Engaging Students in Introductory Biology Courses through the use of Clickers

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Students learn best when they are actively involved in the learning process. Student response systems, or 'clickers' are a mechanism of engaging students in learning, particularly in larger classes. Previous studies have indicated that students enjoy using clickers and they remain more engaged in the material when clickers are incorporated throughout the semester compared to the traditional lecture format. There have been limited studies about the success of clickers in improving student learning, particularly compared to other active learning strategies.

Clickers have many potential uses in large classes including:

- ❖Collecting opinions
- ❖Collecting anonymous feedback
- ❖Taking attendance
- ❖Generating discussion
- ❖Reviewing material
- ❖Gauging student mastery of concepts
- ❖Administering quizzes
- ❖Discussing case studies

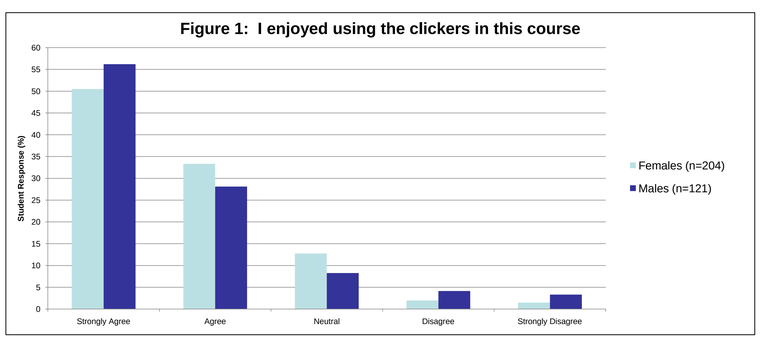
In this study, we incorporated clickers into three different introductory biology courses for both science majors and non-majors and assessed both student satisfaction and improved student learning. In all the classes in this study the students were assigned clickers for the entire semester, the clickers were used in almost every class period, and usually multiple times during the class.

At the beginning of the semester, with less than 10% of the class having previous experience with clicker technology, students responded as follows to general questions about the use of technology in the classroom:

- ❖86% enjoy using technology in the classroom
- ❖84% appreciate when a teacher asks questions intermittently to assess student learning
- ❖66% are unlikely to answer a question posed by a teacher willingly
- ❖53% find it uncomfortable to participate in discussions in large group settings
- ❖65% indicate that they usually have opinions that they would like to add to a class discussion

Our research supports other previously published data about student satisfaction with clickers in the classroom including student enjoyment (fig.1), likelihood of increased participation (fig.2), perception of clickers as an effective teaching tool (fig.3), and desire to use clickers in other courses (fig.4).

Figure 1: I enjoyed using the clickers in this course



Additionally, on end of semester surveys, 88% of students responded that they are glad that clickers were used in their course that semester and over 90% of students preferred using clicker technology to take quizzes compared to paper quizzes.

Figure 2: Clickers allowed me to participate more in this class than I would in another class this size

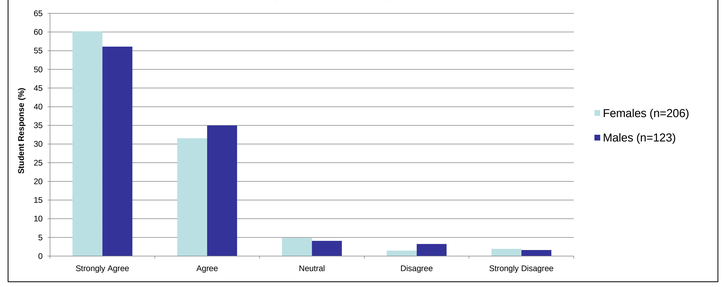


Figure 3: The clicker is an effective teaching tool in a class this size

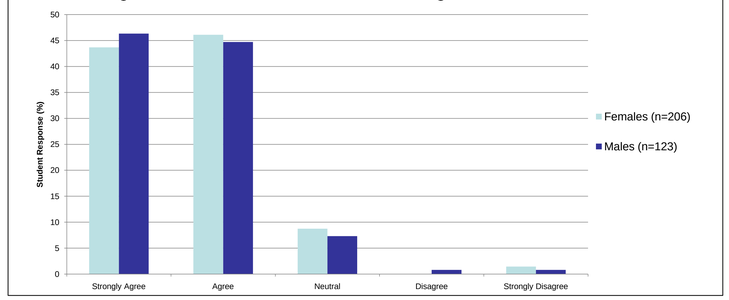
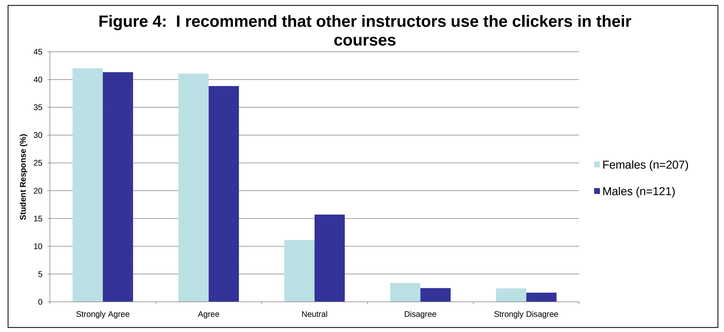


Figure 4: I recommend that other instructors use the clickers in their courses

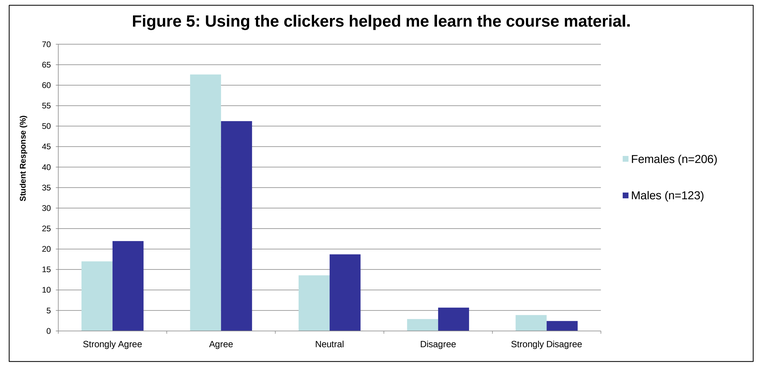


Listed below are Viterbo student comments about the benefits of using clickers in the classroom :

- ❖"The review questions during class kept me awake and on track with the lecture"
- ❖"The questions refreshed my memory of what we went over in the last class"
- ❖"It makes taking quizzes exciting and fun"
- ❖"It helped me get fully involved in the learning process by physically engaging in the process"
- ❖"It encouraged me to come to class more often, knowing I would miss clicker quizzes/questions if I skipped"
- ❖"It was great for me to see how I compared with the rest of the class"
- ❖"I appreciated the instant feedback on my answers"
- ❖"I liked the active participation rather than just sitting there listening"
- ❖"With the clickers we were constantly reviewing and reinforcing key concepts – improving my retention of the material"
- ❖"The clicker quizzes always put me in a good mood – and I learn better when I am in a good mood"
- ❖"It allowed me to see what I needed to study by showing immediate results"

The majority of students clearly enjoy using clickers in the classroom, but do clickers improve student learning? Figure 5 demonstrates that students perceive that the technology improves their learning.

Figure 5: Using the clickers helped me learn the course material.



In one course, 92% of students indicated that the clicker technology positively impacted their learning in Biology 160. Additionally in this course, sixty multiple choice questions from several exams were compared to assess the impact on student learning. Thirty of the questions were related to concepts reviewed by clickers and 30 questions were related to concepts that were not reviewed by clickers. The percent of students (n=68) who got the correct answer on the multiple choice question was compared:

- 81% correct on concepts reviewed by clickers
- 68% correct on concepts not reviewed by clickers

These limited data suggests that clickers may improve student learning compared to traditional lecture alone. More studies need to be completed to compare the benefits of clickers to other active learning strategies.

Not all of the student comments about clickers were positive however. Students express the follow concerns:

- ❖"Sometimes the clickers didn't work and we wasted time"
- ❖"Sometimes I wanted more time to think about a question"
- ❖"People could cheat pretty easily in a large class"
- ❖"I couldn't be sure they recorded the answer I wanted"
- ❖I don't like "keeping track of the clickers and not losing them"
- ❖"I don't think the questions on clicker quizzes were as complex as they would have been if we took the quizzes on paper"
- ❖"They would be too expensive if we had to buy them ourselves"
- ❖"They are ok in a science class, but I hope other disciplines don't adopt them"

Best Practices for Clicker Use

The following suggestions for implementing clickers into courses comes from the literature (available on request) and our own experience using clickers:

- ❖Use the clickers consistently throughout the semester so the instructor and the students get comfortable with the technology
- ❖Keep slides short with simple questions
- ❖Limit the number of answer options (similar to a multiple choice question on an exam)
- ❖Use the clickers throughout the lecture, not just at the beginning or the end
- ❖Give students plenty of time to answer questions
- ❖Be able to adapt to students forgetting their clickers or technology issues