

Using Clickers in the Construction Classroom

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Keeping students engaged in a classroom has always been a challenge. With today's students who have grown up constantly bombarded by fast-paced audio and video, they demand the same in the college lecture. This paper will address how using a Student Response System (SRS), commonly known as clickers, has helped an instructor at a four-year university pull the students' attention to the lecture material. This paper's intention is to introduce construction faculty to student response systems. Specific topics will include a brief history of clickers, a description of the system, the author's implementation of clickers in two different construction courses, the results, the students' opinions of clickers, tips for implementing a student response system, and the future for clickers.

Keywords: student response systems, clickers, engagement

Introduction

After being out of college for twenty-two years, the author began teaching in construction management and technology. Very quickly, he noticed that today's students seem less motivated to sit and just listen to a lecture. Technology has pervaded their lives with cell phones and texting, portable media players, and laptops. Most students are reluctant to give answers for fear of being embarrassed, which has always been the case.

In brief, student response systems allow the instructor using PowerPoint to pose questions to students. Students then enter their responses using a small handheld device. The students' answers are tabulated and the percentages of each possible answer are displayed along with the correct answer. The results are recorded in a file for later analysis. The rest of the paper explains this in detail.



Figure 1: Clicker & USB Receiver, and Bundled Kit

What Are Clickers and Why Use Them?

Student Response Systems, commonly called clickers, are also known as Classroom Response Systems (CRS), Classroom Performance Systems (CPS) and Audience Response Systems (ARS).

What is a Student Response System?

Student Response Systems have been around for about 35 years. When the author was telling his father-in-law Marv Marshaus, a retired career high school math teacher, about the new system the author was trying out in one of his lectures, he told me about his system. In 1975, Ayersville, Ohio was building a new high school, and he was allowed to request items for his classroom. Installed was a system of twenty-four desks with four buttons hardwired into the student's desk, which will allow the students to respond A through D to his questions put up on overheads. He had a panel at his desk that would show their responses with small lights. Also included were meters that showed percentages for each answer. He then manually recorded the results. Mr. Marshaus referred to the system as "Tune Them In and Turn Them On Electronically." As a humorous note, he mentioned that students would sometimes fool with the system, allowing class time to be wasted.

Today's systems are much more sophisticated in regard to hardware and software, but not necessarily in concept. They integrate into a Microsoft PowerPoint presentation on a PC or Mac. Radiofrequency (RF) or infrared (IR) transmitters, also called keypads, and receivers are used, Figure 1. RF systems are becoming the standard because they work better than IR systems. Lower cost systems may only allow for a 1 to 9 response with an LED indicating that a response has been sent. Some higher cost systems allow text to be input.

The instructor has a receiver that transmits the students' responses into a computer program. A summary of the students' responses with a percentage of each answer selected showing on the screen. The individual responses are saved in a file for later report generation and exporting to spreadsheets.

The Uses for Clickers

Clickers have multiple uses:

1. Classroom response systems are to engage students into a lecture with interspersed questions.
2. Clickers are used to give quizzes.
3. They can add to the energy level of the classroom by stimulating individual and team competition.
4. Student response systems can take attendance.
5. They can facilitate classroom discussion.
6. Clickers in the classroom are used for exam review.
7. They can be used to find the fastest responders in competitions.
8. Clickers could be used for peer assessment after students give presentations.

Why Clickers Work

The author believes clickers are effective for a variety of reasons. The student's responses are anonymous to the other students, which allow all students to participate. They force a shift mental mode, from passive listening to active participation. It forces thought instead of just an intake of information. It is tactile, gives students something to do with their hands other than text message under the desks. Feedback is immediate which means the student does not need to wait for a quiz or test for assessment. Answering is anonymous, allowing less confident students to participate. Competition is fostered by adding a Leader Board, which only displays the top scores, see Figure 2.

From the instructor's viewpoint, clickers allow immediate assessment of the students' comprehension. The instructor can pause and add clarification if the students did not understand a topic. While waiting for the students to respond to a question, the instructor has a break from speaking in which to collect his thoughts.

The pedagogical issues are still being explored, but one theory contains three key points that an integrated Student Response System should contain (Holland & Lide, 2006)

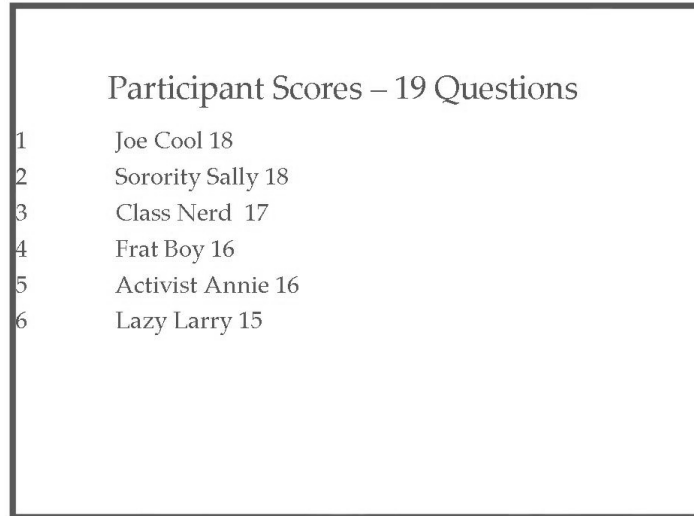


Figure 2: Competition Leader Board

1. **Learner Centered.** The class must be focused on the knowledge, skills, and attitudes of the student. The instructor becomes more of a coach and less of a teacher. Studies have shown that up to double the retention of lecture material using a SRS compared to traditional lecture.
2. **Knowledge Centered.** Learning critical thinking skills are necessary to achieve higher levels of learning, not just factual memory. This can be achieved with clickers by presenting a problem to the class, allowing them to discuss the problem and then key in their responses. Another round of a mini-lecture, discussion and answer entry occurs until the desired learning outcome is achieved. This is also referred to as peer instruction.
3. **Assessment Centered.** Prompt feedback to the students so that the students and instructors can observe the progress in the learning outcomes. This is easy to achieve with the clickers.

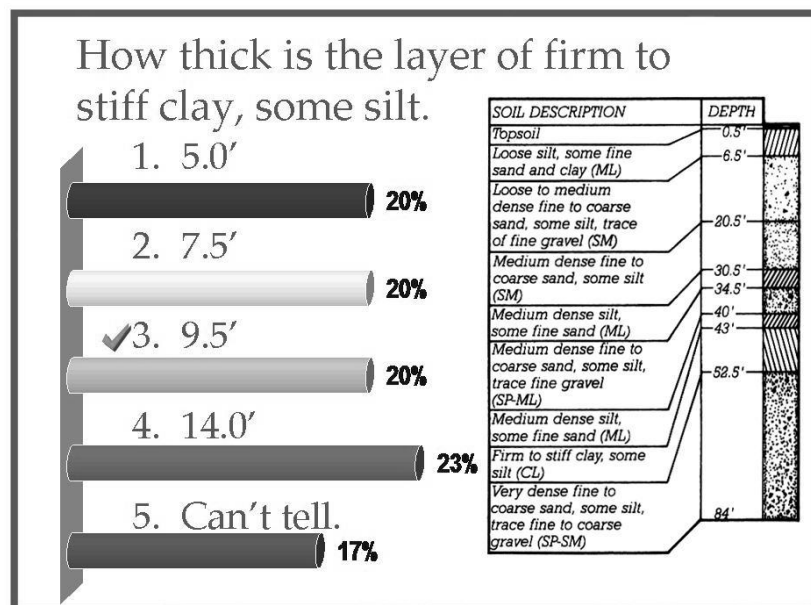


Figure 3: Question Example with an Offset Bar Chart and Picture

The Students' Opinions of Clickers

After using the clickers for three weeks, students were asked for their thoughts on using the clickers. Everyone raised their hand except for one student. When asked why he did not like them he responded, "I don't like clickers because I have to pay attention".

From Fall 2007 pilot program, 75-80% of the students stated the use of clickers made the class more engaging, fun, or enhanced their learning. Another survey from Spring 2008 semester, 84% of the students stated the same. Overall 94% rated the clickers either good or excellent (Rathsack 2008).

Students did not like waiting for other students to answer. Adding a countdown timer solved this. They certainly did not like it when there were technical difficulties. Most of this was solved by testing before class. Some students asked for the questions to be posted online which the author has not done to date.

It was suggested by one student that if the results from each lecture were graded, and not merely an attendance score, it would enhance her learning of the material. The other students met this with much opposition. Other semesters of students have been asked their thoughts on this, with the response being universally negative.

Students have suggested bonus points or prizes for the high scores. I tried a suggestion of current music playing while the timer was running, but this proved to be too big a distraction.

Implementing a Student Response System

The success of implementing a SRS system depends on a combination of technical, social, and pedagogical factors (Jackson 2003). All must be taken into account for the system to be effective in the classroom.

The Mechanics of a Student Response System

The components of a student response system:

1. A receiver which is attached to the computer (a usb port on the TurningPoint system).
2. Student transmitters (one per student).
3. Computer software which integrates into PowerPoint.
4. A personal computer or Mac.
5. Microsoft PowerPoint software.
6. An overhead projector.
7. An instructor willing to implement the system, and
8. Students.

Most classrooms will have all of the above except the first three items. The software for the TurningPoint system was at no charge, the receiver costs about \$150.00, and the clickers cost about \$48.00 each. The cost to the school will be minimal if the students purchase the clickers. The bookstore will buy them back for approximately \$22.00.

Questions are integrated into a PowerPoint presentation. These questions can be multiple choice, true or false, ranking, or other types. Integration with the Blackboard online system is available for posting attendance and scores, and for registering students' clickers if they are supplying their own.

Several formats for question and answer display are available such as horizontal bar, vertical bar, pie, or donut charts.

Steps to Implement a Student Response System

1. Install the software on computer.
2. Determine types of questions to be asked.
3. Select the formatting of the questions to be used.

4. Add question slides to PowerPoint presentation.
5. Determine if counters and timers are wanted on the questions, Figure 3.
6. Add competition slides to the end of presentation.
7. Create a device ID/student file also called a participants file.
8. Test the system using the actual student transmitters.

The sequence of events in the lecture:

1. Participant data is loaded.
2. Slides are shown to the students presenting the lecture information.
3. A SRS slide is presented asking the students to respond to a question.
4. A timer starts counting down the time allowed for the question.
5. A counter is shown giving the number of responders.
6. When the time is up, the instructor shows the percentages given to each answer.
7. The instructor shows an indicator of the correct answer.
8. Time is taken to discuss the answer if necessary.

Following lecture, the instructor can generate various reports showing student's:

1. Attendance
2. Score
3. Many other variations of the above.

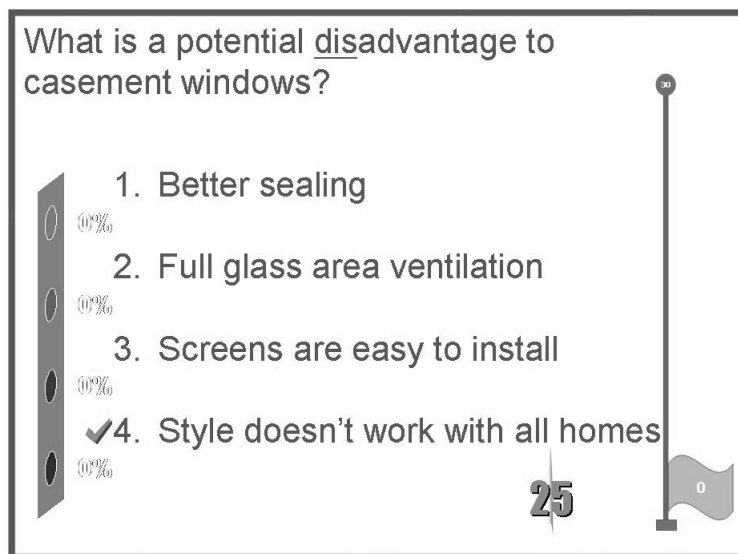


Figure 4: Response Counter and Timer

Types of Student Response System Questions

The formats of questions the author currently uses are multiple choice or true / false. Other forms are available such as ranking.

Questions are used for different purposes to:

1. Check the students' comprehension of the presented material, Figure 3.
2. Check the students' retention of the presented material from previous lectures, reading assignments, or lab.
3. Reinforce an important concept.
I like to refer to this as a "virtual hammer".
4. Assess prior knowledge before it is presented, Figure 5.
5. Present a list of advantages, disadvantages, or properties by presenting a list with one incorrect choice or an "all of the above" response, Figure 4.

6. Ask for the student's opinion to stimulate a discussion.
7. Questions can also be added on-the-fly.

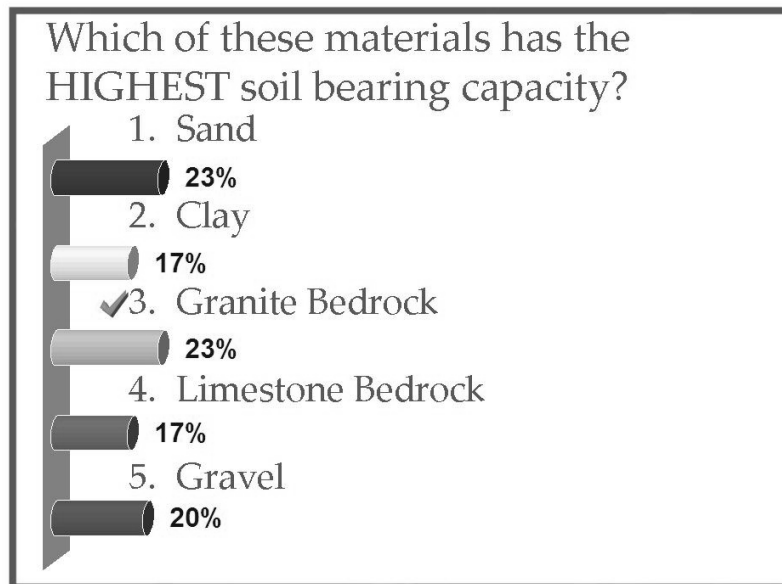


Figure 5: Preassessment

Tips for Using the TurningPoint Software

There is a moderately steep learning curve in implementing this software. These tips should speed your implementation. This is assuming the user is proficient with PowerPoint. These tips are a result of five semesters' use of the system.

1. Make use of web seminars provided by the vendor.
2. At the first class, give a short icebreaker presentation to familiarize the students with the system.
This helps relieve the student's anxiety.
3. Run a test in the first class to verify every student's clicker is working to relieve their concerns of not being recorded.
4. Explain your reasoning for using a student response system.
Engagement, attendance, quizzes, presentation of lists, and as you see fit.
5. Explain that there may be minor problems, and ask for their patience.
This helps diffuse the student's irritation.
6. The first slide should be to remind the instructor to load the participant data.
Very important for the students to have their answers recorded.
7. Add a counter to show how many students answered the question.
It lets the students know the system is working.
8. Add a timer to count down the time left to answer.
Students become bored if they answer and have to wait too long for the others.
Set the time length to match the number of answers and the difficulty of the question. Add more time for math problems.
9. The students prefer a count down sound with the slide.
They are uncomfortable with silence.
10. Put a sticker with a number on the top of each clicker if the instructor supplies the transmitters.
Finding the numbers on the back is too difficult.
11. Mix up the types of questions, multiple choice, true / false, discussion, lists.
Students get bored even with a Student Response System.

12. Warn students not to use other students' clickers.
Remind students that this is considered academic dishonesty.
13. Avoid making the lecture scores a part of the students' grade.
At least until you have fully developed the questions and the system.
14. Add a humorous choice to an occasional question, Figure 6.
Everyone enjoys a good laugh.
15. Display a Leader Board at the middle and the end of the lecture.
This is great for stirring up competition.
16. Consider giving a prize or extra credit for the top scores on the individual Leader Board.
This would definitely enhance the competition.
17. Make sure to store the session information.
It is not good to forget to record the students' efforts.

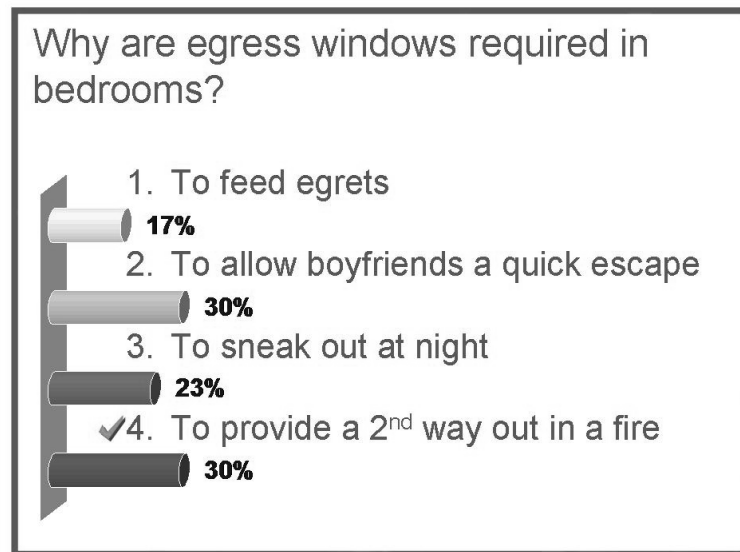


Figure 6: Humorous Question

The Author's History with Clickers

In the fall of 2006, the author attended a classroom technology open house at Bowling Green State University (BGSU). The most attention grabbing display was the TurningPoint Student Response System. After receiving an explanation of the system, the author immediately thought this was a fantastic idea. The representative said that BGSU was going to do a pilot program with this technology, and was looking for volunteers. The author signed up with the hope of using the system during spring semester. It took until summer semester for me to receive the hardware for the pilot program. This was good because working with a smaller group for the first use made it much easier.

There were several meetings with the BGSU sponsor of the pilot, The Center for Teaching, Learning, and Technology (CTLT), now the Center for Teaching and Learning, and other pilot faculty. While waiting for the hardware, the author installed the software and took two interactive online training seminars from Turning Technologies, Inc. A receiver and enough clickers for a class of eighteen students were loaned one week before the summer semester of 2007.

The author started with existing PowerPoint slides from his class: "Introduction to Construction CONS 235". This class is mix of students majoring in Construction Management, Architecture, Interior Design, and some other majors. Students are mostly sophomores and juniors with some freshmen and seniors. An outline of the class PowerPoint slides is provided online to the students before each lecture.

Adding question slide was the beginning. The questions previously asked during the lectures were adapted to TurningPoint questions, which turned out to be more difficult than expected. Formulating three wrong but plausible answers takes time. Sometimes a true or false question worked better. Pictures can be included on the questions slides, Figure 3.

Working from student feedback counters, timers, sound, Leader Boards, and teams were added to the presentation for fall of 2007. This was the "Introduction to Construction CONS 235" large lecture class with 75 students.

For spring semester 2008 the author added TurningPoint question slides to my "Construction Document Reading CONS 239" class. For fall semester, 2008 Bowling Green State University adopted the Turning Technologies TurningPoint system as the officially supported Student Response System.

Future

The only disappointment experienced with the implementation of a student response system was the lack of a significant improvement in student test scores. Using the same lecture notes as before implementing the clickers, there was no significant change in test results.

With the TurningPoint system, the LED light is supposed to light green when a response has been sent. However, when many students are responding the lights may show amber, which caused the students anxiety. Displaying the student names of those who have not responded is possible before time expires, but not after time has expired.

The next step will be comparing the student response scores and attendance with their test results. Further work will be to develop pedagogies using Student Response Systems that will improve the retention of the presented material. One option might be to make the actual score, compared to just attendance, part of their grade.

Conclusion

Using the student response system has been a resounding success. More students are now engaged in the lecture. They all must now be active participants, rather than passive listeners. Although there are some hardware and software limitations, hardware and software developments will continue to improve the systems. The challenge will be to use the systems to improve the retention of the class material.

Hardware / Software Supplier

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