Project-Based Physics (PBP): Linking Physics Instruction with Students' Prior Learning and with their Future Careers

June 24-26, 2004 (Thurs. – Sat.)
at Lee College
Baytown, TX (near Houston)

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Physics students enter our classrooms with important skills and knowledge (along with a few alternative conceptions). Furthermore, they also bring expectations about the ways they will (or won't) use physics in their careers or in other aspects of their life outside the classroom. There are many highly laudable efforts that have been made to address the impedance mismatch between students' background as well as the needed exit knowledge and skills for physics courses. We believe a problem-based learning (PBL) format is another effective tool in this mission. This workshop is designed for teachers who are interested in using and developing new authentic learning tasks in introductory physics.

Our strategies center on contextual learning (CL) that presents the students with some problem or project that they need to accomplish and they must learn the requisite physics within that context to complete the problem/project. Many physics courses include major projects, usually as a capstone activity and these students frequently point to the projects as one of the highlights of the course. Our strategies differ from the capstone project approach in that students are presented with the meaningful context first, and the physics content comes in on a just-in-time schedule.

Medical schools began using problem-based learning a quarter century ago in the pursuit of doctors that could enter the work world prepared to deal with real patients upon graduation. Realizing that physicists can learn from physicians, we decided to apply a similar CL approach. We're convinced that our students leave our classes better prepared to apply physics (and other important knowledge/skills) in their future courses and careers as a result.

"In problem-based learning, students working in small groups must identify what they know, and more importantly, what they don't know and must learn to solve a problem… Students must go beyond their textbooks to pursue knowledge in other resources…" (from White, H. B. (1996). L. Richlin (Ed), *To Improve the Academy Vol.* 15 (pp. 75 - 91). Stillwater, OK: New Forums Press and the Professional and Organizational Network in Higher Education.)

This workshop will feature the use of "control systems" as a basis for student learning activities. Control system activities engage learners in using physics and mathematics to create automated systems. They use calculators and computers in the classroom in much the same way that engineers, medical workers, technicians and others use the embedded computers that control many operations of automobiles, hospital instruments, home appliances and industrial machinery. In this workshop, participants will build a LabPro-controlled switch and learn to use it in activities from kinematics and work/energy. Participants will work with some very powerful and unusual activities such as: running a variable speed motorized car (forward or backward) for any arbitrary time and to use the motorized car as a "tow truck" to deliver a specified number of joules of work (positive or negative).

Another major aspect of the workshop will feature the use of Very Large Contexts (VLC) in which student teams have 4-5 weeks to construct a project, collect pertinent data, create a technical instruction manual for their device and develop a multimedia presentation about their efforts. Participants will work in small groups on specific VLCs projects.

There will also be an opportunity to share and discuss issues relating to implementation and to teaching physics more effectively. There will be extensive discussions on how to use various strategies, tools, and tactics to overcome problems and barriers. Discussion and information on the needs of the technological workforce and its connection with the activities of this workshop will also be presented. The workshop leaders have years of experience in developing and refining curriculum for introductory physics students. The local host will be Tom O'Kuma who has managed to propel Lee College into the forefront of physics education with his interest in developing and applying new, research based, instructional strategies.