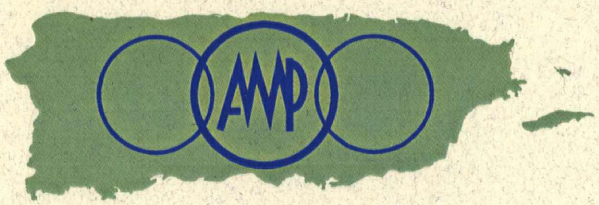
PONCE HILTON HOTEL

PR-LSAMP'S SECOND ANNUAL BEST PRACTICES CONFERENCE

PUERTO RICO



LOUIS STOKES –ALLIANCE FOR MINORITY PARTICIPATION

CREATING EXCITEMENT ABOUT SCIENCE'S ROLE IN THE FUTURE

Dr. Michael Zey
Plenary Speaker

OCTOBER 25, 2002

ABSTRACTS OF PRESENTATIONS

Best Practices Conference

October 25, 2002

PLENARY SESSION

Title of Presentation: Creating Excitement About Science's Role in the Future"

Presentor: Dr. Michael Zey

People are attracted to careers in science and math for any number of reasons. Certainly, people pursue scientific careers out of a "love of science," or even for purely vocational/occupational reason. However, biographies of noted scientists and mathematicians reveal that these notables often decided to pursue such careers because they were inspired by real events which illustrated the impact of science and mathematics on society, the economy, and history itself.

In other words, these people became scientists mainly to influence events and to a great extent help change the world. For example, many astrophysics claim that they decided to pursue their field of endeavor when they realized they could help send humans to the Moon. Many scientists become biologists in order to cure disease. Computer scientists see their work as an integral part of the successful functioning of areas such as banking, the military, and/or communications networks.

The purpose of this speech, then, is to show mathematics and science professors how by generating in their students a sense of excitement about how science can influence and benefit the real world, they can persuade their students to pursue a lifelong career in biology, math, physics, computer science, genetic engineering, etc.

I will cover real life current and projected discoveries and breakthroughs in a number of fields, including space exploration, genetic engineering, and transportation, which the audience, professors and teachers, can utilize to inspire their students to persevere in their scientific studies.

As I will demonstrate, "creating excitement about science's role in the future," is the most effective tool to attract and retain the best and the brightest science and mathematics professionals.

Title of Presentation: Strengthening the Learning Process in Chemistry Courses: Design of Web Pages and Electronic Instructional Modules

Presentor: Dr. David Santiago, Prof. Raquel Vergara, and Dr. Carmelo García

Institution: UPR-Humacao

Abstract:

To strengthen the learning process of undergraduate students in chemistry courses, Web pages and electronic instructional modules were designed for the General Chemistry, Organic Chemistry, Instrumental Analysis and Physical Chemistry course conferences and laboratories. The format includes course description, operational objectives, evaluation criteria, course materials, examples with solutions, links to other academic sites and problem sets. The Web pages with the electronic instructional modules have been integrated into the existing departmental page. The use of these Web pages in the corresponding courses was initiated during the first semester of academic year 2002-03.
The web pages developed are:

http://cuhwww.upr.clu.edu/~quimgen
http://cuhwww.upr.clu.edu./~nieves
http://cuhwww.upr.clu.edu/~quimorg
http://cuhwww.upr.clu.edu/~jorcas
http://intrquim.upr.clu.edu./~instrumental

Title of Presentation: Applying TaDDEI in Chemistry Courses

Presentor: Prof. Yolanda Vaillant

Institution: UPR-Humacao

Abstract:

The TaDDEI Workshops (Talleres para el Desarrollo de Destrezas de Estudio Independiente) is a collaborative project between the Puerto Rico LSAMP Project and the UPR-Humacao's Chemistry Department, was initiated in 1993. These workshops are tightly coordinated and integrated with the chemistry classes, and were designed to help participants develop essential skills necessary for improved comprehension of chemistry course content. An overview of TADDEI's objectives, organization, content and its impact on student performance (grades in Chemistry courses) and student retention, will be presented. Fifty copies of the "Student Guide "and " TADDEI"s Professors and Mentors Guide " will be distributed among participants.

Title of Presentation: Introduction to Structural Bioinformatic Resources in the Biochemistry Course

Presentor: Dr. René Nieves

Institution: IAU-Bayamón Campus

Abstract

Bioinformatic resources are essential to analyze the large amount of biological data available. A student today must become acquainted with many of these tools, and utilize them to study and analyze data.

An exercise has been devised to familiarize biochemistry students with structural bioinformatic tools, and use them in the study of basic biochemical information and concepts. In addition, students learn basic information technology skills and concepts, so essential for today's biology students.

In this hands-on exercise, students access structural files from the Protein Data Bank for various macromolecules, utilize appropriate software to display and manipulate these structures, and use the software capabilities to analyze and compare various of their aspects. In addition, students are introduced to other Internet sites that can be helpful to them in their courses.

Title of Presentation: Computerized Modules to Develop Quantitative and Scientific Reasoning Skills in Introductory Science Courses

Presentor: Dr. Noel Motta

Institution: UPR-Río Piedras

Abstract:

Issues regarding the design and implementation of computerized modules for science courses will be discussed. Examples of modules that have been implemented or modules that are being developed by various professors will be presented, with emphasis on instructional design strategies and assessment activities. The results from a recent study with General Chemistry pilot groups will be shown, including the lessons learned, and how they are being applied to the development of modules for the Biology, Chemistry and Physics Introductory Courses.

Title of Presentation: Enhancing Students' Academic Success in Science and Technology Courses through Preparatory Workshops

Presentor: Dr. Maiella Ramos

Institution: UPR-Arecibo

Abstract

Preparatory workshops were offered to students registered in General Chemistry, Chemical Technology and Introductory Physics courses to enhance students' academic success. A total of 157 students participated in this project.

The Pre-Chemistry I and Pre-Physics I workshops focused on mathematical concepts that students should master in the General Chemistry I, Chemical Technology I, and the Introductory Physics I courses. The main math areas included metric units, significant figures, scientific notation, algebraic equations among others. The learning strategies used in these workshops were cooperative learning, peer-leadership, audiovisual and computer resources, and laboratory experiences. Pre and post-tests were administered to workshop participants to assess knowledge gains. Students that participated in the Chemistry I workshops obtained a score of 36% in the pre-test and a 62% in the post-test. Students that took the Pre-Physics I workshop obtained 54% in the pre-test and 67% in the post-test.

The General Chemistry II and Chemical Technology II workshop topics covered were chemical equilibrium, kinetics and electrochemistry. The Introductory Physics II concepts covered were dimensional analysis, unit conversion, integrals, derivatives, and determinants (matrices). The learning strategies used in these workshops were cooperative learning, peer-leadership, audiovisual and computer resources. Pre and post-tests were administered; Chemistry and Chemical Technology students obtained a score of 32% in the pre-test and a 54% in the post-test. Students from the Pre-Physics II workshop obtained 47% in the pre-test and 62% in the post-test.

Results showed that students participating in the workshops obtained a higher percent of satisfactory grades than non-participants.

Title of Presentation: Improving Learning and Teaching in Pre-Calculus Course Through Tutoring

Presentor: Dr. Estela Pagán

Institution: UPR-Río Piedras

Abstract:

The Department of Mathematics at the Rio Piedras Campus of the University of Puerto Rico has a high number of failures in the pre-calculus sequence. In order to address this problem, a pilot project was designed to improve the teaching and learning of pre-calculus. The project made use of a diagnostic test to determine students' mastering of knowledge and skills needed to succeed in this course (Math 3023); 28 tutoring sessions by trained tutors; collaborative work, and team teaching. Four sections participated in this pilot project with a total of 120 students. The results for two of the the sections that participated during the first semester of academic year 2001-02, showed that of those that passed the diagnostic test (answered correctly 50% or more of the questions), 66% passed the course. This percent increased to 83% for those who took 15 or more of the 28 tutorial sessions offered. Of those that failed the diagnostic test, only 3 passed the course. The passing rate of this course was 51%.

The results showed that: 1) the diagnostic test is a good predictor of success in the pre-calculus course, and 2) that attendance to the tutorial sessions increases the probability of student passing the course.

Based on these results PR-LSAMP sponsored a Mathematics Immersion Project for all new incoming science and mathematics students to the Colleges of Natural Sciences and for Science Education majors (Secondary Science and Math Teachers). A total of 348 students participated in the Summer Project. Other participants included the 24 science and math tutors; 17 high school math teachers (invited as observers), and 6 math professors. The diagnostic test was administered to all 348 incoming students, and all students participated in all the tutoring sessions (28). Results showed that 64% passed the Pre-calculus course.

Title of Presentation: Structured Instructional Approaches to Improve Science and Math Education in Introductory Courses

Presentor: Prof. Luis Pérez

Institution: UPR-Cayey

Abstract:

¿How to promote and assess conceptual development using digital technology? To define students' initial cognitive state (at the beginning of the course), a web environment has been created to probe their preconceptions about force and motion, and their beliefs about the first part of the Physics Introductory Course (Mechanics). The outcomes of these assessments are being used to create learning experiences that confront students with their preconceptions and beliefs in order to see their inability as tools to explain the phenomena under study, and to promote conceptual development and positive attitudes toward science.

The presentation will include a brief description of the digital technologies being used, the most common preconceptions found among our students, their expectations about what is going to happen in the course, and an example of a learning activity using digital video.

Title of Presentation: Systems Dynamics Modeling in Physics Education

Presentor: Prof. Joaquín Medín

Institution: UPR- Bayamón

Abstract:

An approach on how to use System Dynamics modeling to shift the focus of physics teaching toward a more qualitative conceptual learning, will be presented. System Dynamics (SD) assumes that everything that goes around us can be modeled by systems of interacting quantities with feedback loops. The models are made up mainly of only three types of building blocks: state variables, their rates of change, and functional relationships. SD was initially developed for social systems and then spread to many other disciplines. Modeling physical phenomena using the SD approach means applying the fundamental concepts and laws of physics and leaving the task of solving the equations to the computer. The modeling software (STELLA) helps learners, both in the formulation of the model and in the exploration of its validity when applied in a simulation. The special feature of the graphics oriented modeling system lies in a graphical representation of the model structure, similar to a concept map. A sample of models will be presented to illustrate how SD modeling can help to accentuate the conceptual structure of a physical theory and to examine more complex and realistic phenomena than is typical in the teaching of introductory physics courses.

Title of Presentation: Is the E.Q. a factor in the success of Chem-2-Chem Peer Led Team Learning?

Presentor: Prof. Rosita Báez

Institution: UPR-Cayey

Abstract:

Developing a more humane attitude in our role as educators could possibly help form more successful individuals. Questionnaires, reflective exercises and other instruments were studied to find out if the impact of the emotional quotient (E.Q.) is a determining part of the success of the Chem-2-Chem Project. Since its inception in August 1997, Chem-2-Chem has provided the opportunity for advanced Chemistry students to offer tutoring and mentoring to entering students registered in the General Chemistry course. Both groups studied in established learning teams, promoting a favorable environment for active participation that provides a valuable support network. Studies will be presented that show that the success index (A+B+C) of the participants is approximately 16% higher than for non-participants and that the failure index (F+W) is 12.7% lower. Results on a more recent study on the Chem-2-Chem Organic Chemistry Project, will also be presented. The relation between emotional intelligence factors and the success of the project will be discussed.

Title of Presentation: Promoting Student-Centered Pedagogies Through a Technology Rich Environment

Presentor: Dr. Gerardo Morell

Institution: UPR-Río Piedras

Abstract:

The results of Science Education Research continuously point out that, for many students, traditional teaching methods are not effective in developing conceptual understanding (Bonwell & Eison, 1991). The problem with lectures is not that they prevent the construction of meaningful knowledge, but that they fit only those students who can make sense of ideas while listening and taking notes. Other students need the opportunity to reflect on the material by discussing it, writing about it, and using it to solve problems (Claxton & Murrell, 1987).

One way to increase student engagement in their own learning during the class period is to leave the coverage of facts to the students independent work time and devote the class time to help students mature the concepts. This can be accomplished by integrating into the class session cooperative group work, class discussions, and interactive lectures. Over the past years, we have been merging these instructional strategies into the teaching process in the Physical Sciences courses in order to help students reflect on their own thinking, detail their own understanding, listen to each others ideas, and ask questions for clarification.

Devising key conceptual questions and developing class-wide discussions at the appropriate time during the class period are key to the successful implementation of this pedagogy. This is facilitated and enhanced by the dynamic environment created through an interactive classroom. This technology-rich environment is a combination of hardware and software that facilitates the presentation of questions, the collection of student answers, and the display of histograms showing how the class answered, all of which are interactively presented in order to trigger class discussion of students reasoning. The interactive classroom makes it easier to engage students in learning activities during class and enhances the communication among students, and between the students and the professor, and gives the opportunity to carry-on instructional interventions that address students' needs as they arise.

Title of Presentation: Chemistry Through Discovery

Presentor: Dr. Jairo Pardo

Institution: UPR-Cayey

Abstract:

A new paradigm for the educational reform of the General Chemistry course is proposed, where the experience of the laboratory (process and product) becomes the center of the learning process. In this model of guided discovery the students formulate hypothesis, gather data, participate in the analysis of data and prove/disprove their conjectures. The concepts are introduced through the laboratory, which then are further discussed and analyzed during the class. All the experiments are presented within the context of the students' daily life.

A detailed example of one of the experiments will be presented, including evaluation data and what students say in their reflective diary.

Title of Presentation: Problem-Based Learning: A Constructivist Approach to Facilitate Non-Traditional Learning Experiences

Presentor: Dr. Lizzette M. Velázquez-Rivera

Institution: UPR-Río Piedras

Abstract:

The teaching of science in Puerto Rico has evolved, and continues to evolve, from an emphasis on the transmission and storage of information toward an emphasis on meaningful learning of scientific concepts, processes and attitudes. An array of diverse teaching methodologies exist based on the different perspectives to learning.

The Problem Based Learning methodology, originally used by students of medicine, is recognized as an example of non-traditional, constructivist practice (Barrows & Kelson, 2000). PBL is a method that facilitates the construction of knowledge by students as they solve a problem.

During the first semester of the 2002-03 academic year, the author adapted the PBL methodology to the design of science courses and curricular units. These courses and units now include the use of manipulatives, the integration of technology, and varied and multidimensional evaluation. Among the achievements documented to date, the following are the most significant: the construction of a scientific culture (content, scientific methodology, and values); individual and cooperative responsibility, and students' progress in different academic areas, such as oral and written language skills, vocabulary, group work, creativity, mastery of scientific concepts, mathematics and problem solving skills, and skills related to observation, prediction, formulation of inferences and hypotheses, and experimental design.

Experience in developing a university course using the PBL methodology, will be shared with the audience. Also, the foundation, characteristics, and structure of PBL methodology, will be described