

## **Data Visualization Techniques and Strategies - Microcomputer-Based Laboratories** **October 29-31, 2009 at Springfield Technical Community College, Springfield, MA**

Workshop Leaders:

Scott Schultz, Delta College, University Center, MI

Dwain Desbien, Estrella Mountain Community College, Avondale, AZ

Tom O’Kuma, Lee College, Baytown, TX

Recent physics education research (PER) data indicates microcomputer-based laboratory (MBL) tools coupled with an activity-based physics approach provides a better method of teaching physics by enabling the teaching/learning process to build on students’ direct experiences in the physics classroom/laboratory or studio. These MBL tools give students immediate feedback by presenting data graphically in a manner that can be easily and quickly understood. The ease of data collection and presentation afforded by these tools invites students to ask, discuss, and answer their own questions. Thus, students acquire an increased competence in the use and interpretation of graphs as well as a better understanding of the physical relationships, principles, and concepts that underlie their experiences. In this hands-on workshop, participants will work in areas involving force, one-dimensional linear motion, rotation, sound, heat, electricity, magnetism, nuclear radiation, and light. They will explore approaches and curriculum materials from *Tools for Scientific Thinking* and *Real Time Physics* as well as hardware, software, and sensors from Vernier Software (LabPro/LabQuest Interface and Logger Pro software) and PASCO Scientific. These curriculum materials are often used with sensors and interfaces from other vendors as well.

Recent versions of MBL tools allow the inclusion of movies for some interesting activities. The movies can be synchronized with the sensor data taken at the same time and replayed. Video analysis, frame-by-frame, can provide distance, velocity, and acceleration data in situations where sensors are not workable.

The emphasis of this workshop will be on using these tools (available for both Mac and Windows computers) to teach physics more effectively to two-year college (TYC) and high school (HS) students. There will be extensive discussions on how to use these tools in TYC and HS courses, and tactics to overcome problems at TYCs and HSs. In addition, this workshop will be concerned with the assessment of physics learning in these areas and the application of the research findings in cognitive science and PER as applied to students’ learning of introductory physics, particularly in the context of the use of the microcomputers at TYCs and HSs. Discussion and information on the needs of the technological workforce and its connection with the activities of this workshop will also be presented.

Scott Schultz started investigating the use of computers as an educational tool to teach introductory physics in 1991. Reconciling his educational philosophy to actively engage students in the learning process with his initial exploration into the various schema that computers were then being used in the classroom, he realized that MBL would have the biggest initial impact on his students. Eighteen years later he still credits MBL as the technology that has the greatest impact on his students learning. As a winner of his college's Gerstaker Award for "Innovative Use of Technology in the Classroom", Scott continues to look for ways to improve student learning while relying on those things that are working.

Dwain Desbien and Tom O’Kuma have many years of experience in developing and refining curriculum for introductory physics students. In addition, and more importantly, all the workshop leaders have had extensive experience with the implementation and adaptation of curriculum in a variety of institutions and for many types of introductory physics students along with the training of faculty in using and developing their own curricula for their technology-oriented students. This workshop is designed for TYC and HS teachers who are interested in using computer technology in the lab to improve the teaching and learning in introductory physics courses.

The workshop local hosts will be Margaret McCarthy and Beth McGinnis-Cavanaugh. Located on 35 acres of the Springfield Armory National Historic Site and founded in 1967, Springfield Technical Community College is a major resource for the economic vitality of Western Massachusetts. As the only technical community college in Massachusetts, STCC offers 86 degree and certificate programs in areas of study such as Arts, Humanities & Social Sciences, Business & Information Technologies, Engineering Technologies, Health, Liberal Arts Transfer/General Studies, and Math, Science & Engineering Transfer. With an enrollment of over 6,000 students, STCC is a vibrant campus rich in diversity.