Modeling and Research-Based Problem Solving Workshop

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at Miami-Dade Community College-Wolfson Campus, Miami, FL

Dwain Desbien, Estrella Mountain Community College, Avondale, AZ
David Maloney at Indiana University-Purdue University Fort Wayne, Fort Wayne, IN
Tom O'Kuma at Lee College, Baytown, TX
Curtis Hieggelke at Joliet Junior College, Joliet, IL

Recent research findings in teaching and learning indicate 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 (PER) has indicated that active learning techniques have substantially increased student conceptual understanding in introductory physics which provide a basis for problem solving with understanding. This workshop will provide an overview on these efforts and the research in problem solving. Various approaches to problem solving based on research will be presented. This will be followed by small group work on creating sample problems that employ these approaches. This work will be shared and critiqued by the group and workshop leaders. The advantages and weaknesses of these approaches will also be discussed.

This workshop will also focus on Modeling. Modeling is a fundamental process of science. We observe a physical phenomenon and create a model to explain at least certain components of the situation. Our models have limitations and typically have predictive capabilities. 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. As physicists we have been exposed to numerous modeling tools (equations, free-body diagrams, motion diagrams, etc.). This workshop will introduce new modeling tools and demonstrate how to use existing tools in more robust ways.

Another essential component of modeling is classroom 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.

Participants will have an opportunity to develop new materials for their students in a collaborative group of other Two Year College (TYC) and High School (HS) educators. One of the primary goals of this workshop is to show how these ideas can be implemented at TYCs and HSs. Several methods of integrating the ideas presented at this workshop into the curricula will be discussed including results from TYC and HS settings. Participants will also receive copies of the new (2004) *Ranking Task Exercises in Physics: Student Edition* from Prentice Hall.

Discussion and information on the needs of the technological workforce and its connection with the activities of this workshop will be presented. 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. There will be extensive discussions on 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.

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. The workshop leaders have also had extensive experience training faculty in using and developing their own curricula for their technology-oriented students. The local host will be Guille Damas who has provided strong leadership for a fine physics program in an urban campus in a major city. Recently, the physics program at Miami-Dade Community College – Wolfson Campus was selected as one of the ten outstanding TYC physics programs visited during the SPIN-UP/TYC project.