Active Learning Methods in Teaching Introductory Level Physics

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Abstract

We teach Physics, but how do we know whether students learn Physics? Do the examinations correctly measure the conceptual understanding of students? Research has shown that there is a wide gap between what a teacher teaches through traditional instruction methods and what the students learns. Most students could complete an entire course and pass examinations with excellent grades, but still have very little understanding of the important basic concepts in Physics.

Physics education research conducted during the last two decades has shown that “Active Learning Approaches” are far superior to traditional passive learning modes for improving students’ conceptual understanding of Physics concepts. Learning environments that actively engage students and allow them to take an active part in their learning process can lead to large conceptual gains compared to traditional instruction methods. A widely used active learning method to teach introductory level Physics is the Interactive Lecture Demonstrations (ILDs) by the instructor, which uses real experiments often involving real-time data collection and display combined with student interaction to create an active learning environment in large or small lecture classes.

Another effective active learning method is the Interactive Laboratory Sessions where students are engaged as individuals in doing real time experiments and deeply involved in thinking about what they are doing. This encourages students to interact with the subject matter, discuss with the instructor and with their peers and to knowledge generate rather than receive knowledge. In both these methods, students do experiments, solve problems, answer questions, formulate questions of their own, discuss, explain, debate, or brainstorm in an active learning environment. There are several other types of active learning methods which have been found to be effective in enhancing the conceptual understanding of introductory level Physics by students. Problem based learning, web-based interactive methods, peer instruction method and project based learning are some of these methods.

Active learning methods increase student participation in the learning process, increase student engagement in discovering knowledge by themselves, increase student retention of basic concepts, provides student ownership in course, minimize lecturing by the instructor, provide a more exciting classroom experience leading to higher level thinking.

In an interactive learning environment, the instructor ceases to be the source of all knowledge, but rather assumes the role of a facilitator who guides the students through the learning process. With the instructor as the guide, students are presented with numerous opportunities to predict, experiment, observe, discuss and exchange ideas with their peers and with the instructor.

Active learning perspective has three underlying assumptions: (i) Learning by its very nature should be an active process, (ii) Different people learn in different ways, and (iii) Learning becomes meaningful and effective only when the learners discover the knowledge by themselves and make it their own.

“I hear, I forget, I see, I remember, I do, I understand”