2009

Aspira Inc. of Illinois

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On Sunday, February 15, 2009 Kristine Kurpiewski and Paul Shafer presented a paper at the 9th annual American Association of Physics Teachers – American Association for the Advancement of Science (AAPT-AAAS) meeting held at the Hyatt Hotel on Michigan Avenue, Chicago. They presented a paper entitled "Project-Based Freshman Physics at Small Inner City High Schools" as part of an AAPT Symposium – "Early High School Physics-Building a Foundation for Understanding the Sciences" led by Nobel-Prize winner, Dr. Leon Lederman. Their presentation was well received by those present. Many positive comments were received about how project-based freshman physics at Aspira High Schools started and has changed in 5 years. People were impressed how inexpensive projects built by 9th graders out of scrap wood, pop bottles, old radiators, mouse traps and other "junk" materials could lead to very rich experiments and experiential engaged learning for students. Paul Shafer was asked to come back on Monday to work with an AAPT panel on discussing how freshman physics could be improved, enriched and project ideas shared. People were very interested in how we are planning to incorporate Earth Space Dynamics into the freshman physics curriculum, so that formulas that students have previously learned in conceptual and applied physics could be used in the last quarter of the freshman year to help students understand the real power of earthquakes, tornados, hurricanes, tsunamis, meteor impacts and gravitational attraction between planets and moons. Diamond Montana & Monica Gomez contributed to this paper.

Session KA: AAPT Symposium – Early High School Physics: Building a Foundation for Understanding the Sciences

Location: Fairmont, Imperial Ballroom
Sponsor: AAPT
Date: Sunday, Feb.15
Time: 1:30–3:30 p.m.

Presider: Leon Lederman

SYMPOSIUM on Physics Education

Leon Lederman

Considered by many to be the most concrete of the sciences, physics is the basis for understanding the more abstract concepts introduced in chemistry and biology. At an earlier time when biology primarily concentrated on classification and chemistry focused on applications rather than the atomic structure of matter, it made more sense to follow a biology/chemistry/physics sequence. Putting physics first gives students a basis for understanding the theoretical nature of more advanced science concepts. This movement to reverse the traditional B-C-P science sequence first took hold more than 20 years ago in response to the recommendations of *A Nation at Risk*. Interest in Physics First has recently accelerated due to the strong advocacy by Leon Lederman. Now more than 1200 schools have adopted some version of the Physics First idea as a result of successful national and statewide awareness and implementation efforts.

– Paul Hickman, a longtime physics teacher and Physics First advocate, will set the stage for the discussions with an overview of this movement to reorder the traditional high school science sequence.

Science Education Consultant, 23 Rattlesnake Hill Rd., Andover, MA 01810; hickmanp@comcast.net

– Marsha Rosner studies how biochemical signals promote the growth, differentiation or death of cells. She will share her thoughts about how physics can support understanding in high school biology and chemistry.

Director and Charles B. Huggins Professor, Ben May Institute for Cancer Research, The University of Chicago, Chicago, IL 60637; mrosner@ben-may.bsd.uchicago.edu

– Ron Kahn, a former award-winning physics teacher, will speak to the statewide efforts initiated by Rhode Island's Governor Donald Carcieri. The project seeks to implement an improved science sequence in the state's high schools.

Director of Client Services, East Bay Educational Collaborative, 317 Market St., Warren, RI 02885; rkahn@cox.net

– Gabriel de la Paz, an active high school physics teacher, will speak to the A-TIME for Physics First statewide partnership effort in Missouri. He serves as a peer teacher for their professional development efforts.

Clayton High School, 1 Mark Twain Circle, Clayton, MO 63105; delapaz@clayton.k12.mo.us

– Corinne Williams, who is now an Assistant Superintendent at a local area school system, will share some data, observations and thoughts from her doctoral work on Physics First.

Asst. Supt. For Teaching & Learning, Bremen High School District 228, 15233 Pulaski Rd., Midlothian, IL 60445; cwilliams@bhsd228.com

– John Hubisz, who just completed a review of textbooks appropriate for Physics First, will speak to the instructional materials available to support early high school physics courses.

Physics Dept., North Carolina State University, Apex, NC 27502; hubisz@unity.ncsu.edu

Session LA: Project-Based Physics

Location: H-Columbus AB
Sponsor: Committee on Physics in Two-Year Colleges
Date: Sunday, Feb. 15
Time: 6–8 p.m.

Presider: Thomas L. O'Kuma

An invited and contributed session on Project Based Physics includes papers in which physics that is project based is taught. The PBP papers could be for the entire course, the laboratory component or the course, or other approaches.

LA01: 6–6:30 p.m. Project-Based Physics

Invited – Martin S. Mason, Mt. San Antonio College, 1100 N. Grand Ave., Walnut, CA 91789; mmason@mtsac.edu

Projects serve as an organizing principle for sections of the first-semester engineering physics course at Mt. San Antonio College. Students complete three major five-week projects, all of which require them to develop a computational model that will have predictive power. Vpython is used as the language of choice because of its visualization power and ease of use. Implementing projects and computational modeling requires significant amounts of class time. Project-based courses contain both traditional content-based student learning outcomes and nontraditional outcomes. These nontraditional outcomes are more difficult to assess, but may contribute to a student's overall success in science or engineering. Student success in the second-semester engineering physics course is compared for students who completed the computational modeling project based course vs students who completed the traditional course. Student success in subsequent engineering courses and overall program completion rates are compared for the two populations.

LA02: 6:30–7 p.m. PBP: Learning Physics from the Real World

Invited – David Weaver, Chandler-Gilbert Community College, 7360 E. Tahoe Ave., Mesa, AZ 85212; david.weaver@cgcmail.maricopa.edu

My implementation of project-based physics (PBP) flips the course focus from the way I was taught (and the way taught for more than 15 years). Instead of using physics topics (and later, models) as the organizing structure for the course with the applications to follow, our projects serve as the context within which students learn the physics. I will talk about the overall structure of my courses, describe the typical project itinerary, identify my and my students' roles, and show examples of various projects we've used as well as student products from the projects. In addition, I will discuss why I think PBP is important to do and why I think it works so well.

LA03: 7–7:30 p.m. Using Control Systems as a Basis for Brief Physics Projects*

Invited – Frederick J. Thomas, Math Machines, 1014 Merrywood Dr., Englewood, OH 45322; fred.thomas@mathmachines.net

Engineering-style control systems employ physics and math to make things happen, including automatic control of linear and angular motion, lighting, heating and cooling, and more. Starting with a grant from NSF's Advanced Technological Education program in 2002, "Math Machines" have continued to develop as a technique for engaging physics students in the design, testing and revision of mathematical functions that achieve specified physical outcomes under varying input conditions. Examples include programming an RGB light-emitting diode to oscillate with a frequency that depends on temperature, programming a rotating mirror to deflect a light beam onto a moving target, and programming an "algebraically controlled vehicle" to align itself with a magnetic field.

*Based in part upon work supported by the National Science Foundation under Grant No. DUE-0202202.

LA04: 7:30–7:40 p.m. Authentic Experimental Research at the High School Level

Sophia Gershman, Watchung Hills Regional High School, 108 Stirling Rd., Warren, NJ 07059; sgershman@whrhs.org

An expansion of undergraduate and pre-college research opportunities and classes has been taking place in response to the growing need for scientifically savvy citizenry. This paper shares the extensive experience in the development of an educational environment suitable for authentic experimental research conducted by high school students. The framework for building mentorship relationships between teachers and students receives particular attention. The facility development and outside collaborations are also discussed. Specific examples of student projects are presented, including the experiments in psychology, plasma physics, environmental science, and other science fields. The research laboratory environment has been used for teaching Physics and Experimental Design courses, and for special research programs. High school students present unique developmental needs and advantages. High schools provide an opportunity to create a model scientific community that intensifies student learning and helps them develop a broad set of science skills.

LA05: 7:40–7:50 p.m. Teaching Freshman Project-Based Physics in Small Inner City High Schools, 2003-2008

Paul W. Shafer, Aspira of Illinois Inc., 1711 N. California Ave., Chicago, IL 60647; pshafer@mrcscs.aspirail.org

Kristine Kupierski, Monica Gomez, and Diamond Montana, Aspira of Illinois Inc.

We started Aspira Charter High School in a converted warehouse in 2003. We chose applied and conceptual physics as the first of three science courses required by our students to graduate. We had no equipment and few books, but through a project-based approach, teacher team effort, and a method where the students designed and built machines and working experimental apparatus, our students were able to learn experientially physics concepts, formulas, applications of formulas, and mastery of basic physics. We have progressed since the first year to a much more elaborate approach to Physics First.

Session LB: Rethinking the Upper-Level Curriculum

Location: H-Columbus CD
Sponsor: Committee on Physics in Undergraduate Education
Co-Sponsor: Committee on Laboratories
Date: Sunday, Feb. 15
Time: 6–7 p.m.

Presider: Ernest Behringer

LB01: 6–6:30 p.m. Rethinking Upper-Level Curricula in Light of Introductory Physics Reform

Invited – Mark P. Haugan, Dept. of Physics, Purdue University, 525 Northwestern Ave., West Lafayette, IN 47907-2036; haugan@purdue.edu

Several new calculus-based introductory physics curricula have been developed in recent years and some are now being used at major research universities. For example, *Matter & Interactions* [1] is in use at Purdue University, the Georgia Institute of Technology and the North Carolina State University. These new curricula are products of deep reflection on the structure of physics knowledge and of a growing, research-based understanding of student thinking and learning. Their use creates a potential for significant improvement of upper-level physics instruction because they deliver students with new kinds of knowledge and skills to more advanced courses. To convey a sense of this potential for progress, I will examine examples of novel instructional approaches to aspects of quantum mechanics, relativity and other upper-level topics

PROJECT-BASED FRESHMAN PHYSICS AT SMALL INNER CITY HIGH SCHOOLS 2003-2008

Presenters: **Paul W. Shafer & Kristine Kurpiewski**

Aspira of Illinois, Inc.

February 15, 2009

Presented at 9th Annual AAPT–AAAS Meeting in Chicago


First Project (GRASP)
Students tested various commercial products using measuring tools & lab methods to determine how well product performs
Took students through the scientific method & enhanced their abilities to use measuring tools
Weekly goals and timelines established for project
Various assessment rubrics developed
Students learned how to work as an indiv
dynamics
Students presente
product was the b
proved or disprove
HYATT
REGENCY
CHICAGO


PROJECT-BASED FRESHMAN
PHYSICS AT SMALL INNER
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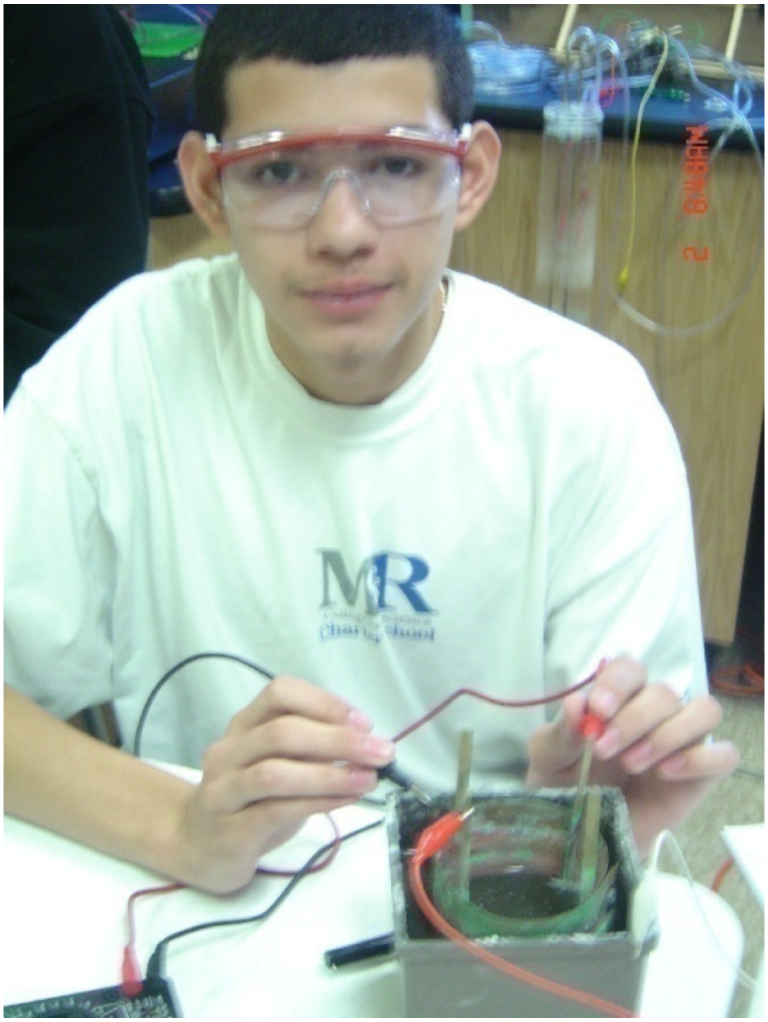

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