentation	Information Technology	IC- Organize and navigate information structures and evaluate info
Using Boolean operators to find information on databases and the Internet	Information Technology	IC - Organized and navigate information structures and evaluate information
Citing electronic sources using APA style	Information Technology	IC - Communicate to other audiences
Assessing research articles in databases	Chemistry	IC - Communicate to other audiences
How to write an essay	Information Technology	IC - Communicate to other audiences
Physics in Biology	Biology	ITS - Using the internet to find information and resources
The cell in genetic engineering	Biology	ITS - Using the Internet to find information and resources
Volcanoes	Geology	ITS - Using the Internet to find information and resources
Distance calculations between countries using Calculus	Mathematics	ITS - Using the Internet to find information and resources
Transformation of functions	Mathematics	IC - Engaged in sustained reasoning
Limits of functions	Mathematics	IC - Engaged in sustained reasoning
Riemman areas	Mathematics	IC - Engaged in sustained reasoning
Using Excel Graphics	Mathematics	ITS Using a graphics and/or artwork package to create illustrations or other image-based expressions of ideas
Variance Analysis	Engineering	ITS – Using a spreadsheet to model simple processes or financial tables
Photosynthesis	Biology	IC - Organize and navigate information structures and evaluate information
Nonmenclature	Chemistry	ITS – Using instructional materials to learn how to use new applications or features
Earthquakes	Geology	ITS – Using the Internet to find information and resources
Selection Structures	Technology	ITS - Using a computer to communicate with others
Knowing Windows XP Tools	Technology	ITS - Using basic operating system features
Configuration of the components of a personal computer	Technology	ITS - Using basic operating system features
Effective presentations	Information Technology	ITC- Digital representation of information
Digital Photography	Information Technology	ITC- Digital representation of information

During this year an assessment instrument was developed and incorporated at the end of each module. Users are asked to complete the questionnaire and provide feedback so as to improve the modules' content and exercises.

Since the programming phase was behind schedule, UIA-Bayamón hired two private companies (VICOM and JWD) to speed up the programming process. VICOM will integrate the existing modules and the ones they will develop, with a standard look and feel layout. JWD will provide a robust platform to host the project on the WEB. Modules will be available in English and Spanish.

During Year 5, UIA-Bayamón will conduct the following activities: 1) programming of exercises; 2) publishing the modules; 3) training STEM faculty from PR-LSAMP institutions on the use of modules and their integration into STEM courses, and 4) distribution of modules to all PR-LSAMP institutions and LSAMP institutions nationwide.

Activity #4:

Strengthening the Teaching and Learning Process in STEM Courses – Professional Development Activities for STEM faculty.

Description of Activity #4:

The thrust of this activity is to expose and train STEM faculty members on strategies that have proven successful in strengthening the teaching and learning process in STEM courses. An Annual Best Practices conference is held to provide a forum for faculty members to share initiatives to improve students' academic performance.

Findings for Year 4:

(1) The Systems Dynamic Institute

In 2001, PR-LSAMP began to sponsor a series of workshops on the application of systems dynamic to the teaching process, as part of its efforts to disseminate among PR-LSAMP institutions successful best practices to enhance the teaching and learning process. As a result of these workshops, a group of faculty members joined efforts to create The Systems Dynamic Institute. The goal of the Institute is to create a critical mass of practitioners of systems dynamic modeling to transform the teaching and learning culture in the universities. Effective systems dynamic modeling provides a high level of understanding of the interaction of the parts and the behavior of the system as a whole. Developing the students' capacity for model building is accomplished by having them actually construct the models and perform the simulations.

The PR-LSAMP webpage now includes a link to the Institute's page, which includes the Institute's activities, reference materials, and a collection of models that could be easily down loaded and/or simulated through the Internet.

(2) The Annual Best Practices Conference

For the past four years PR-LSAMP has been sponsoring an annual conference on Best Teaching and Learning Practices to Improve Students' Academic Performance. Over 150 STEM faculty members from PR-LSAMP universities in Puerto Rico attended the 2004 conference held at the San Juan Intercontinental Hotel. The two main speakers were: Jeanne Narum, Director of Project Kaleidoscope, with the topic: *"Leadership for the Coming Decade: A Snapshot of People, Programs, and Places Transforming the Undergraduate STEM Learning Environment"*, and Dr. Gregor Novack who presented his nationally recognized teaching strategy *"Just-in-Time Teaching (JiTT)"*. In the afternoon the three leaders of the groups that are working in the development of the PR-LSAMP electronic modules presented to the participants the status of their work. Prof. Luis Pérez (UPR-Cayey) on the *"Assessment System to Measure effectiveness of the General Physics Course"* and *"Modules to Strengthen Students' Mastering of Basic Physics Concepts"*; Dr. Manuel Reyes (UPR-Rio Piedras), on *"Development of Electronic Modules on Biology, Physics and Chemistry to Enhance Conceptual Understanding and Critical Thinking Skills, and to Reinforce the Integration of Concepts from the Three Disciplines"*, and Dr. Omar Hernández on the *"Development of Modules to Develop Information Technology Skills within STEM Courses"*.

Abstract of Plenary Session's Conferences

"Leadership for the Coming Decade: A Snapshot of People, Programs, and Places Transforming the Undergraduate STEM Learning Environment" by Jeanne Narum - This session will be in three parts: 1) an overview of a select number of interesting directions in curricular and pedagogical reform from across the country; 2) a collective exploration in thinking through some of the politics and processes of initiating and

sustaining effective programs; and 3) individual and collective reflections on taking risks-roles and responsibilities of leaders. Each participant will leave with three next steps to take, in the context of thinking about student learning, their institutional culture and their own opportunities and challenges as a leader.

“Just-in-Time Teaching (JiTT)” by Gregor Novak - The advent of the world wide web protocol and particularly the possibility of rapid dissemination of information in so many formats shifted my focus from subject contact to the learning process. Why not use the technology to enhance the process of learning rather than to deliver content? My first approach was to have students work in the classroom on strategically designed exercises, delivered to workstations from a web server. This is an active learner classroom. However, somehow it did not work as expected. There are many reasons why the effort fell short: students felt they had less face-time with the instructor; since all the work was done in the classroom, students felt rushed to complete the tasks; it was very difficult to analyze student work quickly enough to spot common trends, and bringing the classroom together was a problem as groups were working on different tasks. The solution was staring us at the face: Move the technology out of the classroom. Let the students do the preparatory work before coming to class, with ample time to reflect, and give the instructor time to prepare the lesson with timely student input. In other words, Just-in-Time Teaching (JiTT).

The First Transdisciplinary Scientific Conference on Nanotechnology

For the first time this year, PR-LSAMP offered a Transdisciplinary Scientific Research Conference for faculty, researchers and graduate students. The topic selected was Nanotechnology. Local and international researchers presented the latest research trends in this field. The Plenary Speaker was Dr. Gunther Oberdorster from Rochester University with the topic: *“Engineered Nanoparticles: Can They be Harmful?”*. Other speakers included: Dr. John Carlisle, from Argonne National Laboratory; Dr. Diego Díaz, from Beckman Institute for Advanced Science and Technology; Dr. Luis Solá, from Dupont of Puerto Rico; Dr. Ram Katiyar, Dr. Carlos Cabrera, and Dr. Gerardo Morell, from UPR-Rio Piedras; and Dr. Miguel Castro and Dr. Carlos Rinaldi, from UPR-Mayaguez. Graduate students, including PR-LSAMP BDP Fellows who are conducting research in this field, presented their research projects in a poster session. Approximately 200 faculty members and graduate students attended the conference.

Activity #5

Pre-College to College: Induction into STEM Research

Description of Activity #5

Activity #5 aims at developing a STEM Research Program for junior and senior high school students to learn the fundamental knowledge and skills to do scientific research. The goal is to motivate high school students to enter STEM college programs through active involvement in challenging and pertinent research activities that will strengthen their conceptual knowledge in STEM and familiarize them with the environment and ongoing research endeavors in STEM programs.

Findings for Year 4:

Five scientific workshops were offered by local scientists. BDP Fellows attended the workshops and served as role models, as they shared with students their academic and personal experiences. The workshops and seminar series were offered at six schools with a total participation of 131 junior high school students. The schools were selected to cover the island's geographic regions: two in the central mountain region; one in the southern part of the island; two in the north western part of the island and one in the San Juan Metropolitan Area. The topics of the five workshops were:

- a. Earth Science: The Geology of Puerto Rico
- b. Chemistry: Chemical Process in Our Daily Lives
- c. Mathematics: Learning Ho to Use the Graphic Calculator
- d. Biology: Tropical Biodiversity
- e. Physics: Physical Laws as the Apply to Daily Life

All twenty-two BDP Fellows (Cohort #1 and Cohort#2) visited the six high schools, exposing participants to twenty two role models in different STEM disciplines.

The Summer Research Academy for High School Students

As in previous years, the theme of the 2005 Summer Academy was the Geology of Puerto Rico, with field trips and workshops integrating chemistry and mathematics concepts. Twenty-five junior high school students from the Josefina Colón Zayas in the town of Jayuya located in the central mountain region participated in this two-week academy. Three university professors and two high school teachers served as resources. The main objective of the academy was for participants to develop research skills, critical thinking skills, sampling techniques, analysis, and reporting of findings. The second main goal of the activity was to motivate students to pursue careers in STEM fields. Results from prior years show that, on the average, 90% of participants in the Summer Academy continue undergraduate studies in a STEM field at a PR-LSAMP institution. These students during their undergraduate years participate in the PR-LSAMP activities, progressing through the educational pipeline supported by PR-LSAMP.

Activity #6

Undergraduate to Graduate: Research Opportunities and Mentoring Program to Strengthen Students Academic Preparation for Graduate Studies

Description of Activity #6:

Research stipends are awarded annually to students for research experiences during the academic year and the summer at local and national universities and laboratories. As part of this component, PR-LSAMP provides participants with travel stipends to present their research projects at national conferences. An annual local activity, the Puerto Rico Interdisciplinary Scientific Meeting (PRISM), offered by PR-LSAMP and co-sponsored by the local ACS Chapter and the PR-AGEP Program, allows students from across the island to come together and share their research projects and experiences.

The PR-LSAMP Mentoring Program aims at establishing a web of mentoring relationships among the faculty, graduate students, upper level undergraduate students and lower division undergraduate students to enhance synergy between programs. Faculty mentors supervise student mentors and also participate in directly assisting students. Mentors also plan and offer a series of workshops each semester to address general areas of difficulty encountered by students. A two week Summer Bridging Seminar is conducted in which mentors are assigned to their students to get to know them and establish a working relationship, and to familiarize students with the overall services and activities of the component.

Findings for Year 4:

Undergraduate Research Experiences - During academic year 2004-05 and during Summer 2005, PR-LSAMP awarded 326 stipends to STEM undergraduate majors to participate in research experiences at local research laboratories. Also, 270 stipends were awarded to the researchers to cover laboratory materials to be used by the students during their research experiences (\$200 per student), as shown in Table 2.

Table 2
PR-LSAMP Undergraduate Research Experiences
Academic Year 2004-05 and Summer 2005

Institution	# of Stipends Awarded to (Students)*	# of Stipends Awarded to Researchers*	\$ Awarded to Students	\$ Awarded to Researchers for lab materials	Total \$ Awarded per Institution
UPR-Rio Piedras	93	76	\$74,400	\$15,200	\$89,600
UPR-Mayaguez	84	75	\$67,200	\$15,00	\$82,200
UPR-Humacao	48	43	\$38,400	\$8,600	\$47,000
UPR-Cayey	15	13	\$12,000	\$2,600	\$14,600
UPR-Bayamón	7	5	\$5,600	\$1,000	\$6,600
UPR-Arecibo	19	17	\$15,200	\$3,400	\$18,600
UPR-Aguadilla	8	6	\$6,400	\$1,200	\$7,600
UPR-Ponce	3	3	\$2,400	\$600	\$3,000
Pontifical Catholic Univ.	14	11	\$11,200	\$2,200	\$13,400
UIA-Metro	4	2	\$3,200	\$400	\$3,600
UIA-Bayamón	23	15	\$18,400	\$3,000	\$21,400
TOTAL	326	270	\$260,800	\$54,000	\$314,800

* This figure is not headcount. A student and a researcher may participate more than once during the academic year and Summer research experiences

During the Summer of 2005, UIA Bayamón sponsored a Summer Research Internship. Six students worked with their research mentors in their research projects. Also, the institution sponsored the 3rd Scientific Research Congress with the theme Bioinformatics: Innovations and Applications.

Undergraduate to Graduate Bridging Component

Eight workshops were offered to 25 undergraduate STEM students at UPR-Rio Piedras in a sustained one-year effort to strengthen their academic preparation and encourage them to continue on into graduate studies. Table 3 presents the title of the workshop, the name of the resource professor and the resource person's STEM field.

An integral part of each workshop is to present the application of the topic to graduate school, particularly on research opportunities at the graduate level. All students attended all workshops.

Table 3
Undergraduate to Graduate Bridging Component at UPR-Rio Piedras
Academic Year 2004-05

Workshop	Speaker	STEM Field
Getting Ready for Graduate School		
Preparing for the GRE (Part 1)	Julio Rodriguez	Science Education
Preparing for the GRE (Part II)	Julio Rodriguez	Science Education
Preparing the Statement of Purpose and Curriculum Vitae for Graduate School Application	Sandra Macksoud	Science Education
Becoming Familiar with On-going Research Projects and Laboratories at UPR-Rio Piedras:		
The Physiology of Cellular Membranes	Rosaura Ramirez	Cell Physiology
Ecology and Behavior of the Puerto Rican Birds Community	José Colón	Behavioral Ecology
Philogeny and Systematic Botany	Eugenio Santiago	Botany
Entomology with Emphasis in Ant Ecology	Hermógenes Fernández	Entomology
Role Model Series		
From an Undergraduate Student at UPR Rio Piedras to a Certified Meteorologist with the National Weather Service	Félix Castro	Atmospheric Science

Eight of the 25 PR-LSAMP participants (32%) are currently enrolled in graduate school: Purdue University (1) in Mathematics; Texas A&M (1) in Physics; University of Maryland (1) in Chemistry, and 5 at UPR-Rio Piedras, Physics (4) and Biology (1). The five students enrolled in graduate studies at UPR-Rio Piedras, are Bridge-to-the-Doctorate Fellows.

Mentoring Program

Twenty-two professors and 77 upper level STEM students from six different institutions served as PR-LSAMP mentors to 1,011 STEM students. These professors offer basic mentoring through their STEM courses and three of them also through WEB-CT. STEM courses impacted by the Mentor Professors include: General Chemistry, Organic Chemistry and Physical Chemistry; General Biology, Microbiology and Genetics; Chemical Processes for Chemical Engineering; Agriculture (Fisheries), and Calculus I. This program benefits all STEM students enrolled in these gatekeeper and bottleneck courses. Table 4 presents, by institution, the number of faculty members that served as mentors, the number of peer mentors and the number of students that benefited from the mentoring program.

Table 4
Faculty Mentors, Peer Mentors and Participants by PR-LSAMP Institution
2004-05 Mentoring Program

Institution	Number of Faculty Mentors	Number of Peer Mentors	Participants
UPR-Aguadilla	3	6	100
UPR-Arecibo	2	4	50
UPR-Mayaguez (includes WEB-CT)	4	8	459
UPR-Bayamón	1	2	27
UPR-Humacao	1	5	200
IAU-Bayamón	10	50	148
IAU-Metro	1	2	27
Total	22	77	1,011

All students took the core mentoring workshops included in the PR-LSAMP program beginning with the workshop on becoming familiar with the institution and followed by workshops to strengthen study skills, time management skills, stress management, writing skills, and cooperative learning. In addition to these core-mentoring workshops, each participating institution programmed and offered workshops to meet specific needs or interests of their students. Table 5 presents a sample of the workshops offered at each of the institutions.

Table 5
Workshops Offered by Institution as Part of the PR-LSAMP Mentoring Program
2004-05

Institution	Workshops
UPR-Aguadilla	Introduction to Scientific Research CPR Technique Orientation on Graduate Schools Introduction to Power Point
UPR-Arecibo	Introduction to Scientific Research Ecological Research in the Estuary Area of Caño Tiburones Air Pollution
UPR-Mayaguez	How to Read Scientific Papers Assessment Techniques Research Techniques for the Synthesis of Natural Organic Products Visit to the Pfizer Facilities Orientation to Graduate School

	Mathematics in the General Chemistry Course Using the WEB-CT Platform Techniques to Grow Hydroponic Crops Library Resources Techniques to Cultivate Mushrooms
UPR-Bayamón	Four Workshops on Skills for Calculus I
UPR-Humacao	Study/Learning Skills Within the Context of a Course (TaDDEI)
UIA-Bayamón	Quantitative Methods to Solve Linear Equations Digital Circuits How to Use Power Point Mechanical and Electromagnetic Systems Data Collection and Tabulation How to Prepare a Poster
UIA-Metro	Plagiarism and Copy Rights Team Working Skills Use and Application of the Graphic Calculator Effective Oral Presentations Science and Technologies in the Forensic Sciences

PRISM

The Puerto Rico Interdisciplinary Scientific Meeting (PRISM) is the annual island wide forum for undergraduate science, technology, engineering and mathematics (STEM) students to present their research projects. For the past 13 years, PR-LSAMP has co-sponsored this activity, together with the local chapter of the American Chemical Society and the PR-AGEP Program.

On March 12, 2005, 247 undergraduate STEM majors (189 in science, 48 in engineering, 4 in mathematics, and 6 in science education) from the different PR-LSAMP institutions presented their research projects to an audience of 840 students and faculty members. For the first time this year, PRISM included a poster session for STEM graduate students to present their projects. One hundred and two (102) graduate students participated for a total of 349 presentations.

The invited Plenary Speaker was Dr. Leon M. Lederman, an internationally renown high energy physicist, and the 1986 Nobel Prize in Physics. The topic of the conference was not on the muon neutrino, the discovery for which he and his colleagues received the Nobel prize, but on why scientists need to get actively involve in the process of improving science education at all levels. Dr. Lederman is the founder of the Teachers Academy for Mathematics and Science in Chicago, which aims at re-training all science and mathematics teachers in the city's public schools. He is also the founder and resident scholar of the Illinois Mathematics and Science Academy, a 3-year residential high school for talented children.

Abstract of Conference

“Why Scientists Need to get Actively Involve in the Process of Improving Science Education at All Levels”

“We tend to overwork the description ‘crisis’. However, having a 19th century educational system in the 21st century deserves at least such a description. Why? Science and technology continue to be the driving forces for human behavior, health, longevity, and economic well-being. They also bear part of the burden for poverty, lack of access to Internet, and looming environmental catastrophes. That’s why”.

Travel to Scientific Meetings

During this year PR-LSAMP provided a total of \$7,807 in travel stipends for students to present their research projects in national conferences. A total of 15 STEM students from six PR-LSAMP institutions benefited from this PR-LSAMP initiative. Examples of national forums attended are the AAAS, ACS, and AICHE. Table 6 presents by institution the number of students that received travel stipends and total amount of funds awarded.

Table 6
Travel Stipends Awarded to STEM Undergraduate Students
To Present Research Projects at National Forums 2004-05

Institutions	Number of Participants	Funds Awarded (\$)
UPR-Arecibo	1	\$500
UPR-Cayey	1	\$400
UPR-Humacao	3	\$1,681
UPR-Mayaguez	2	\$1,000
UPR-Ponce	1	\$500
UPR-Rio Piedras	7	\$3,726
Total	15	\$7,807

NIST Summer Internships

Since Phase I the National Institute of Standards and Technology (NIST) of the U.S. Department of Commerce, has been providing summer research experiences to PR-LSAMP students. During the Summer of 2005, three students, two from UPR-Mayaguez and one from UPR-Humacao, participated in the 9 to 12 week Summer Internship Program. NIST provided a total of \$21,132 to cover stipends, housing, and travel expenses. This internship provides students with the opportunity to work in research projects with mainland STEM students and nationally recognized researchers. Table 7 presents the name of the participants and their research projects

Table 7
NIST Summer of 2005
Name of PR-LSAMP Participants and Research Projects

Name of Student	Title of Research Project
William Neris	Electron Backscatter Diffraction Measurements on Tetragonal Material for Applications in Ferroelectric Random Access Memory
Melvin Irizarry	Optical Trapping and Single Molecules Studies
Verónica Rodríguez	Phase Behavior of Mixed Lipid Bilayerd

Pfizer Fellowships

PR-LSAMP joined efforts with Pfizer Corporation and eight STEM students are currently benefiting from a Pfizer fellowship in Pharmaceutical Sciences. Students are awarded a fellowship to cover their cost of studies and to conduct research with a selected UPR faculty mentor. Table 8 presents fellowship recipients and institution.

Table 8
Pfizer 2004-2005 Fellowship Recipients and Institution

Name	Institution
Anitza Villalobos	UPR-Medical Sciences Campus
Yaira González	UPR-Medical Sciences Campus
Coral del Mar Matos Rivera	UPR-Mayaguez
Gustavo Afanador	UPR-Mayaguez
Melany Rivera	UPR-Mayaguez
Jan Mangual Soto	UPR-Mayaguez
Lymaris Ortiz	UPR-Humacao
Josue Benjamin	UPR-Humacao

FaST (Faculty and Student Teams) and SULI (Science Undergraduate Laboratory Internships)

PR-LSAMP received a \$25,500 Supplemental award to participate in the NSF and DoE Collaborative Initiatives FaST and SULI. During the Summer of 2005, through the FaST Program, Dr. Luis Rivera, a Chemistry professor at UPR-Mayaguez was able to return to the Argonne National Laboratory with two students, Legna Varela and Giselle Benítez, to conduct research with Dr. Millicent A. Firestone on “*Synthesis, Self Assembly and Polymerization of Soft Nanostructured Templates for Nanoparticle Array Fabrication*”. The SULI Program accepted Manuel Emeric, an undergraduate Physics major at UPR-Rio Piedras, to conduct research during the Summer of 2005 at the Brookhaven National Laboratory. Manuel is now a Bridge-to-the-Doctorate Fellow and plan to obtain a PhD in Experimental Solid State Physics.

**Activity #7:
Bridge to the Doctorate Program**

PR-LSAMP has awarded thirty-two (32) Bridge-to-the-Doctorate Fellowships since the beginning of the program in 2003: Twenty-two at UPR-Rio Piedras (10 in Cohort #1 in 2003 and 12 in Cohort #3 in 2005), and twelve at UPR-Mayaguez (Cohort #2 in 2004).

Table 9 presents Cohort #1 recipients, Table 10 Cohort #2 recipients, and Table 11, Cohort #3 recipients.

**Table 9
Bridge to the Doctorate Fellows at UPR-Rio Piedras (Cohort #1)
Fall 2003**

Name of Participant	BS Degree Granting Institution	PhD Major
Azlin M. Biaggi Labiosa	UPR-Rio Piedras	Physical Chemistry
Daniel Caballero Rivera	UPR-Rio Piedras	Biochemistry
Betzaida Castillo Cruz	UPR-Humacao	Biochemistry
Omar A. Cruz Nieves	UPR-Rio Piedras	Biochemistry
Agustín Díaz Díaz	UPR-Rio Piedras	Inorganic Chemistry
Luzed Díaz Pérez	UPR-Rio Piedras	Cellular Molecular Biology
Marilyn García Arriaga	UPR-Rio Piedras	Organic Chemistry
Karilys González Nieves	UPR-Rio Piedras	Inorganic Chemistry
Jessica Oyola Cintrón	UPR-Rio Piedras	Chemical Physics
Yamaris Pacheco Moctezuma	UPR-Rio Piedras	Biochemistry.

**Table 10
Bridge to the Doctorate Fellows at UPR-Mayaguez (Cohort #2)
Fall 2004**

Name of Participant	BS Degree Granting Institution	Program/Field
Olga Abreu Vega	UPR-Mayaguez	MS/Marine Sciences
Deborah Acevedo Acevedo	UPR-Mayaguez	MS/Chemistry
Yashira Estrada Olavarria	UPR-Mayaguez	MS/Marine Sciences
Miguel Gonzalez Santiago	Inter American University	MS/Chemistry
Luis Gonzalez Solá	UPR-Mayaguez	MS/Civil Engineering
Laura Granell Ortiz	UPR-Mayaguez	MS/Chemistry
Yeira Padilla Luciano	UPR-Mayaguez	PhD/Chemical Engineering
Yaritza Maldonado	UPR-Humacao	MS/Civil Engineering
Luis Rodriguez Garcia	UPR-Mayaguez	Biology
Priscila Santiago Torres	Pontifical Catholic U.	MS/Chemistry
Emmanuel Sánchez	UPR-Mayaguez	Biology
Lourdes Cabello	Pontifical Catholic U.	Chemistry

Table 11
Bridge to the Doctorate Fellows at UPR-Rio Piedras (Cohort #3)
Fall 2005

Name of Participant	BS Degree Granting Institution	Program/Field
Felix Araujo	UPR-Rio Piedras	Biology
Sofia Burgos	UPR-Humacao	Biology
Yizaira Diaz	UPR-Humacao	Chemistry
Manuel Emeric	UPR-Rio Piedras	Physics
Giselle Flores	UPR-Rio Piedras	Chemistry
Jose González	UPR-Aguadilla	Biology
Ana Longo	UPR-Rio Piedras	Biology
Jazmin Martínez	UPR-Rio Piedras	Physics
Pamela Medina	UPR-Rio Piedras	Biology
Manuel Rivera	UPR-Rio Piedras	Physics
Francisco Solá	UPR-Rio Piedras	Physics
Damaris Suazo	UPR-Humacao	Chemistry

All ten Cohort #1 Fellows at UPR-Rio Piedras are now in a PhD Program, and in their third year of graduate studies. They have all passed the qualifying exams, had their thesis proposal approved, and are working in their research projects. The expected graduation date for Cohort #1 is 2007, with some Fellows probably completing the degree requirements by 2006. Nine of them received this year fellowships through AGEP, GANN, EPSCoR or NASA; and one is a Teaching Assistant in the Chemistry Department.

The twelve Cohort #2 Fellows at UPR-Mayaguez completed successfully their first year of studies and are now in their second year of graduate studies. All of them have identified and are working their area of research interest, and all have the goal of having their thesis proposal approved by the Summer of 2006. Of particular interest is Yeira Padilla, a PhD student in Chemical Engineering. During her undergraduate years at UPR-Mayaguez, PR-LSAMP sponsored her research experiences, which allowed her to better define her research interests. During her first year of graduate studies she began to work with Dr. Moses Bogere at UPR-Mayaguez in a collaborative research project between the institution and the University of Arizona, that includes three professors from UPR-Mayaguez and two in UA. As part of this collaborative effort, Yeira was selected to continue her research work this year at the University of Arizona under the joint supervision of Dr. Kimberly Ogden and Dr. Bogere. During the Summer BDP Fellows from Cohort #2 are expected to present their thesis proposals..

The twelve Cohort #3 Fellows at UPR-Rio Piedras began their first year of graduate studies in August 2005 (five in Biology, four in Physics and three in Chemistry). They have already participated in the first BDP workshop, where they were trained to become effective mentors of the undergraduate and high school students working with them in their research labs.

On December 10, 2004, PR-LSAMP BDP Program sponsored the First Transdisciplinary Scientific Research Conference, at the Condado Plaza Hotel in San Juan. The topic of the conference was Nanotechnology. As part of the scheduled activities, BDP Fellows from UPR-Rio Piedras (Cohort #1) met with the newly minted BDP Fellows at UPR-Mayaguez (Cohort #2) to share experiences and establish a networking relationship. Local and international researchers in nanotechnology presented the latest research trends in the field. Among them Dr. Gunther Oberdorster, University of Rochester; Dr. John Carlisle, Argonne National Laboratory, and Dr. Diego Díaz, University of Illinois at Urbana. BDP Fellows conducting research in this field presented their research projects in a poster session.

All BDP Fellows from Cohort #1 and Cohort #2 attended the Annual PR-LSAMP PI Meeting held by NSF in Washington, D.C.

Supporting BDP Activities

Workshops, Field Trips, and Seminars/Conferences Offered

The ten BDP Fellows of Cohort #1 at UPR-Rio Piedras participated in 18 workshops, seminars and field trips during Year 2 (2004-05), as shown in Table 12. It is important to mention that topics and speakers for seminars/conferences offered were selected by the BDP fellows, as they related to their thesis research.

Table 12
BDP Supporting Activities for Cohort #1 at UPR-Rio Piedras
2004-05 (Year 2)

Topics	Resource(s)
Field Trips	
Bristol Myers Squib	Dr. Edgar Miranda
A 3-day Field Trip to La Reserva de las Cabezas de San Juan (Puerto Rico Conservation Trust)	Dr. Cedar García
A 3-day Field Trip through the North and Central Mountain Regions to Study the Karst and the Plutonic Formations (Joint activity with BDP Fellows at UPR-Mayaguez)	Dr. Hernán Santos Dr. Lorna Jaramillo Dr. Eugenio Santiago
Workshops	
Introduction to Computer Programming	Dr. Manuel Reyes
Ethics in Science	Dr. Leonides Santos
Study of the Supra Molecular Behavior	Dr. Jeffrey Davis
Writing the Thesis Proposal	Dr. José Lasalde
Writing Proposal for External Funds	Dr. Brad Weiner and Dr. Jo Taylor
Molecular Techniques in Biology	Dr. Hermógenes Fernández
Scientific Writing	Dr. Mitchel Aide
Integration of Mathematics and Music: The African Rumba	Dr. Erol Montes
Seminars/Conferences	
Presentation of thesis proposal by 8 BDP Fellows in the Graduate School Seminar Series	BDP Fellows
Porous Silicone Techniques	Dr. Philippe Fauchet, Rochester Univ.
Noble Gases Behavior	Dr. Xiaoliang Sunney Xie, Harvard Univ.
Inorganic Particles Cristalography	Dr. Alex Von Zelewsky, U. of Fribourg, Switzerland
Targeting Melanoma Via Oxidative Stress: A Coordinated Chemistry Approach	Dr. Patrick Farmer, Univ. of California at Irving
Sodium Channels in Nicotine Receptors	Dr. Francisco Barrantes, UNESCO
Protein Structures and Cristalization	Dr. Francesco Secondo, Milano, Italy

For the twelve Cohort #2 Fellows, Dr. Angel López, Physics Professor and the on-site BDP Coordinator for Cohort #2 at UPR-Mayaguez, coordinated the following workshops during year 1 (2004-05), as shown in Table 13

Table 13
Bridge-to-the Doctorate Supporting Activities at UPR-Mayaguez
Workshops/Field Trips 2004-05 (Year 1)

Topics	Resource(s)
Effective Mentoring Techniques	Dr. Lizette Velázquez
Role Modeling: From Academia to the Workplace	Mr. Juan Villa, Hewlett Packard
How to Prepare a Poster and Offer an Effective Oral Presentation	Dr. Gerardo Morell
Digital Thesis	Dr. José Mari Mutt
How to Read a Scientific Paper	Dr. Ellen Prat

Visits to High Schools

Each BDP fellow visited each semester a high school participating in the PR-LSAMP Pre-College-to-College bridging component. As part of the workshops conducted by PR-LSAMP on Saturdays at the selected schools, the visiting BDP fellow shares with students their high school and undergraduate experiences, including preferred courses, teachers and professors that were their role models, and insights on how to succeed in a university environment. But most importantly, they serve as role models to these high school students, and motivated them to pursue careers in STEM fields.

Mentoring

Each BDP fellow was assigned an undergraduate STEM student and a high school student to work with him/her in his/her research project. High school students visited the BDP fellow lab an average of 15hrs a week where he/she becomes familiar with the research being conducted by the BDP Fellow and developed basic research skills. One undergraduate PR-LSAMP student was also assigned to work with the BDP fellow on his/her research. The three worked as a team in a seamless pipeline from high school to graduate school. The BDP fellow served as mentor and role model in this process.

V. Institutional Initiatives Co-Sponsored by PR-LSAMP

The Pre-College Engineering Program (PCEP)

As in previous years, PR-LSAMP is one of the co-sponsors of the UPR-Mayaguez Pre-College Engineering Program. The Pre-College Engineering Program (PCEP) is a two-week summer residential program designed to introduce talented high school students to the engineering profession. The main objective of the program is to motivate participants to select and pursue careers in engineering. The program is designed to assist participants in making an informed career selection. The Summer of 2005 Program consisted of two sessions, with 30 participants (15 male and 15 female) in each session.

The program activities included:

1. A general orientation on the academic programs offered at UPR-Mayaguez, and specific orientations on the engineering disciplines offered by the College of Engineering: Civil, Computer, Electrical, Industrial, Mechanical, and Chemical Engineering. The general orientation was prepared and offered by Professional Counselors that work for the College of Engineering. The orientations on engineering disciplines were prepared and offered by young engineering professors. Participants were offered a series of laboratory tours and demonstrations that helped to illustrate the type of work performed by engineers from each specific discipline.
2. Field trips were offered to three manufacturing plants, so participants had the opportunity to appreciate different engineering applications in the production of goods and services.
3. Participation in two of the six engineering workshops, each workshop being related to one of the six engineering disciplines offered by the College of Engineering, where they learned and applied different engineering concepts and practices in a laboratory environment.
4. Participation in a design and creativity competition, where each team was given a design project, which included a detailed problem description, a set of specifications and rules, and a set of materials. Professors and graduate students served as judges during the competition.

A pre and post-test showed the effectiveness of the program in influencing participants' career decisions and increasing their awareness about research and graduate studies in engineering. The results also showed that there was a significant increase in the awareness reported by students regarding the different engineering disciplines. A significant increase is also evident in the participants' perception of the type of work performed by engineers.

The pre-examination and post-examination results also indicate that the program was successful in influencing the participant's decision to pursue an engineering career, in helping the participants to identify which engineering discipline they prefer, and in motivating the participants to pursue graduate degrees. Results indicate that at the end of the program 84.7% of the participants expressed their intention to pursue an engineering degree, compared to 75% prior to their participation in the program. Of the 23 participants that prior to the program indicated being interested in an engineering degree, but that were undecided regarding the specific discipline, 15 were able to focus their interest at the end of the program. Finally, results indicate that at the end of the program 12% wanted to pursue only a bachelor's degree, 44% a Master's degree, and 42% expressed an interest to pursue a doctoral degree.

An important accomplishment of the program has been the prizes and scholarships that some of the participants have received from the National Action Council for Minorities in Engineering (NACME-TechForce Pre-Engineering Award). For this award, each pre-college program in the United States may submit two nominees per year. Only 10 awards are made each year. Throughout its existence, the Pre-

College Engineering Program has submitted ten nominations. Of the ten nominees, nine have received the awards.

The Summer Transportation Institute

PR-LSAMP co-sponsored the Fifth Summer Transportation Institute (STI) held at UPR-Mayaguez. Sixteen high school students from schools in the western part of the Island benefited from this activity. The objective of the Institute was to guide and motivate high school students to pursue a career in the transportation industry. The Institute was administered by the UPR-Mayaguez Civil Infrastructure Research Center. The four-week program included: 1) a core curriculum to introduce students to the transportation industry and its various modes; 2) academic and practical experiences to motivate students to pursue a career in the transportation field; 3) science, mathematics and technology enrichment activities; 4) field trips to various transportation services and modes; 5) introduction and training on the use of the STELLA software for systems modeling; 6) development of a technical project, with an oral and poster presentation

VI. Other Institutional Initiatives at PR-LSAMP Institutions to Strengthen Undergraduate STEM Education

During academic year 2004-05 PR-LSAMP institutions secured a total of \$28.3M to enhance, strengthen, and sustain their STEM Programs. Tables 14 to 23 present the educational initiatives initiated or continued at each PR-LSAMP institution. Projects are presented by funding source and amount of funds assigned for that year.

Table 14 - UPR-Aguadilla

Project Description	Sponsor	Amount of Funds
New Pathways to Learning: Moving Faculty and Students to the Forefront of Multimedia Educational Technology	USDE	\$389,913
Educational Alliance with Hewlett Packard	Hewlett Packard	\$8,321
Summer Internship Program	Various	16,400
TOTAL		\$414,634

Table 15 - UPR-Arecibo

Project Description	Sponsor	Amount of Funds
Improving Academic Outcomes for Science and Math Students Through a Technology-Based Consortium	USDE	\$100,000
Enhancement of Biology and Physics/Chemistry Curricula Through the Implementation of Technology Mediated Reforms and Establishment of Environmental E-Classrooms/Labs	MSEIP	\$100,000
Implementing Environmental Science and Engineering Labs	Office of Naval Research	\$94,895
The Arecibo Geosciences Diversity Program: Enhancing the Education of Hispanics Through Research Experiences	NSF	\$68,722
TOTAL		\$363,617

Table 16 - UPR-Bayamón

Project Description	Sponsor	Amount of Funds
Strengthening the Education Process	CES	\$39,154
TOTAL		\$39,154

Table 17 - UPR-Cayey

Project Description	Sponsor	Amount of Funds
Digital School CADMA	Several Sources	\$6,524,737
Sense Project	Pepsi Cola	\$56,574
RISE Program	NIH	\$361,278
RIMI – Research Infrastructure for Minority Institutions	NIH	\$900,101
Developing Collaborative Computer Based Lab Activities Using the Web – MSEIP	USDE	\$131,299

MSEIP: A Cost Effective Approach to Student Retention in Science and Mathematics	USDE	\$78,895
MSEIP: Development and Enhancement of Lab Experiences	USDE	\$75,374
MSEIP: Enhancement of the Organic Chemistry Lab using ICISS	USDE	\$22,294
MSEIP: Analytical Aquarium	USDE	\$22,375
MSEIP: Integration of Simulation Software into the Microbiology Lab	USDE	\$19,914
PR Science and Math Partnership	NSF	\$1,186,435
Virtual Community of Educators to Integrate Technology into the Classroom	PRDE	\$133,953
Howard Hughes Medical Institute Program	Howard Hughes	\$106,850
Strengthening the Organic Chemistry Curriculum	USDE	\$22,294
TOTAL		\$9,642,373

Table 18 - UPR-Rio Piedras

Project Description	Sponsor	Amount of Funds
Fellowship	FMS Corporation	\$2,000
REU in Tropical Ecology and Evolution	NSF	\$62,496
Center of Research Excellence in Science and Technology	NSF	\$51,602
Graduate Student Research Program Preparation	NASA	\$8,000
Center for Nanoscale Materials	NASA	\$400,000
Graduate Student Research	NASA	\$24,000
Distributed Wireless and Educational Computing Initiative	AS ARMY	\$189,133
Center of Research Excellence in Science and Technology	NSF	\$207,963
Establishment of a Professional Development Program between UPR-ATI-PUPR	PR-DOT	\$80,000
PR Geographic Alliance	PRDE	\$25,000
PR Math and Science Partnership	NSF	\$3,560,992
Undergraduate Biological Sciences Educational Program	Howard Hughes	\$581
Infrastructure for a New Program in Computer Science at UPR-Rio Piedras	UPR	\$69,500
Transition to Research Careers	DHHS	\$208,872
Graduate Assistance in Areas of National Need: Research Fellowships in Chemistry	USDE	\$309,066
MARC		\$358,224
RISE		\$796,380
NASA	NASA	\$246,650
TOTAL		\$6,520,459

Table 19 - UPR-Mayaguez

Project Description	Sponsor	Amount of Funds
Fellowships for Chemical or Mechanical Engineering Students	British Petroleum	\$6,000
Fellowships for Chemical Engineering Students	Merck, Sharp & Dohme	\$30,000
Fellowships for Computer Engineering Students	Verizon	\$250,000
Fellowships for Civil, Mechanical, Industrial, Electrical and Computer Engineering	Boeing	\$25,000

Fellowships for Chemistry Students	American Chemical Assoc.	\$10,000
Fellowships for Civil Engineering Students	Carrero Eng.	\$4,000
Fellowship for Chemistry Student	Abbot	\$2,750
Scholarship for Civil Engineering Student	J. Ortiz Foundation	\$1,000
Fellowships for Civil Engineering Students	Hess Petrochemical	\$10,000
Fellowships for Civil Engineering Students	G Rexach Foundation	\$2,400
Fellowships for Civil Engineering Students	US Dept. of Transportation	\$12,000
Fellowships for Engineering Students	General Motors	\$15,000
Fellowships for Chemistry and Chemical Engineering Students	Baxter Laboratories	\$3,000
Curriculum Integration through Solar Education Program	NASA	\$15,190
Mathematics & Science through Technology	PR Council on Higher Ed	\$46,980
Seminars on ATI Transportation System	PR DOT	\$15,000
Summer Transportation Institute for high school students	PR DOT South Carolina State & RPI	\$14,444 \$42,000
HBCU/MI Student Summer Internship Program	DOD/ARMY	\$214,813
Multidisciplinary Government Research and Education as a catalyst for effective information and technology transfer	NSF	\$99,731
Bio-Sensing Platform Project – four research assistanships	Hewlett Packard	\$11,200
Pre-Engineering Summer Camp	NASA and Others	\$53,500
Partnership for Space Science Education and Research	NASA	\$88,331
Materials Science and Engineering Education Improvement for a Hispanic Serving Institution	USDE	\$10,860
Solar Home – Students development of an efficient solar power house and compete with other institutions	PR Dept. of Nat. Resources	\$25,000
Summer Institute on High Performance Computing	Network Computing Services Inc.	\$34,560
REMA – Mathematical Reconceptions	PRDE	\$19,615
Towards a Mathematics Culture	PRDE	\$113,215
AFAMaC – An Alliance to Strengthen Science and Mathematics Learning	PRDE	\$1,974,357
PR Mathematics and Science Partnership	NSF	\$1,587,131
Center for Innovations on the Teaching of Chemistry	PRDE	\$118,850
Graduate and Undergraduate Student Enhancing of Science and Technology in K-12 Schools	NSF	\$475,871
GLOBE – Project to involve K-12 schools in global related gathering of data	NASA	\$15,000
Science & Space Communications on Wheels	Pfizer Co.	\$8,000
TOTAL		\$5,354,798

Table 20 - UPR-Humacao

Project Description	Sponsor	Amount of Funds
Sea Grant – Marine Education	NOA	\$46,698
Women Education Equity Act	USDE	\$25,457
PR Science and Math Partnership	NSF	\$1,190,272
Advance Institutional Transformation	NSF	\$504,056
PENN-UPR Partnership for Research and Education in Materials (PREM)	NSF	\$510,000
ACS-PRF Supplement for Underrepresented Minority Research Fellowship	ACS	\$5,000
CCLI- Active Student Participation in Introductory Physics Laboratories Using Real Time Physics	NSF	\$24,855
Acquisition of Complimentary Equipment to Enhance Student Training in Nanoscale Materials Research	NSF	\$63,350
Improving Academic Outcomes for Science and Math Students Through a Technology-Based Consortium	USDE	\$100,000
Enhancement of the Mathematics Component of the 2004 SACNAS Conference	NSA	\$34,717
Humacao Research Scholarships Increasing Student Achievement in Computational Mathematics	NSF	\$99,665
Undergraduate Research in Mathematics as a Strategy to Increase Academic Achievement and Promote Students to Higher Education in Mathematics	NSA	\$220,191
MBRS Support of Continuous Research Excellence	USHHS	\$38,000
IDEA Network for Biomedical Research Excellence	NIH	\$618,054
TOTAL		\$2,480,315

Table 21 - Pontifical Catholic University of P.R.

Project Description	Sponsor	Amount of Funds
Amateur Scientists	NSF	\$15,000
A Multimedia Program to Facilitate Retention and Academic Performance of Minority Students in Entry-Level Math and Science Courses	USDA	\$88,734
MARC*STAR Honor Program	NIH	\$628,216
MSEIP- Teaching Through Videoconferencing and Teaching On-line with Lectura Through Streaming Video	USDE	\$89,086
Puerto Rico Space Grant Consortium	NASA	\$10,000
Strengthening Knowledge and Skills in Science, Math and Oral Communications through Environmental Sciences Experiences	NSF	\$15,000
Improving Academic Outcomes Through Technology-Based Consortium	USDE	\$537,756
TOTAL		\$1,407,826

Table 22 - IAU-Bayamón

Project Description	Sponsor	Amount of Funds
Student Support Services	USDE	\$271,074
The 3 rd Karts Symposium	AAAS	\$4,000
Sponsoring of a Competition of Automotive Design and Construction	BPPR	\$8,000

Partnership for the Establishment of a Microsoft Academy	Microsoft	\$12,000
Equipment for the Manufacture Laboratories	Medtronic	\$7,000
Student Support Services	USDE	\$271,074
Center for Technical Development and Commercialization	SBA/PRIDCO	\$95,000
PR3 Net Portal	PRIDCO	\$158,006
Center for Technology Development and Commercialization	PRIDCO	\$250,000
Partnership for Innovation (PFI)	NSF	\$10,000
Project Access	NASA	\$12,000
SNAP Software Development Center	PRIDCO	\$303,000
Title V USDE	USDE	\$328,770
Upward Bound Math and Science	USDE	\$222,916
TOTAL		\$1,952,840

Table 23 - IAU-Metropolitan Campus

Project Description	Sponsor	Amount of Funds
Integrating Technology into the Classroom	USDE	\$127,680
Using the WEB to Develop Mathematical Skills in Pre-Calculus and Calculus Courses	MSEIP	\$300,000
TOTAL		\$427,680

VII. Contributions to the Development of Human Resources

Baccalaureate Degree Production at PR-LSAMP Institutions

In academic year 2004-05, PR-LSAMP institutions awarded 3,106 baccalaureate degrees in science, technology, engineering, and mathematics (STEM) disciplines. Since 1991, **PR-LSAMP institutions have awarded a total of 38,949 BS degrees in STEM fields, making a significant contribution to the STEM workforce.** Table 24 presents the number of STEM degrees awarded per academic year, and Table 25 the number of BS degrees awarded in 2004-05 by PR-LSAMP institution.

Table 24

Total Number of BS STEM Degrees Awarded by Academic Year

Academic Year	Number of STEM BS Degrees Awarded
1990-91	1,709
1991-92	1,840
1992-93	1,896
1993-94	2,086
1994-95	2,281
1995-96	2,674
1996-97	2,754
1997-98	2,726
1998-99	2,789
1999-00	2,771
2000-01	2,893
2001-02	3,094
2002-03	3,207
2003-04	3,123
2004-05	3,106
TOTAL	38,949

Table 25

BS Degrees Awarded by PR-LSAMP Institution in Academic Year 2004-05

Institution	Year 2005
University of Puerto Rico	2,082
Pontifical Catholic University	112
Inter American University	532
Polytechnic University	390
TOTAL	3,106

Table 26 presents the number of BS degrees awarded per STEM discipline in Academic Year 2004-05.

**Table 26
STEM Baccalaureate Degrees Awarded by Discipline in 2004-05**

STEM Discipline	BS Degrees Awarded
Chemistry	278
Physics/Astronomy	132
Mathematics	27
Life Science	1223
Computer Science	291
Engineering	976
Geosciences	32
Agricultural Sciences	109
Environmental Sciences	38
TOTAL STEM Disciplines	3106

SME Baccalaureate Degrees Awarded Nationwide

The URP/STEM Bachelor's Degrees Report for Academic Year 2003-04 (Reporting Year 2004) shows that 24,176 degrees were awarded nationwide to underrepresented minorities. Of this total, 11,498 degrees were awarded to Hispanics or Latinos. In 2004 PR-LSAMP institutions awarded 3,123 baccalaureate degrees in STEM disciplines, accounting for 27% of the degrees awarded to Hispanics nationwide, as shown in Table 27.

**Table 27
STEM Baccalaureate degrees Awarded Nationwide to Underrepresented Minorities
UREP/STEM Bachelor's Degrees Report
Academic Year 2003-04, Reporting Year 2004**

Discipline	Hispanics	Total Minority Groups	PR-LSAMP Institutions
Agricultural Sciences	363	760	115
Chemistry	541	1115	257
Computer Science	1778	5031	345
Engineering	4006	7598	1033
Environmental Science	178	319	60
Geosciences	107	167	19
Life/Biological Sciences	3764	7579	1124
Mathematics	510	1205	37
Physics/Astronomy	251	402	133
Total	11498	24176	3123

Enrollment in STEM Disciplines at PR-LSAMP Institutions

During the PR-LSAMP 14 year period (1991 to 2004), PR-LSAMP institutions have increased their STEM enrollment, from 12,572 in 1991-92 to 28,299 in the Fall of 2004, as shown in Table 28. Table 29 shows undergraduate enrollment by STEM discipline in the Fall 2004, and Table 30 presents STEM undergraduate enrollment by institution.

**Table 28
Total Undergraduate STEM Enrollment By Academic Year
At Participating PR-LSAMP Institutions**

STEM Undergraduate Enrollment	Academic Year
12,572	1991-92
14,557	1992-93
14,818	1993-94
16,344	1994-95
19,139	1995-96
23,159	1996-97
24,767	1998-99
23,476	1999-00
23,427	2000-01
26,524	2001-02
27,529	2002-03
27,068	2003-04
28,299	2004-05

**Table 29
FT/PT Undergraduate Enrollment at PR-LSAMP Institutions By STEM Discipline
Fall 2004**

STEM Discipline	Undergraduate Enrollment 2004
Chemistry	2122
Physics/Astronomy/Electronics	1738
Mathematics	443
Computer Science	3501
Geosciences	446
Engineering	10031
Life Sciences	8689
Environmental Science	397
Agricultural Science	932
TOTAL ALL STEM DISCIPLINES	28299

Table 30
Undergraduate STEM Enrollment by PR-LSAMP Institution Fall 2004

Institution	STEM Enrollment Fall 2004
UPR-Río Piedras	2568
UPR-Mayaguez	7547
UPR-Humacao	958
UPR-Cayey	875
UPR-Bayamón	1864
UPR-Arecibo	579
UPR-Aguadilla	1345
UPR-Ponce	924
Polytechnic University of PR	4146
Inter American University	6498
Pontifical Catholic University	995
TOTAL	28299

Baccalaureate Graduates that Continue Graduate Studies

If we track the baccalaureate origin of the nationwide PhD recipients, the National Opinion Research Center (NORC), which reports Ph.D. data, shows for the years 1998 to 2003 that:

- 17.1% of the Hispanics (U.S. citizens) that obtained a **PhD in a Natural Science** field nationwide, received their BS degree from a PR-LSAMP institution (284 out of 1652). UPR-Río Piedras and UPR-Mayaguez are the leading baccalaureate institutions of U.S. Hispanic Ph.D.'s in Science.
- 14.7% of the Hispanics that obtained a **PhD in Engineering** nationwide, received their BS degree from a PR-LSAMP institution (65 out of 442). UPR-Mayaguez is the leading baccalaureate institution of U.S. Hispanic Ph.D.'s in Engineering.

Table 31 shows the leading U.S. Baccalaureate Institutions of U.S. Hispanic Ph.D.'s in S&M fields for the 1998-2003, and Table 32 for Engineering fields.

Table 31
Top 25 Baccalaureate Institutions of U.S. Hispanic PhDs (U.S. Citizens Only)
Natural Sciences 1998-2003

Baccalaureate Origin Institution	Degrees Awarded	
		PR-LSAMP Institutions
1. University of Puerto Rico – Rio Piedras	163	
2. University of Puerto Rico – Mayaguez	73	UPR-Rio Piedras = 163
3. University of California – Berkeley	44	UPR-Mayaguez = 73
4. University of Texas at Austin	32	UPR-Cayey = 16
5. University of California – Davis	29	UPR-Humacao = 16
6. University of California – Los Angeles	29	Pontifical Catholic U. = 11
7. Texas A&M University	26	IAU at San Germás = 5
8. Univ. of New Mexico – Main Campus	25	Total = 284
9. Stanford University	24	
10. Univ. of California – San Diego	24	
11. Cornell University – Endowed Colleges	23	
12. Univ. of California – Irvine	23	
13. New Mexico State Univ. – Main campus	20	
14. Univ. of California – Santa Cruz	20	
15. MIT	19	
16. University of Texas at El Paso	18	
17. University of Florida	18	
18. Florida International University	17	
19. University of Puerto Rico – Cayey	16	
20. University of Puerto Rico – Hmacao	16	
21. Univ. of Illinois at Urbana	15	
22. University of Texas at San Antonio	14	
23. University of Miami	14	
24. St. Mary's University	12	
25. Trinity University	12	
Total Top 25 Institutions	726	
Total Doctorates Granted to Hispanics	1652	

Source: NSF/NIH/USED/NEH/USDA/NASA, Survey of Earned Doctorates, selfa-lance@norc.org

Other institutions in Puerto Rico with BS graduates that went on to receive a PhD during this period of time were: Pontifical Catholic University of PR (11) and Inter American University at San Germán (5). In summary, institutions in Puerto Rico accounted for 39% of the baccalaureate origins of the Hispanic PhDs from the top 25 institutions of Hispanic doctorate recipients and 17% of all institutions.

Table 32
Top 20 Baccalaureate Institutions of U.S. Hispanic PhDs (U.S. Citizens Only)
Engineering 1998-2003

Baccalaureate Origin Institution	Degrees Awarded
1. University of Puerto Rico – Mayaguez	56
2. MIT	26
3. University of Texas at El Paso	16
4. Texas A&M University	14
5. University of California – Berkeley	12
6. University of California – Davis	11
7. California Polytechnic State U. – San Luis Obispo	9
8. Cornell University – Endowed Colleges	9
9. Rensselaer Polytechnic Institute	9
10. University of Illinois at Urbana	9
11. University of Puerto Rico – Rio Piedras	9
12. New Mexico State University – Main campus	8
13. University of Texas at Austin	8
14. University of Florida	8
15. Purdue University – Main campus	7
16. California Institute of Technology	6
17. Florida International University	6
18. University of Colorado at Boulder	6
19. University of Miami	6
20. University of New Mexico – Main campus	6
Total Top __ Institutions	241
Total Research Doctorates	442

Source: NSF/NIH/USED/NEH/USDA/NASA, Survey of Earned Doctorates, selfa@norcmail.uchicago.edu

At the local level, the University of Puerto Rico's three graduate institutions, UPR-Rio Piedras, UPR-Mayaguez, and UPR-Medical Sciences awarded a total of 31 PhD degrees in science and engineering in 2005. Table 33 presents the number of PhD degrees awarded by these three campuses in 2004-05 by science and engineering field. Table 34 presents the number of PhD degrees awarded by the three campuses from 1990 to 2005.

Table 33
Number of PhD Degrees Conferred in 2004-05
by the University of Puerto Rico by Science and Engineering Field

Institution	Number of PhD Degrees	Science and Engineering
UPR-Rio Piedras	18	Biology (12) Physics (1) Chemistry (5)
UPR-Medical Sciences	4	Biology (1) Biochemistry (1) Microbiology (2)
UPR-Mayaguez	9	Computational Sciences (2) Chemical Engineering (2) Marine Sciences (4) Chemical Engineering (1)
Total	31	

Table 34
Number of PhD Degrees Conferred by the University of Puerto Rico
by Science and Engineering Field from 1990 to 2005

Academic Year	Number of PhD Degrees Conferred
1990	14
1991	9
1992	9
1993	17
1994	12
1995	10
1996	17
1997	16
1998	31
1999	22
2000	25
2001	36
2002	32
2003	30
2004	23
2005	31
TOTAL	334

VIII. Dissemination, Publications and Products

The PR-LSAMP Web Page

The PR-LSAMP web page (www.prlsamp.org) includes the calendar of activities, information on past, current, and up-coming main events, such as the Puerto Rico Interdisciplinary Scientific Meeting and the Annual Best Practices Conference on Teaching and Learning. It also includes the PR-LSAMP Annual Reports with the activities' descriptions and findings, and the data on enrollment and degrees awarded by institution.

The webpage links are:

1. The Resource Center for Science and Engineering, the umbrella organization for the PR-LSAMP alliance, with links to other systemic projects coordinated by the RCSE
2. The Puerto Rico LSAMP Program
 - a. Organizational Structure
 - b. PR-LSAMP Metrics
 - i. Enrollment
 - ii. Degrees BS
 - iii. Degrees PhD
 - iv. Index of Course Efficiency
 - v. A Metrics Manual and a Summary of the Procedure
 - vi. The PR-LSAMP Student Tracking System
3. PR-LSAMP Main Events
 - a. Annual Best Practices Conference
 - b. PR-LSAMP 10th Anniversary
 - c. PRISM
4. Curriculum and Teaching Strategies
 - a. TaDDEI
 - b. Chem-2-Chem
 - c. Cooperative Learning
 - d. Integration of Class and Laboratory in the Introductory Physics Course
 - e. Pre-Calculus Tools for Everyone
 - f. Internet Tutorials for Calculus II Course
 - g. PR-LSAMP System Dynamics Institute
 - h. Electronic Data Banks for STEM Disciplines
5. Student Activities
 - a. Research Experiences
 - b. Mentoring
 - c. Bridging Activities
6. Bridge-to-the-Doctorate Program
7. Skills for the Millenium
8. PR-LSAMP Annual Reports
9. PR-LSAMP Institutions
10. PR-LSAMP Directory
11. PR-LSAMP Forms

The PR-LSAMP Newsletter

A Newsletter is published twice a year and disseminated to all institutions in Puerto Rico and to LSAMP institutions nationwide. It includes the highlights of the activities and main events. Also, special issues are produced to cover significant events, such as the Bridge-to-the-Doctorates Fellowship Program

The PR-LSAMP Annual Report

A copy of the PR-LSAMP Annual Report is sent to the Presidents, Chancellors, Deans and Department Directors of all the PR-LSAMP institutions. A copy is also sent to the PI of the LSAMP institutions nationwide.

Other Dissemination Efforts

At the LSAMP PI Meeting last Spring, fifty copies in DVD format of the module on “One Dimensional Motion”, including the student and teachers guides, were distributed to the PIs of aother LSAMP Alliances.

In addition, PR-LSAMP participants continue to be spoke-persons for the project as they attend and/or present their research projects in national scientific conferences