An important skill for proficient problem solving is the fluent use of multiple representations of information (e.g. text, equations, pictures, diagrams, and graphs). In this study, introductory physics students and graduate students viewed several kinematics graphs on a computer screen and were asked to match a region of the graph with a text description of motion. The graphs were carefully designed to elicit common student difficulties with graph interpretation. We compare subjects' performance on the items, their reasoning criteria, and eye movements recorded using an eye tracker.

AD05: 8:40-8:50 a.m. Initial Assessment of a Curriculum on the Physics of Biomedicine

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James K. Johnson, Grace R. Van Ness, Elliot Mylott, Ralf Widenhorn, Portland State University

Undergraduate educational settings often struggle to provide students with authentic biologically or medically relevant situations and problems that simultaneously improve their understanding of physics. Through exercises and laboratory activities developed in an elective Physics in Biomedicine course for upper-level biology or pre-health majors at Portland State University we aim to teach fundamental physical concepts such as light absorption and emission, and atomic energy levels through analysis of biological systems and medical devices. We report on the effect engaging students in tasks with real medical applications has had on their conceptual understanding of light and spectroscopy through analysis of their responses to open-ended questions. The nature of the activities gives students opportunities to use the medical apparatus and unpack the underlying physical concepts. Additionally, we use the Colorado Learning Attitudes toward Science Survey to determine the extent to which student attitudes toward learning science are changing through the course.

AD07: 8:50-9 a.m. Assessment of Effectiveness of Studio-Mode Instruction in Algebra-based Physics Courses

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Jacquelyn Chini, University of Central Florida

While the success of the studio mode of instruction in calculus-based physics courses is now well demonstrated, the same cannot be said for algebra-based courses. Keeping this in mind, a study has been conducted on algebra-based electricity and magnetism courses in which studio and lecture sections were taught by the same instructor, using the same text book. Students' understanding of the magnetic forces has been assessed using common quiz questions. This presentation will highlight students' performance when the problem is asked in a condensed versus divided form. In an effort to assess the relative effectiveness of the two modes of instruction, results of the Survey of Electricity, Magnetism, Circuits and Optics (SEMCO) will also be presented.

AD08: 9-9:10 a.m. Research-based Active-Learning Instruction in Physics*

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Ronald K. Thornton, Tufts University

The development of research-based active-learning instructional methods in physics can serve as a model for creation of evidence-based instructional practices in all science fields. Based on a recent review,[1] we define these methods as those (1) explicitly based on research in the learning and teaching of physics, (2) that incorporate classroom and/or laboratory activities that require students to express their thinking through speaking, writing, or other actions that go beyond listening and the copying of notes, or execution of prescribed procedures, and (3) that have been tested repeatedly in actual classroom settings and have yielded objective evidence of improved student learning. We describe some key features common to methods in current use. These features focus on (a) recognizing and addressing students' physics ideas, and (b) guiding students to solve problems in realistic physical settings, in novel and diverse contexts, and to justify or explain the reasoning they have used.

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1. D.E. Meltzer and R.K. Thornton, *Am. J. Phys.* **80**, 478 (2012).

AD09: 9:10-9:20 a.m. Longitudinal Standing Wave Tutorial for a Physics of Music Class

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The Longitudinal Standing Wave (LSW) Tutorial is a PER-based curriculum that helps students to develop their understanding of sound waves using marked springs, tuning forks, pipes, and plenty of discussion. Though originally designed for the two-semester introductory college physics class, I have recently used this tutorial as a laboratory exercise in a general education Physics of Music class. The group discussions in these two classes of students have interesting similarities and differences. Some of these are a