

Instructional Strategies for Introductory Physics (ISIP) Workshop

April 7 – 9, 2011 – Mt. San Antonio College, Walnut, CA

Martin Mason, Mt. San Antonio College, Walnut, CA

Dwain Desbien, Estrella Mountain Community College, Avondale, AZ

Tom O’Kuma, Lee College, Baytown, TX

Recent physics education research indicates that the “traditional” lecture-style, passive learning model does not substantially impact the learning and understanding of most students who take introductory physics. The research also indicates that most students enter introductory physics with alternative conceptions to many of the basic concepts that are taught in introductory physics. For most students, passive learning techniques generally do not replace these “misconceptions” with concepts that are more consistent with our understanding of nature. Results from physics education research have identified several different active learning techniques that have substantially increased student conceptual understanding in introductory physics.

This workshop will provide hands-on experience with the use of video-based motion analysis in a wide range of applications, including the teaching laboratory, projects, and homework. Video analysis can be done in the classroom with inexpensive web cameras, digital cameras or traditional video cameras. Participants will learn how to make digital video clips for analysis, as well as how to use video analysis for homework problems and in the classroom. For example, participants will create a number of movies of one-dimensional and two-dimensional phenomena and make center-of-mass analysis of pre-recorded movies.

A complete first semester video analysis based laboratory curriculum will be presented which contains over thirty different video analysis labs based on the Minnesota problem solving labs. The workshop will use the new video feature of the Logger Pro 3.8 software from Vernier Software & Technology that allow video movie clips to be analyzed and synchronized and replayed side by side with MBL data. Evaluation copies of analysis software, selected digital video clips, and a CD with many video analysis labs that can be edited by the user will be provided to the participants for their use after the workshop. Participants will have the opportunity to take and analyze high speed video footage (up to 1000 fps) using the Casio Exilim series cameras which are now available commercially.

Another instructional strategy of the ISIP workshop will be Modeling Discourse Management. Participants will experience a classroom management technique called modeling discourse management. While this classroom management style was created for a modeling curriculum, it can also be used with most PER based activities or curriculum. Modeling discourse management is an attempt to improve student-student interactions, student-teacher interactions, and classroom discussions.

The modeling theory of physics focuses the introductory physics curriculum around a small set of models. Participants will learn these models and practice applying them to physical situations. Essential to creating a useful model is to have quality-modeling tools. This workshop will introduce new modeling tools and demonstrate how to use existing tools in more robust ways.

The workshop leaders have many years of experience in developing and refining curriculum for introductory physics students. In addition, and more importantly, 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 technology in lab and their courses to improve teaching and learning in introductory physics courses.

There will also be an opportunity to share and discuss issues relating to teaching physics more effectively (particularly for students enrolled in technician/technology education programs), and how to use various strategies, tools, and tactics to overcome problems and barriers to learning at TYCs and HSs. Important issues such as standards, assessment, diversity, and technology utilization will be addressed at various points during the workshop. Discussion and information on the needs of the technological workforce and its connection with the activities of this workshop will also be presented.

The local host will be Martin Mason who has provided strong leadership for an outstanding physics program in a suburban campus in a major city. Recently, the physics program at Mt. San Antonio College was selected as one of the ten outstanding TYC physics programs visited during the SPIN-UP/TYC project.