Full Proposal: Adaptation and Implementation

Integrating Methods to Encourage Student Preparation for Class Meetings
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Summary
I propose to design, test, and report on a teaching technique to enhance student learning primarily outside of the classroom. I will use a mix of informal assessment techniques and student response system technology that I claim will improve the students’ preparatory study habits. The trials will take place in a small lecture (under 50 students) setting.

Targeted Learners
This work should be broadly applicable to many science, mathematics, engineering, and technology (SMET) classes at the undergraduate level. I will be developing the techniques in the context of a section of Computer Science 2 (4003-232), a course taken by first-year students in Computer Engineering, Software Engineering, Computer Science, Computational Mathematics, and other disciplines. A section of C.S. 2 has a maximum of 45 students.

Previous Work
As part of the first Faculty Learning Community in the 2001-02, I designed a technique that I hoped would encourage students to do their reading assignments before coming to class [Heli]. The technique was to give out quizzes on a topic before it was covered in class. The students would then grade each other’s papers anonymously. Afterwards we would discuss the results, allowing me to spend the most time on those areas that the quiz demonstrated as being the most difficult for the students. I saw this as a way to raise the level of discussion of class topics.

In the fall of 2005 I participated in another program, sponsored by Online Learning, for almost the same purpose. I employed a technical solution, a student response system, in my computer science theory class (4003-380) to get the students to answer questions about the material. Sometimes the questions were asked after presenting the material, but sometimes the questions would come first, again to determine if the students had been
doing their reading assignments and understanding the material. Unlike some other faculty in the program, I did not collect data on individual students for grading purposes. I simply collected group statistics on the fly in order to adjust my lecture in real time.

**Motivation and Background**

This project attempts to overcome several deficiencies in the learning process. Primarily, I want to find something to help overcome the freshman student’s lack of good study habits. Also, as usual, I am looking for ways to break up the monotony of a straight lecture. Numerous studies have shown that a person’s attention span is far shorter than the 50 or more minutes RIT allots to a class.

Computer Science 2 [CS], the course in which I intend to apply the techniques, is a crucial one in our sequence. Data collected by the department office staff indicates that success in this course is a good predictor of success in the program as a whole, both positively and negatively.

Many educators have advocated for active learning or peer instruction techniques, as they are sometimes called. Besides the activities of quizzing and question answering in class, the new one I would like to try is called the ConcepTest [Ell][Land]. The ConcepTest is an active student-centered learning technique that has often been used in natural science courses and oft recommended for computer science, but rarely used in the latter. It will be explained in detail in the General Plan section below.

Another technique some advocate is JITT, or Just-In-Time Teaching [Chen]. This involves having students prepare work the night before lecture. I am not confident our students’ schedules will allow this technique to work with our student population, so I am not going to attempt it.

Using the technological response systems called “clickers” is an important part of my plan. I don't like using a show of hands to vote for an answer. There may be many students in a class that have a tendency to wait and see how the “smart kids” vote before raising their hands. I do not intend to utilize clickers to collect data on individual students for grading purposes. However, there is a possibility that I will use the individual IDs that clickers provide to attempt some correlation studies across topics. As of the time of writing this proposal, plans in this area have not solidified.

**General Plan**

In both cases, assessment results from my earlier experiments (see **Background**) were encouraging, but the processes must be formalized and documented more. I would like to attempt to combine the above two techniques into a comprehensive solution of getting immediate student feedback without the fear factor of influence on their grades.

4/12/06
Activities I intend to work into the plan are as follows.

- Design one short quiz on each course topic, approximately one per week, to be administered after the reading on the topic is due and before the material is covered in lecture.
  - The students’ answer sheets will be anonymous.
  - The students themselves will do the grading, on collected and randomly redistributed answer sheets.
  - Answers will be reported to me either by a show of hands or through the clickers. Clearly I cannot utilize clicker IDs here since the answer sheets were randomly redistributed.
  - I will adjust my lecture according to the level of understanding in evidence from the answer distribution.

- Design Conceptest questions to be put to the class at various times during lectures, on the average of one per lecture.
  - Answers will be reported via the clickers.
  - If a significant number of answers are incorrect, each student will be asked to convince his/her neighbor of the answer s/he chose.
  - The “voting” will then be repeated and the answer discussed.

- Design between three and six in-class lab assignments that the students will do in one of our instructional computing labs. These will intentionally include some material not covered in lecture, but contained in the reading material for the topic. Candidate topics (from the course description) are:
  - Inheritance
  - Java Collections Framework
  - File Input/Output
  - Multithreading
  - Graphical user interfaces
  - Networking

These materials will be developed during the summer of 2006 and applied to my C.S. 2 class in the winter of 2006-07.
Expected Innovations and Evaluation Procedure

I expect increased student participation, hopefully resulting in better preparation. The innovations are pre-lecture quizzes in both printed and electronic (clicker) media.

All quizzes and questions will have the answers stored and tabulated to look for trends. There will also be regular polling of the class through anonymous surveys to get a measure of how much reading is going on and when. Extra questions will be added to the student evaluation form at the end of the quarter to again assess the students’ reactions to the technique and how much preparation they did for their classes.

Although not scientific, the final grades of the students in my section will be compared against those in the course as a whole as a way of speculating what lasting impact if any these techniques had on learning. Since the department now keeps statistics on individual course outcomes, those data will be compared as well to see if the techniques were more effective in some areas than others.

I will also present the results described above in a faculty forum. But more importantly, if successful, I will schedule colloquia to inform other SMET faculty of the technique and advise them how they might apply it.

Bibliography

Some of the documents listed here are not formally published. I can make copies available to the reader upon request.


[Heli] Heliotis, James, Pre-tests for Reading Motivation - A Project for the 2001-02 Faculty Learning Community, 2002.


## Budget Plan

<table>
<thead>
<tr>
<th>Item</th>
<th>Explanation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clickers</td>
<td>From Turning Technologies. We already have a cache of about 20. If I have a class of 45 students (maximum), I will need 25 more. We already have a receiver.</td>
<td>$1250</td>
</tr>
<tr>
<td>Laptop computer</td>
<td>Turning Technologies currently requires a PC for its software. If this does not change, the department can loan me a PC laptop for the course.</td>
<td>$0</td>
</tr>
<tr>
<td>Development time</td>
<td>Summer pay to develop quizzes, computer-based questions that work with the clickers, and conceptests. (includes 8.3% benefits)</td>
<td>$4,332</td>
</tr>
</tbody>
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**TOTAL**                                                  | **$5582** |