

New Faculty Workshop Reunion 2007
Poster Abstracts

“How We Rebuilt our Physics Department”

Martina Arndt, Bridgewater State College, marndt@bridgew.edu

Nine years ago, the physics major at Bridgewater State College (Massachusetts) was in danger of being eliminated. Since then, we have rebuilt our department and tripled our number of majors. Much of this rejuvenation has come from the efforts of all new faculty and staff. This poster will highlight some of the things we have done in to improve the overall physics education and experiences for our students. These efforts include: restructuring our major, incorporating technology, revamping introductory and upper level laboratories, introducing of many exciting new courses for general education students, majors, and in-service teachers, and providing new research opportunities and facilities. As a result of these efforts, our department is dynamic, vibrant, and a wonderful place to work and learn.

“Tougaloo College CIPA II Project”

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The "Tougaloo College CIPA II project" is a \$392K award to Tougaloo College, granted by NASA, and administered through UNCFSP (United Negro College Fund). The CIPA II (Curriculum Improvement and Partnership Award II) is used to strengthen the STEM curriculum in Minority serving institutions in addition to institutionalizing Project Management into the curriculum. The Tougaloo College CIPA II program will strengthen the Physics program at Tougaloo College, in addition to developing a Freshman level interdisciplinary team taught course in Space Sciences, having extracurricular activities in the form of field trips to NASA and NISSAN, providing internship opportunities to students at NISSAN/NASA, broadening the learning experience through exposure and training in Project Management, provide mentoring to STEM through MentorNet, and perform outreach activities to area High Schools.

The Physics program enhancement is in two parts, introductory and upper level Physics course enhancements. The reform to the introductory Physics courses incorporate tools coming out of the Physics Education Research community, that are actively promoted by the American Association of Physics Teachers. The resources provided through the AAPT New Faculty Workshop have provided substantial resources to the PI (Banerjee) in forming the core aspects of this grant. The development of the upper level Modern Physics laboratory will also incorporate similar tools. The activities of the Tougaloo College CIPA II will be presented at the meeting.

“Using Clickers and Peer Instruction at Wartburg College”

Benjamin Bousquet, Wartburg College, Ben.bousquet@wartburg.edu

Since attending the New Physics and Astronomy Faculty Workshop in November 2004, I have incorporated a form of peer instruction and a student response system into my introductory physics courses at Wartburg College. I have found this approach to be worthwhile in these “medium-sized” calculus-based and algebra-based classes of 30 to 60 students. This poster will present some of the lessons I have learned, and suggest ways to get the most out of this technique.

"Inquiry-based Physics Lab to Accompany Algebra-based Physics"

Todd Brown, University of Pittsburgh at Greensburg, ltbrown@pitt.edu

The University of Pittsburgh at Greensburg has offered an inquiry-based physics lab for the past 42 years. The students are given minimal instruction and are expected to develop their techniques, theory, and methods of data analysis on their own. While the experiments are relatively simple, the lab can be quite involved for the students. In the past several years we have developed several new experiments for the lab and it is possible to do this type of lab with a minimum amount of equipment. This presentation will discuss some of the successful experiments we have used and the major pitfalls we have encountered with this type of lab.

"Inquiry-based Instruction in Introductory Physics Laboratory"

Tikhon Bykov, McMurry University, tbykov@mcm.edu

Several laboratory experiments from the classical mechanics part of introductory physics courses were modified to increase the proportion of the inquiry-based instruction. In particular, lab instructions were modified to provide general guidance instead of step-by-step instructions to stimulate student creativity in experimental design. The role of the peer interactions and peer review was significantly increased. To help accommodate different learning styles and enhance knowledge generalization, several labs included multiple experiments highlighting different aspects of the same physics phenomenon. Some labs offered activity options for students. Several labs were accompanied with short pre-lab Physlet-based assignments. The modified curriculum was pilot-tested in the academic year 2006-2007. Students' ratings of usefulness of the labs for their learning, indicated that most of modifications were perceived as useful with the highest ratings for the group work and peer review. However, many students still indicated high preference for the detailed step-by-step instructions.

"Balancing Teaching, Research and Administrative Responsibilities"

Debi Prasad Choudhary, California State University Northridge, Debiprasad.choudhary@csun.edu

California State University Northridge grants tenure based on performance in Teaching, Research and Administrative responsibilities. Keeping this in mind, I tried to organize my activities with success. In the past two years, I taught a wide range of classes starting from Introductory Astronomy for non-science majors to the Plasma Physics for graduate students and supervised students for their Dissertation work. I designed two laboratories, one for introductory astronomy and the other for the advanced undergraduates in physics. Among several grants, I received the Early Career Award from National Science Foundation to support my research activities. I served in many committees including the Graduate Studies Committee of the University and organized a special session of AGU in New Orleans and IAU at Praha. Later, I resumed my research activity leading to the publications that include papers in The Astrophysical Journal. In this poster, I present the analysis of my time management in terms of the percentage of time devoted for these three activities on each three month segment and objectively describe the process items for engagement.

"An Evaluation of Electronic Response Systems"

Philip Collins, University of California, Irvine, collinsp@uci.edu

Following a new faculty workshop in 2003, UCI faculty piloted and then successfully lobbied for campus-wide implementation of electronic student transponders. This poster summarizes lessons learned as the campus worked with various implementations and as faculty of different

skill levels dealt with technology adoption. This poster was recently presented at the AAPT conference on "Achieving Systemic Change at Leading Research Universities."

“Online Oceanography and Meteorology Courses as Ideal General Science Offerings”

Serhii Kalynovs'kyi, Columbia Union College, serhiik@cuc.edu

Faculty of Physics department and administration of Columbia Union College, the liberal arts institution in Washington, DC metro area believes that Online Weather and Online Ocean Studies courses, developed by American Meteorological Society with funding from the National Science Foundation (NSF) are the ideal offerings for satisfying general education requirements in the area of physical science. The courses are taught in computerized physics lab and their format is a mixture of a traditional textbook teaching and lab activities with online activities through the use of the real time atmospheric and ocean data, maps, forecasts, and satellite and radar imagery delivered via the Internet. Meteorological observations and a boat field trip are also part of the course lab, which help the students to connect information they see on the maps with actual data acquisition. Quick changes and endless variety of patterns in the atmosphere and the ocean allow quick verification and uniqueness of the predictions, which offers an excellent way to engage students into real investigation thus providing them an opportunity to have a taste of scientific exploration in physical science without advanced math skills as a prerequisite.

Oceanography and meteorology give a physics educator a rare opportunity to show the students how both deterministic and probabilistic approaches work in geophysics as well as to demonstrate the limits of modern knowledge right in the introductory course. Other important outcomes of the course are development of analytical skills and critical thinking. Weather and climate are something very practical and important for everybody, and forecasts of physical parameters with subsequent verification create interest and motivation, which helps an educator to reach his/her goals.

“Peer Instruction, JiTT, and Service Learning in Upper Division Physics”

Daniel Kim-Shapiro, Wake Forest University, Shapiro@wfu.edu

Techniques for enhancing active learning have been relatively widely and successfully applied in introductory physics courses and other disciplines. They have been applied less often in upper division physics courses. I will discuss how I have used Peer Instruction and Just in Time Teaching in a first semester Quantum Mechanics course. Examples of material used for applying these techniques will be included. Service Learning has been applied relatively widely in many disciplines, but not so much in physics. I will describe what service learning is and how I have used it in my Biophysics course.

“Pedagogical Reform from Private Engineering to Public University”

Lok Lew Yan Voon, Wright State University, Lok.lewyanvoon@wright.edu

This poster will mainly document my and associated colleagues' impact on physics pedagogy at the two universities I have been employed at from my initiation at the New Faculty Workshop as an assistant professor in 1998 to being currently a full professor and chair. The present reforms involving our introductory physics courses are connected to our science education program.

“Minority Women as Participants in Math and Science”

Amy Lovell, Agnes Scott College, alovell@agnesscott.edu

How does a liberal arts college for women recruit and retain underrepresented minority students in math and science courses? Do physical science course enrollments reflect the diversity of the student body as a whole? Agnes Scott College is a small private liberal arts college for women, with at least 25% of students from under-represented minority groups. We find that both minority and first-generation college students are under-represented on the course rosters of astronomy, chemistry, calculus-based physics, and calculus. Among students majoring in these fields, the gap is wider still. We continue to gather enrollment data and are seeking solutions that will raise the numbers of minority students in physical science courses into proportion with the diversity of the student body as a whole.

“Connecting Concepts and Calculations in an Introductory Physics Course”

Jutta Luettmmer-Strathmann, University of Akron, jutta@physics.uakron.edu

In many fields, solving complex problems requires a combination of conceptual and quantitative thinking. Students in introductory courses, however, find it difficult to make this connection. We have designed worksheets (for group work and individual study) for challenging physics problems. They help students use their conceptual knowledge to analyze a situation and apply logical reasoning before turning to a quantitative evaluation. In comparing two introductory physics courses we found that the worksheets allow students to solve more challenging homework problems. Student feedback and a preliminary analysis of exams also suggest that the worksheets may be effective in linking concepts and calculations.

“Rebuilding a Department, Essentially From Scratch”

Eric Martell, Millikin University, emartell@millikin.edu

When I took over the Department of Physics and Astronomy at Millikin University three years ago, I was the only faculty member and we had one physics major. Since then, the department has grown to include two tenure-track faculty and 14 majors (along with two minors). This was accomplished through many conversations with administrators, a curriculum revision (guided by the SPIN-UP report), the support of colleagues in the other sciences and mathematics, and a lot of outreach and bridge-building, on campus and throughout the community. Building a department (essentially) from nothing is a challenge, but is also exciting, and allows the department to integrate best practices in pedagogy and curricula, without being sidetracked by the inertia of people and institutions unwilling to change.

“Improving the Upper Level Experimental Physics Course”

David Marx, Illinois State University, marx@phy.ilstu.edu

Most physics departments have a course for majors in experimental physics that involves doing canned experiments in modern physics, optics, and electronics, and perhaps, student designed and executed experiments. At Illinois State, we have substantially revised our course to provide additional tools that professional physicists need as well as to expose students to the many sub-disciplines of experimental physics.

“Using Hands-on Overlay Models of Solar System Motions”

Nathan Miller, University of Wisconsin - Eau Claire, millerna@uwec.edu

I have developed a series of astronomy exercises using hands-on models of the solar system consisting of paper bases and transparency overlays. These exercises were motivated by the idea that students with weak math and physics backgrounds can still master the geometric reasoning needed to deeply understand solar system motions. Beginning with a study of the apparent motions of stars and the Sun using a transparency-overlay planisphere, the exercises move on to the orbital reasons for the Sun's apparent motion, inferior planet motion, Jupiter's true position along the ecliptic, and others. A constant theme of these exercises is the interaction between the view from the Earth's surface and a solar-system-wide view. These exercises have the advantage of being cheap to produce and more concrete for students than computer models. These exercises are suitable for in-class use in large lectures and work well with student response systems.

“Student-Developed Computer Projects in the Undergraduate Curriculum”

William Oliver, University of Arkansas, woliver@uark.edu

Computer techniques have been introduced into the undergraduate physics curriculum to enhance learning. The emphasis is not on the use of packaged programs, applets, etc. but on having the students learn techniques and develop projects themselves. Examples are given of both introductory projects and those developed in more advanced courses.

“Streaming Video Physics Tutorials”

Jacob Roberts, Colorado State University, Jacob.roberts@colostate.edu

We have just recently prepared streaming video tutorials to demonstrate problem-solving techniques in our introductory-level physics courses for scientists and engineers. The primary motivation is to provide an "on-demand" resource to the students so that they can receive instruction when they need it most. This poster will present what we have learned about how to best record these streaming videos. We are still at a preliminary stage in this project.

“Creating a SCALE-UP classroom at Ithaca College”

Michael Rogers, Ithaca College, mrogers@ithaca.edu

Our 99-seat Performance-based Physics classroom uses the SCALE-UP model of integrating lecture, laboratory, and recitation sections for all of our introductory physics classes. Our NSF-DUE-CCLI #0536246 grant is focusing on adapting general education astronomy into the SCALE-UP model to enhance student understanding of the nature of science. Our poster will present our process of securing funding, constructing our new classroom, our current efforts at changing our courses to maximize student learning using this facility, and the dynamic nature of our classroom.

“Incorporating LabVIEW in the Intermediate Laboratory Experience”

Steven Sahyun, University of Wisconsin – Whitewater, sahyuns@uww.edu

A novel approach to the intermediate physics laboratory is to use the resources of the Synchrotron Radiation Center (SRC) national laboratory located in Stoughton WI and run by the University of Wisconsin.[1] Students collect data at the laboratory in person and remotely through the use of a Web interface. This experience relies heavily on the use of LabVIEW for data acquisition and remote instrument control. To provide students with a better understanding

of how the process occurs, the first three weeks of the course are devoted to learning LabVIEW in order to collect data and to control basic circuits. This poster will detail how LabVIEW is incorporated into the course structure as well as student reactions to the course.

[1] Sahyun, S.C., Polak, J. M., Moore, C. J. Undergraduate student laboratory experience at the Synchrotron Radiation Center. *Am. J. Phys.* 74, 987 (2006)

“Ups and downs with Studio Physics: Results from our 5 year experience with interactive physics teaching at the University of Alabama”

Rainer Schad, University of Alabama, rschad@bama.ua.edu

We established a Studio Physics program at The University of Alabama for our introductory physics classes [both calculus and algebra based] a couple of years ago, modeled after similar approaches around the country. The intention is to enhance student understanding and learning through a more interactive format with integrated lecture/lab sessions.

- Do the students love it? Well, not unanimously, but we know better what is good for the students, don't we?
- Do the students benefit from it? We, think so. We are still trying to quantify this with all possible shortcomings of such quantitative data.
- Does the faculty love it? It would be unfair to say that we all love it. The response is rather mixed. This leads to sometimes fruitful, sometimes endless discussions about possible improvements.
- Does the faculty benefit from it? [Who cares?] I would dare say no. The various in-class activities multiplied the out-of-class preparation and digestion time significantly. Evaluation scores typically suffered which might have an impact on salaries.

I will present in my poster an overview over our experiences with the Studio Physics format, ranging from class room design over time management to student learning, intended as an open ended presentation to solicit and stimulate discussion.

“The Physics Learning Center at Old Dominion University”

Charles Sukenik, Old Dominion University, csukenik@odu.edu

The Physics Learning Center is a place where physics students at all levels can come to work on homework assignments, submit online homework, and receive assistance from faculty and/or graduate students, if needed. It was simple to set up, requiring only some space, a few computers, and a small time commitment from faculty. It has been well received by the students and proved to be a very efficient use of faculty time. We will discuss our observations of how students tend to use the Center and ways in which the Center has enhanced physics learning.

“Integration of Lab and Lecture in Large Introductory Courses”

Matthew Sullivan, Ithaca College, mcsullivan@ithaca.edu

The Physics Department at Ithaca College has recently adopted the SCALE-UP teaching methodology developed by Bob Beichner at North Carolina State University. This transformation was already underway at the time of my hiring. I will describe the process of transforming a traditional lecture-based class into a combined lecture/lab group work atmosphere. This will involve anecdotal as well as quantitative data, as the Department is currently studying the effectiveness of the new teaching methodology.