

# CWSEI – PHYS & ASTRO Newsletter

Dec. 2011/Jan2012

Our department has always been committed to high standards in education. 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 newsletter to keep you up-to-date with the latest CWSEI efforts.

With this issue, we will start a series on instructional elements that have been successfully implemented in UBC physics courses.

## ***Pre-Reading Assignments – Why they may be the most important homework for your students.***

By Louis Deslauriers, Cynthia Heiner, and Georg Rieger

We usually think of physics or astronomy homework as a task – usually a problem set – in which students apply what they have learned in class. But homework can very effectively be used to prepare students for the next class. In this newsletter, we will discuss the benefits of pre-reading assignments, report on what students think about pre-reading, and give tips on how to implement pre-reading assignments.

### **What are pre-reading assignments and what are their benefits?**

The main purpose of a pre-reading assignment is to prepare students for learning in your next class. Traditionally, students are introduced to a topic for the first time in lecture; however, students can read the textbook before coming to class – making lecture their second exposure. Students will get more out of lectures if they come to class knowing the basic definitions and physics vocabulary, as well as having had the chance to work through simple examples of concepts at their own pace.

The first benefit is immediately clear: You don't have to spend (much) time on definitions or low-level examples, and you have more

class time to make sense of the more challenging examples and correct for misconceptions. Secondly, by looking at the average responses to quiz questions, or by directly asking your students what was difficult in the pre-reading assignment, you can gain insight as to which sections your students find difficult. You can then address these confusions in your next class.

A third benefit of pre-reading assignments is that your students will be able to follow your lectures better. Research conducted by Louis Deslauriers in three physics courses at UBC (Phys100, Phys 102, Phys 250) has shown that student questions after hearing a lecture are on a higher level in weeks with pre-reading than in weeks without pre-reading. Additionally, students reported having a harder time following the lecture in weeks where no pre-reading was assigned.

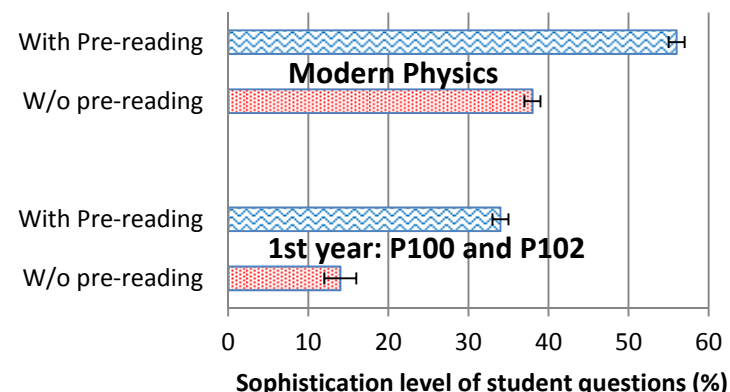


Figure 1: *Sophistication level of student questions for weeks with pre-reading assignments and for weeks without. The sophistication level of student questions is quantified using a Blooms levels-type metric.*

### **What students think about pre-reading assignments**

Assigning reading from a textbook is not new. However, students often do not take the time to actually *read* the assigned text on a regular basis. So what is different with the pre-reading approach? By assigning guided readings coupled with targeted quiz questions, as described below, students begin to recognize the textbook as being helpful to their learning.

From survey data from Phys 101, 85% of the students reported that they read the assigned text every week or nearly every week, with only slightly higher numbers of students completing the

online quiz (confirmed by Vista records). When asked what motivated them to do the pre-readings, more than half said it was because they found the pre-readings ‘helpful for understanding the material’, and ‘to know what to expect in lectures’. Students also cited the marks as motivation. Here’s what some students said:

**Student A:** *“I know that if I complete the pre-reading I will better understand what is going on in the lecture as well as I can figure out where I need to pay the most attention and potentially ask questions.”*

**Student B:** *“I think this forced me to think and was very beneficial to start off the week as I would come into class knowing what to expect and what was expected of me.”*

**Student C:** *“To be honest, I did so because it was for marks. After a while, I didn’t mind reading it; and the questions on the pre-reading quizzes help me understand some of the concepts.”*

### How to implement pre-reading assignments

The pre-reading approach follows from “Just-In-Time-Teaching” (JITT [1]), by which every class is preceded by a pre-reading assignment and a quiz with open ended questions about the difficulties encountered during the reading a day before the next class. The instructor reacts to these postings by adjusting the lecture to discuss the difficulties “just in time” for the next class. The full JITT approach requires a strict timetable for the students and the instructor, which may be challenging to implement in many classes, in particular in multi-section courses.

There is, however, a ‘softer’ approach to JITT that still reaps many of the same benefits. Here the students get a weekly pre-reading assignment to complete over the weekend, preparing the students for the next week of lectures. This simple form has been successfully implemented in Phys 100, Phys 101, Phys 102, and Phys 153; Phys 153 uses two assignments per week. The reading is encouraged by a pre-reading quiz, which is worth marks. There are two key components for the successful implementation of pre-reading assignments: (1) the reading is very specific, and (2) the quiz questions explicitly refer to the textbook, that is, the questions force students to open the textbook.

[1] (C. H. Crouch, E. Mazur, Am. J. Phys. 69, 970 (2001))

### Best practices

1. The assignment should focus on what you plan to discuss in class. This creates a clear connection between the reading and the

expectations of the students for lecture.

2. Omit everything that is not absolutely necessary. The shorter the assignment is, the more likely the students will actually *read* it.
3. The reading should be guided with explicit prompts for the students of what to look for while reading.
4. Give a reading quiz for marks. By assigning marks, you are telling your students that this assignment is important. Students also cite these marks, even as little as 2%, as motivation in keeping up with the reading over the entire term.
5. The questions on the quiz should force the students to read the sections you want them to read and concentrate on the figures that are rich with information. By referring to specific figure numbers, (or equations, etc.) in the textbook, students must at least open the textbook to be able to answer the question.
6. *Refer* to things from their pre-reading– but do not *re-teach* them. The point of pre-reading is that the students are expected to come to class with some knowledge. If you re-teach it all, the students will quickly catch on and stop reading. Explain the purpose of pre-reading in your first class and stick with the approach.

Note that a multiple-choice online quiz is better than a clicker-based (in class) quiz. In addition to saving precious class time, having the students do the assignment at home with their textbooks open lets them review – before class – their mistakes (and at their own pace). A reading quiz is not a pop quiz -- the idea is to prepare students and not to surprise them.

Pre-reading assignments should take less than an hour, with the quiz portion taking no more than 10-15 min. – typically around 5 questions. Use mostly questions that all students could answer with the book, but add in a few that require a little more ‘reading between the lines’. Don’t forget: your goal at this point is to draw their attention to something in particular and to motivate, not to trick them.

Lastly, it is important that the students are explained why the pre-reading will be beneficial to them. Be explicit with your students about your expectations. On the one hand, you expect the students to read the text and try hard to answer the quiz correctly. On the other hand, you do not expect them to ‘teach’ themselves the material nor understand it all 100% from the textbook alone. This first exposure helps reveal the trouble spots to both the student and the instructor.