

# CWSEI-PHYS and ASTRO

## Newsletter 'April 2010 Edition'

For many years, the Physics and Astronomy department has been committed to high standards in education. In the last two years, with support and leadership from the Carl Wieman Science Education initiative, the department has made increasing progress in successfully implementing research based educational methods in our physics and astronomy classrooms. An increasing number of faculty are showing a keen interest in these developments. In response, we will periodically distribute a newsletter to keep you updated with the latest CWSEI efforts in our department.

With this term coming to an end, we would like to encourage you to come and observe two courses to have successfully undergone such large transformations. The courses are both highly interactive and have already shown large learning gains and remarkable positive shifts in student attitudes. As it turns out, this highly interactive style of teaching has also made quite an impact on both instructors teaching these courses (see below).

*The course are Physics 304 (Quantum Mechanics) with Prof. Kirk Madison [MWF, 4-5pm, Hennings 201] and Physics 408 (Optics) with Prof. David Jones [MWF, 9-10am, Hebb13].*

Mona Berciu

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Professor Kirk Madison (Phys304, Quantum mechanics):

"Phenomenal engagement: the magic of in-class activities"  
One of the most notable differences, from the instructor's point of view, between a traditional lecture course and a transformed course is student engagement. It's like night and day. In my experience, it is exceedingly difficult to sustain full student attention and engagement during a derivation of any length in a traditional lecture style course - even if you take breaks to tell jokes and do cartwheels. Whereas, if you give the derivation or part of it as a clicker question or as an in class activity, you get 100% engagement completely for free. The first time I saw this in my own

class, I was in complete shock. It's crazy how well it works. Moreover, this engagement is sustained even when you stop work on the problem allowing you to lecture to them about the relevant physics in context. While the attention you get is absolutely phenomenal right after the exercise, it must be used judiciously since it decays very quickly the longer you talk. Integrating questions and activities into a lecture provides a natural mechanism to maximize engagement and learning during class."

Professor David Jones (Phys408, Optics):

In my undergraduate education I experienced both a lecture based technique (at Montana State U) and a more interactive, almost tutorial-like seminar style method of teaching (at Swarthmore College). For me as a student, the latter was much more effective. I think all of us can agree that it is nearly always more effective to teach students in an interactive/one-on-one approach (perhaps the Oxbridge tutorial style was ahead of its time!). Given these experiences, during my first years of teaching lecture courses at UBC, I always had an underlying feeling that I was short-changing my students by lecturing to them 100% of the time. But I thought simply the size of PHYS 408 (40+ students) precluded me from running it with a seminar/tutorial style. As it turns out, this isn't such a limit as long as it is implemented carefully. This year we've changed PHYS 408 to emulate a tutorial-like approach by using primarily in-class activities in which students work together on problems or concepts in groups. I still give them targeted 5-10 min lectures as feedback to the exercises but for the most part class time is taken by these activities. The results have been dramatic: the level of student engagement has increased enormously. It is clear they are taking responsibility for learning the material rather than being talked at. Class attendance is now averaging 90% for a 9 AM class (in previous terms it was 50-60%). The level of questions myself and the TAs receive on the material is noticeable at a higher level of sophistication. And perhaps most convincingly their exams scores to date have been higher than previous terms. Finally, I actually am finding it actually a more enjoyable method of teaching than straight 100% lecture.