CWSEI – PHYS & ASTRO Newsletter

August 2010

Our department has always been committed to high standards in education. Recently, with support and leadership from the CWSEI, we have made increasing progress in successfully implementing research based educational methods in our classrooms. An increasing number of our faculty are showing keen interest in these developments. In response, we will distribute this monthly newsletter to keep you up-to-date with the latest CWSEI efforts.

In this issue, Georg Rieger is discussing his experience in teaching the summer term of Phys101 for the past few years.

Mona Berciu

Dr. Georg Rieger (PHYS101 summer course)

PHYS101 is a large service course that is primarily intended for non-physics majors and is a required course in many science programs. I have been teaching the summer section of PHYS101 since 2004 and I have worked on improvements to the course every year. Since 2008, I have received support and advice from the three CWSEI STLFs (Jim Carolan, Louis Deslauriers, and Peter Newbury). In my eyes, this year's PHYS101 summer course has been my best course so far – it was also the course with the least amount of lecturing.

PHYS 101 has several course elements with the following purposes:

1. Pre-Reading Assignments – new content
2. Lectures – sense making, checking of understanding, motivation
3. Tutorials – problem solving skills
4. Mastering Physics online homework – problem solving practice
5. Pre-lab quizzes – preparation for labs
6. Labs – Experiments, skills, concepts

The students have to complete pre-reading assignments before coming to lecture. These assignments consist of reading several textbook sections and completing a reading quiz. They contain detailed instructions in order to focus the reading on the textbook sections and examples that are important to the course. The quiz consists of two to three multiple choice questions (posted online on vista) that the students should be able to do in about 10 minutes if they have carefully read the assigned textbook sections. I tell my students that it is important for them to know the basic definitions and main ideas when they come to class and that it is beneficial to follow the worked examples in the textbook. I also ask them to think about what is difficult during the reading and to formulate questions. It is clear to the students that I will focus on the difficult concepts and examples in class, and that they have the opportunity to ask questions either in class or later by e-mail. The reading has therefore two main purposes: the students become familiar with new content and it prepares them for the classroom discussions.

The focus in lectures is on making sense of the new concepts introduced in the textbook and on the discussion of applications and examples. The lectures are highly interactive. I use clicker questions, worksheets, PhET simulations, and small group work. It is quite similar to what Mark van Raamsdonk has discussed in last month' newsletter. (http://www.cwsei.ubc.ca/Files/PHAS/PHAS-CWSEI_Newsletter_July-2010.pdf)

During these in-class activities, a teaching assistant and I provide help and give hints to the students, who usually work together in groups of two or three students. Although the class was relatively large this year with an average attendance of about 120 students (out of 143 enrolled), it was sufficient to have one very good teaching assistant (Janelle van Dongen) in the lecture hall with me. I think that David Jones and Kirk Madison have also very successfully used such a combination of pre-reading assignments and worksheet-based classroom activities in their classes. (http://www.cwsei.ubc.ca/Files/PHAS/PHAS-CWSEI_Newsletter_Apr-7-2010.pdf) Whenever possible, I use real-world examples so that the results can be compared to something the students know from experience or can easily be found on the web.

I still do a little bit of lecturing, mainly to briefly summarize important concepts and to illustrate their application in real life by showing lecture demonstrations, animations or short videos that I find on the web.

Sometimes at the end of a lecture, I follow up on the classroom discussion by distributing and collecting self-reflection sheets, on which I ask the students explicitly "What was difficult during today's lecture?" This gives the students the opportunity to reflect on their

learning. I am usually able to read a sufficient number of these sheets in less than half-an-hour to get a good impression of how the lecture went and enough information to improve an example or a worksheet. It also gives me another chance to discover misconceptions and address them at the beginning of the following lecture.

In the summer, a 50-minute tutorial follows each 80-minute lecture after a short break. The tutorial takes place in the same lecture hall for the whole class and is run by a teaching assistant with my support. This lecture-based tutorial is similar in style to the lecture and we use clickers and worksheets but the emphasis is now on problem solving. We discuss problems and examples that are directly related to the lecture that the students have just heard. About half of the tutorial questions are from my previous exams. This provides extra motivation at the end of an intense morning. More practice in problem solving is offered by the Mastering Physics online homework that is automatically graded and does not require extra TA time.

This year, Peter Newbury was involved in the PHYS101 summer course and his main job was to help revise the labs. This is work in progress that will continue during the fall term since there was not enough time to revise all the labs in summer. One of the new features is the use of PhET simulations as part of the pre-lab preparations. I am sure that Peter will report on his efforts once the labs are completed and when he has collected more data and feedback from students. Peter also helped me with the design of some of the in-class worksheets. I want to share two of his tips that were very helpful to me: 1) Do an in-class activity right away during the first lecture, instead of covering all the details of course administration, to show what the learning environment is going to be like during the term. 2) Plan your activity so that there is enough time at the end of the class to summarize and discuss the results of the activity.

As a final point, I can confirm what Mark, David, and Kirk have already reported in previous newsletters: From my experience, a highly interactive class with minimal (or no) lecturing leads to increased student performance on exams, to higher attendance and it is rewarding and more fun to teach. I also had the impression that the students enjoyed it more than a traditional lecture.