

Final Report

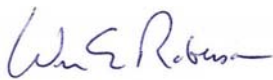
to the

University of Massachusetts Subcommittee on Academic Technology

on the Personal Teaching Improvement Project

Enhancing Science Learning with Clickers

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1. Original objectives and strategies, and revisions to the original plan:

Clickers are wireless personal response devices that look like TV remote controls. They are used in classrooms to elicit students' prior knowledge and assess their understanding immediately and anonymously. Their usage aligns well with current research-supported effective pedagogies. The major aims of our project were to (1) expand the usage of classroom clickers in science courses, (2) assess effective clicker question formulation to enhance learning by UMass Boston's unique student population, and (3) compare their utility in three sizes/levels of classes.

No changes or modifications have been made to our originally-stated goals, objectives and deliverables

3. Activities carried out:

- (1) We purchased 158 i-clicker remote units and 3 base receivers from i-Clicker (41 Madison Ave, 38th floor, New York, NY 10010) in August 2008

- (2) These i-clickers were used by Dr. Robinson during each laboratory period (with one exception – the Boston Harbor boat trip) in all three sections of EEOS 121 Introduction to Environmental, Earth and Ocean Sciences Laboratory (22, 12 and 15 students in each section; 49 students total), and by Dr. Sevian in the large chemistry lecture course, Chem 116 Chemical Principles II (60 students) during the Fall semester. In addition, clickers were used by Dr. Sevian in her large Chem 115 Chemical Principles I class (120 students) and Dr. Robinson in his small graduate class, EEOS 635 Environmental Toxicology (5 students) during the Spring semester.
- (3) On 29 September 2008, Dr. Robinson used i-clickers during one of the EEOS department's Monday seminar classes in order to familiarize the department faculty with clicker usage. He coordinated his presentation on clicker use with the scheduled presentation by his graduate student, Ms. Jeanette Mollerleu, entitled "The mechanism for the transfer of Cd from the blood to the kidney in marine bivalves." After handing out i-clickers to all faculty and graduate students present, he discussed the benefits and drawbacks of clicker usage. He then demonstrated clicker usage by polling the audience with 4 questions that were devised to gauge the audience's background knowledge in the area that Ms. Mollerleu was then going to report on. After polling each question, he shared the results (i.e. the bar chart that is automatically produced as the votes are tallied) with the audience and discussed the intended purpose of each question. This gave Ms. Mollerleu a much better idea of how much detail she needed to provide in her talk to meet her audience's level of understanding. During her talk, Ms. Mollerleu posed two clicker questions to her audience in order to determine whether or not they understood the concepts she was trying to convey. Finally, after Ms. Mollerleu's talk, Dr. Robinson followed up by asking three additional clicker questions in order to assess how much the audience learned from her talk. The overall demonstration of i-clicker use was well received and raised a great deal of interest by the faculty. Two faculty members approached Dr. Robinson a few days after the seminar, asking if they could use his i-clickers in their classes next semester.
- (4) Prof. Sevian discussed the use of iClickers with most of the faculty in the Chemistry Department during the Fall and Spring semesters.
- (5) We conducted formative evaluations of clicker use by polling our students at the end of the Fall and Spring Semesters. The vast majority of students felt that the use of clickers in the classroom positively enhanced learning.

For example, in the three sections of EEOS 121 Introduction to Environmental, Earth and Ocean Sciences Laboratory, the 35 students who were present during the last class were asked the following question:

“Clickers are.....

- A. *a waste of time*
- B. *useful for sharing opinions among students*
- C. *useful for comparing student’s results among the class*
- D. *useful for getting sense of what the class already knows about a topic at the start of the class*
- E. *useful for stimulating discussion”*

The results of the polling (see table below) indicate that the vast majority of students saw the value in using clickers in class. While divided as to how they were useful, almost a third of the students (11) identified answer D as the most important.

	A	B	C	D	E
# of student responses	2	8	8	11	6
% of student responses **	6 %	23 %	23 %	31 %	17 %

** N = 35 responses in total

The above results are typical for undergraduate lecture classes. Interestingly, even in relatively small sized lab sections (rather than the more typical application in large lecture classes) students perceived that clicker use enhanced their learning. This response was also observed in a small graduate student class (EEOS 635 Environmental Toxicology; student enrollment =5 during the Spring 2009 semester). Four of the graduate students felt that clicker use was useful for stimulating conversation and one felt that it was useful for sharing opinions among students. None of the students felt that clicker use was a waste of time. In addition, when the class was asked if clicker use helped them to learn, all five of the students unanimously responded that clicker use “helped considerably.”

- (6) We have prepared a web page that is in the process of being uploaded onto the Center of Science and Math in Context (COSMIC) web page (<http://www.cosmic.umb.edu/>). Our “clicker page” contains a description of what clickers are, a list of faculty members at UMB who currently use clickers in their classes, a link to a two-page flyer entitled “7 things you should know about clickers,” and a list of references and citations on effective clicker use to promote student learning.
- (7) Apurva Mehta, Director of Client Services for IT Application Services here on the UMB campus has spoken with us about contributing to an initiative to support iClicker technology here at the UMB campus. We expect to participate in this

endeavor in the near future.

- (8) We anticipate that we will prepare a presentation on iClicker use during for the UMass Information Technology Conference sometime during the Fall 2009 semester.

3. Deliverables:

As explained in Section 2. above, our tangible deliverables include:

- (1) The developed web page on clicker use, including links to a 2-page flyer on clickers and in-depth information on effective clicker use.

4. Assessment:

This project has been highly successful. We have almost doubled the number of faculty on the UMB campus who now use clickers routinely (from 4 faculty prior to the submission of our proposal to 7 faculty now). Through our outreach activities, we have made faculty in both the EEOS and Chemistry departments more fully aware of what clickers can do and how they can support enhanced student learning. Because of these efforts, several additional faculty have approached us with questions and have expressed their willingness to try clickers in their own classes. Our experience with clickers has convinced us of their value. We intend to continue using them in our undergraduate and graduate classes, both in large lecture hall formats and in small laboratory sections.

5. Issues and further questions:

Faculty resistance to adopting clickers for their classes revolves around the question “How much time will I have to devote to learning how to use this system?” Our presentations to faculty have stressed that the iClicker system is very easy to use, requires only a small amount of time to become fully familiar with, and is driven by very user-friendly software. One of the reasons that we had chosen the iClicker system over many others that are on the market today was their simplicity and ease of use.

However, we cannot say that clicker use does not require a significant expenditure of time. There are two reasons for this:

- (1) clicker use needs to be seamlessly integrated into the classroom lectures. They must be part of the normal flow of the class. Otherwise, they may actually disrupt the flow of the class.
- (2) clicker questions must be well thought-out if their use is to have maximal effect.

To address both of these issues, a significant amount of time and effort must be expended by the instructor during his/her class preparation. We believe that the benefits far outweigh the costs, however. Nevertheless, this is an area of research that needs to be addressed further.

6. Disposition of funds:

There are no unexpended funds in this grant.

7. Other comments:

We have become even more firmly convinced that clickers can have a significant positive impact on learning in both large and small classes. This small Academic Technology Grant has changed the way both of us address teaching, and has heightened both awareness and use of clickers (albeit small to date) by other faculty members. We have created a learning community on clicker use among faculty here on the Boston campus, and we will continue to serve as a resource for other faculty to call on in the years to come. Our initial assessments have shown that clickers are useful for promoting student learning in large lecture classes, small laboratory sections and in very small graduate classes. We have learned that attention to question formulation is the key to clicker success.