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Creating Effective Learning Environments In Introductory Science Courses*

What are the elements of an effective learning environment for introductory science students? How can we alter course structure and classroom practice as well as general course content to improve student learning? What is the role of active learning in curricular reform?

We have created active learning environments in the introductory science laboratory by developing real-time microcomputer-based laboratory (MBL) tools and student-oriented laboratory curricula like the RealTime Physics: Active Learning Laboratories and Tools for Scientific Thinking and entire courses such as Workshop Physics. By making use of the results of science education research, we have changed the science classroom and laboratory in ways that have been demonstrated to promote significant conceptual learning gains in many settings in universities and schools. Another reason for the success of these materials and techniques is that they engage students and allow them to take an active part in their learning. Such an active learning environment is more difficult to achieve in large or small lecture classes. This talk will report on the use of sequences of interactive, microcomputer-based lecture demonstrations using real experiments to create an active learning environment in lecture classes. Actual demonstrations as well as video tapes of students will be used to demonstrate curricular changes that have led to substantially increased learning for diverse groups of students.

Ronald K. Thornton (Tufts University) holds a Ph.D. from Brown University in High Energy Physics. He is Director of the Tufts Center for Science and Mathematics Teaching and a professor in both Physics and Education. He researches student learning and has co-authored the RealTime Physics, the Tools for Scientific Thinking laboratory curricula and Interactive Lecture Demonstrations (ILDs). He has developed student and teacher conceptual understanding evaluations including the Force and Motion Conceptual Evaluation (FMCE). These materials are used extensively, in many countries, at university, college and high school levels. He has led teaching workshops for physics professors, K-12 teachers, and teacher educators around the world. Among his many awards, Professor Thornton received the 1993 Dana award for Pioneering Achievement in Education and the 1992 Smithsonian/Computerworld Leadership in Education Award. He has twice been chair of the National Committee on Research in Physics Education of the American Association of Physics Teachers (AAPT).

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