

i>clicker Pedagogy Case Study: Clickers in Elementary Classrooms

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PROJECT OVERVIEW

The goal of the project was to investigate how classroom response systems (“clickers”) could be used in elementary classrooms. During a series of hands-on science and inquiry lessons, nine teachers explored several uses for clickers, including formative assessment of student learning.

The study was conducted with two groups: faculty at the Henry Barnard School, a laboratory school on the campus of Rhode Island College that prepares students for teaching careers, and teachers at the Washington Oak Elementary School, with whom Professor Greg Kniseley collaborates during the field placement component of a methods course called *Teaching Elementary School Science*.

Teacher participants in the project included:

Henry Barnard School, Rhode Island College, Providence, Rhode Island

John Arango, Technology Education

Karen Capraro, Grade 2

Michelle Nonis, Grade 1

Washington Oak Elementary School, Coventry, Rhode Island

Andrea Braga, Unified Staff, Grades 3-5

Jackie Costa, Grade 4

Michelle Hammer, Grade 4

Don Jacques, Grade 4

Lisa Kiernan, Grade 4

Brian Main, Unified Staff, Grades 3-5

Also, Dr. Marie Lynch, Assistant Professor of Special Education, examined accommodations for students with disabilities.

In December 2008, Julie Kehrwald from i>clicker conducted an online training session for the nine study participants. Professor Greg Kniseley also presented the teachers with pedagogical training, including recommendations for clicker activities and applications and tips for structuring questions. (Sample questions are located at the end of this document).

During the six weeks between January and mid-February 2009, teachers planned how to integrate clickers into their teaching. Greg Kniseley and project videographer Andrew Grant videotaped one of the project teachers and a student teacher during class and, following the lessons, interviewed them and their students.

During a follow-up meeting in April 2009, each teacher discussed how they used clickers in their classroom, articulated the benefits realized and challenges encountered, and responded to a questionnaire. The teachers' verbal and written responses during this follow-up meeting served as the basis for this case study report.

The project was supported with funding from the Rhode Island Teacher Education Renewal, a federally-funded teacher quality enhancement project. Rhode Island College provided funding for Greg Kniseley's time.

Title/Subject: Clickers were used with K-5 students in the following subject areas:

- *Science:* Grade 4 unit of Science and Technology for Children (STC)–“Electric Circuits”; Grade 2 Full Option Science System (FOSS)–“Pebbles, Sand, and Silt”; Grade 1 STC–“Weather”; Grade 3 FOSS–“ Water”
- *Social Studies:* Grade 2 biography unit during African American History Month–*President Barack Obama*; Grade 1–*Egypt* and *Martin Luther King*
- *Math:* Grade 2–*time*; Grade 1–all math subjects
- *Technology:* Grades K-5–*Lego robotics, buoyancy, forces and structures, properties of water, transportation, and simple machines*

MOTIVATION FOR USING i>clickers

Teachers were motivated to use clickers to:

- improve assessment of student content knowledge and skills before and after a lesson

- receive immediate student feedback on teaching
- engage students in learning
- increase student interaction
- build a community of learners who could share opinions, values, or feelings and become acquainted with each other’s interests, preferences, skills, and abilities

IMPLEMENTATION

Obtaining i>clickers/Registration: i>clicker loaned 100 remotes and one receiver to the Washington Oak Elementary School Grade 4 teachers. Rhode Island College provided additional i>clicker remotes for the project. Teachers used i>clicker’s in-class registration tool (known as “roll call” registration where students ‘vote’ to associate their name with their clicker) to register students in Grade 1 and above. One Grade 4 teacher personally registered students using the “roll call” registration tool (instead of executing the registration activity in class).

Classroom Technology. In addition to clickers, teachers used a tablet PC or other laptop, digital projectors, and PowerPoint. Below is an example of PowerPoint as a tool to instruct students on i>clicker usage and to pre-assess conceptual understanding of FOSS “Earth Materials” in a Grade 4 class.

Assessing Student Learning with I>Clickers in Elementary Science Programs



Prior to teaching a series of hands on, inquiry lessons featuring FOSS “Earth Materials,” Rhode Island College teacher candidates use the I>Clickers student response system to pre-assess Grade 4 students’ conceptual understanding. First, they teach the students how to use the remote (A). Next, they present selected response questions on PowerPoint slides (B). Students vote with their remote (C). After each question, students view the results (D), turn and talk with a partner and discuss the reason for their response. Then, teacher candidates conduct a discussion with the whole class.

Also, RIC teacher candidates use clickers during a post-assessment lesson. The I>Clicker software stores individual student responses to each question. This enables teacher candidates to compare the pre- and post-assessment data, reflect on the progress of their students’ understanding, and propose actions for improving instruction.

Daily Use/Questions Asked: Teachers used clickers to facilitate a variety of applications and activities, including:

- formative assessment (to inform teaching and learning and to help teachers gauge student understanding of lecture material)
- peer instruction (Think-Pair-Share cooperative structure)
- interactive games such as “Millionaire” and “Jeopardy”
- daily classroom management routines such as attendance, lunch count, and surveys

In most classrooms, teachers used the clickers about two times a week, asking 5-10 questions during each lesson. Clickers were used daily in the technology education classes. Questions elicited the learners’ ability to recall and confirm facts, understand bigger ideas, and make predictions before or during an investigation. The use of clickers stimulated students’ self-assessment, reflection, and idea-sharing and allowed teachers to more easily assess students’ reasoning.

Teachers used the following strategies during the polling process:

- Learners worked in small groups and worked alone.
- Learners discussed their answers with their peers and then responded (peer instruction model).
- Learners voted first and then the teacher opened up the class for discussion.
- Teachers allowed for discussion after a question.
- Teachers called on learners at random to explain their answers.

Examples of Implementation

Following are reports by teachers on some i>clicker applications and outcomes.

As an “Anticipation Guide” in Reading

I first had the children view questions about Barack Obama and answer them with their best guess. Next, I read aloud an Obama biography and asked the students to listen for the answers to the questions I had just asked. Following the read aloud, the students were then asked the same questions.

As Ongoing Feedback on Teaching

I used the reporting feature to determine which students were participating. It showed me immediately what I needed to review with my students. It allowed me to discuss the issues with my students in the moment. The students looked at the graphs to inform them of the percentage of students answering questions correctly. When there was a misconception, they noticed by looking at the graphs. We would go over the choices again and discuss what happened. It showed me what I could do better in future lessons and at times how I could structure the question differently.

If children were unable to answer a question, it told me that I had not been successful in my original lesson; it also told me I needed to redesign the lesson for next year and re-teach the lesson ASAP.

As a Math Review Tool

Towards the completion of our unit on “Time,” I made a PowerPoint that included timelines, clock faces, vocabulary associated with time, calendar pages, etc. After answering each question, I displayed the graph, and allowed students to discuss the answers as a class.

RESULTS

Successes

More Engaged, Motivated, and Interactive Learners. The use of i>clickers resulted in increased learning and more dynamic class interactions.

The process allowed the students . . . to effectively use the response system during class. They were able to test their knowledge and understanding, ask questions, and share ideas. Using the i>clicker to integrate instruction and formative assessment into the lessons . . . increase[d] student engagement, interest, and learning.

I loved the i>clickers. If I had them in my room permanently, I would use them quite often for a variety of purposes. The best part is that you can engage everyone simultaneously rather than one question, one answer, etc. Using the clickers required every student to think about every question posed.

The clickers worked as motivation to the students because it was something new.

I was able to observe the clickers used in a fourth grade class. The clickers kept the students engaged and motivated.

The CRS allowed my students to be anonymous. This worked quite well for my students who are reluctant to share with the whole group. It gave them an immediate answer, which they loved. They have a hard time waiting for anything in a world with instant messaging, digital cameras, etc. The graphs provided the students with the instant gratification that they so desire.

Challenges

Teachers reported some challenges with the process and equipment:

The principal challenge was making sure that the process [technology] did not take over the actual learning.

The most challenging part, that I never did overcome, was how to use the system for inquiry science in an individual lesson. How do you design a question with answers without taking away some of the inquiry? If I offer you choice A, B, C, D, you will know the correct answer is one of the options. This will, I think, stop you from coming up with the ideas on your own.

At Washington Oak Elementary School, some users encountered technical problems. It became clear, after reviewing the teachers' feedback, how important the availability of ongoing technical support will be for successful, sustained implementation of clickers in elementary schools. While i>clicker technical support is available, few of those involved in the pilot made contact with the support team. Note that no problems were reported at the Henry Barnard School.

Making sure there were enough clickers for all classes and that the clickers we had worked properly (batteries) caused some problems. Additionally, setting the four classrooms to different frequencies so that more than one class could use the clickers at one time was challenging.

A challenge for me was the "quickness" of the responses being received. At times, it would take over 2 minutes for the last response to be read by the system. In a first grade classroom, that is too long to wait. Though my students are patient, some were frustrated when their clicker did not work, or showed them a red light, over and over again. They knew to raise their hands so that I could help them clear it, but that was also time consuming. Another challenge for me was the set up. I had to schedule my lessons around my special times so that I was able to set up the projector and laptop.

Note from i>clicker: *The base performance described above is indicative of a weak antenna. We would replace the base immediately (gratis) in this case. Fortunately, our technical support team is well-trained to troubleshoot with these kinds of issues and can help solve any hardware problems quickly.*

As a resource teacher without a classroom I found it difficult to incorporate the clickers into lessons.

I did find that the timer being projected was a distraction to the students because some tried to see if they were the last one to click in.

Note from the author: *Savvy, mischievous students play a game with the count-up timer-tally of votes and their remote. This can be irritating off-task behavior that affects both the teacher and other students who “follow the rules.” One suggested solution is to project the voting grid, which displays clicker remote numbers as students vote. The teacher will notice a pattern (remote ABCDE that is always the last to vote)--then identify the student who is playing the game and finally address the "off-task behavior."*

Note from i>clicker regarding technical problems:

We believe these technical issues were due to two factors:

- The user testers were not familiar with the frequency setting options in the i>clicker software that would prevent interference. Many schools choose to assign a default frequency for each adjacent i>clicker classroom and post a sign with that frequency in clear view of the class, to avoid any confusion at the beginning of class for both teachers and students. This is something we'd help train future teachers involved in these activities to do to avoid frequency interference.*
- We also believe one of the receivers sent to the pilot testers was defective (poor range). While defective bases are rare, we would have immediately replaced the base and this would have addressed any speed/red light issues.*

CONCLUSIONS/DISCUSSION

All of the teachers reported that they would use the clickers in the future, and that they were user friendly. They stated that the i>clickers “got me thinking about linking goals-content-techniques-assessment” and were useful “as a tool for lesson modification to accommodate a specific learning style and assessment” and “for the design [of] . . . presentations and discussions that would . . . support active learning.”

Here are some additional comments:

If [our school] gets clickers for the building, I will use them all the time.

I think that utilizing the clickers and the CRS in my classroom is beneficial. I like the fact that information can be provided as to how individuals are answering questions. . . . I would like

to use clickers in the future for assessment purposes, as well as class surveys, lunch count, etc.

I would like to use them in the future. I would have to play with the data to see if the scoring is accurate. It takes a lot of time and planning to implement the CRS in the classroom.

I would love to use them in the future. I think that they are best suited for pre and post assessments, particularly during social studies. I think that I would use CRS much more often if my classroom was set up with a hanging projector.

Now that [the principal] has ordered a set and they came in, I am excited that I will finally be able to use them with my class and hopefully utilize them to help this year's students.

Experimenting with the clickers was beneficial for my students and me. I hope to become more familiar with the clickers in the future and the features they provide.

Several teachers envision using the clickers each day for attendance and lunch count as well as for instruction. However, one teacher reported that she would not use it every day because the novelty would wear off. Teachers envision using clickers at faculty meetings when anonymity is needed. One teacher reported that she would return to the PowerPoint questions assessing content knowledge several times during a series of lessons to see if students' thinking had changed as a result of instruction.

RECOMMENDATIONS FOR OPTIMAL RESULTS

Teachers offered these suggestions to facilitate optimal use of i>clickers.

- Additional professional development and training would be beneficial, including a question-and-answer session after initial use of the clickers as well as a workshop on the i>grader program.
- Teachers should devote sufficient time to plan how they will use the clickers and to become comfortable with them, perhaps by starting with a small routine task such as lunch count before using the clickers in a lesson.

- Before distributing the clickers to students, it is important to clearly define rules for acceptable use and allow time for students to “play” with the devices.
- It is useful for a teacher to set up separate i>clicker software folders for different subjects (e.g., mathematics, literacy, science, social studies, Spanish) or uses (e.g., attendance, lunch count, opinion surveys).
- When there are several classrooms within range of each other, as was true in this study, setting individual frequencies for each remote is important to avoid interference between classrooms.
- To ensure time efficiency and increase use, classrooms should have a permanent projection and computer set up “. . . . so all you have to do is just plug in the receiver and go!”

ADDITIONAL PEDAGOGICAL SUGGESTIONS

To improve inquiry in elementary school classrooms, clickers can be used with Concept Cartoons. Concept Cartoons feature cartoon-style drawings of characters arguing about everyday situations. They address concepts from science, math, and English. In science, the cartoons can be used to engage students in discussion prior to investigation and to pre-assess students’ content knowledge in life, earth, physical, and space science. The cartoons may not have a single “right answer.” A typical cartoon for a science lesson features a visual representation of scientific ideas with minimal text in dialogue form expressing several viewpoints. The scientifically acceptable viewpoint is included and alternatives are given equal status. A Concept Cartoons CD with 120 cartoons is available for purchase. For examples of Concept Cartoons, go to http://www.conceptcartoons.com/science/what_is_a_concept_cartoon.html

DEVICE SUGGESTIONS

- One teacher recommended ergonomic changes in the design of the remote for elementary school learners. The remote could be round and flatter. The A, B, C, D, E polling choices could be color-coded to assist non-readers and visual learners. Also, the individual remotes could be numbered for easy distribution. The bar code numbers could be larger for the instructor to view while entering the settings. Velcro (on desk and remote) could be used to prevent students from dropping or playing with the remote.

Note from i>clicker: These are excellent suggestions and we’ve passed them onto our industrial design and engineering team.

RESEARCH and RESOURCES

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Clip Art

Discovery Education <http://school.discoveryeducation.com/clipart/?pID=clipart>

Microsoft Office Smiley Faces <http://office.microsoft.com/en-us/clipart/results.aspx?qu=smiley+faces&sc=20>

Concept Cartoons

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TYPES OF CLICKER QUESTIONS with EXAMPLES

Pre-Assessment

What idea do you think is best?

- A. Rocks cannot change. Rocks have been always as they are now.
- B. There are many ways rocks can change.
- C. The only way you can change a rock is to break it into smaller pieces.
- D. The only way you can change a rock is to heat it, like lava in a volcano.
- E. I am not sure.

Assess Content Knowledge

Remembering (Assess Factual Knowledge)

Which of the following is NOT an earth material?

- A. air
- B. water
- C. rocks
- D. plants
- E. I don't know.

Understanding (Assess Reasoning)

Which of the following explains why Mineral 1 is softer than Mineral 2?

- A. Mineral 1 can be scratched by a paper clip, penny, and fingernail. Mineral 2 can be scratched by a paper clip only.
- B. Mineral 2 can be scratched by a paper clip, penny, and fingernail. Mineral 1 can be scratched by a paper clip only.
- C. Mineral 1 feels lighter than Mineral 2.
- D. Mineral 2 feels lighter than Mineral 1.
- E. I don't know.

Self-Assessment

What part of the scientist notebook is your best work?

- A. Prediction
- B. Data/Observations
- C. Conclusion
- D. Next Steps/New Questions
- E. I am not sure.

What part of the scientist notebook would you like to improve?

- A. Prediction
- B. Data/Observations
- C. Conclusion
- D. Next Steps/New Questions
- E. I am not sure.

Predicting During an Investigation

What do you think will happen if we place the liquid in the dish for several days?

- A. The liquid will disappear.
- B. The liquid will stay the same.
- C. The liquid goes to the sun.
- D. The liquid will change to gas. A solid material will appear in the dish.
- E. I don't know.

Feedback on Teaching

How would you like me to teach you science?

- A. Allow me to read science books.
- B. Show me science videos.
- C. Conduct hands on activities.
- D. Allow me to view web sites at the computer.
- E. I am not sure.

I had enough time to write in my scientist notebook during today's lesson.

- A. True
- B. False
- C. I don't know.

Opinion (Rating Scales)

How do you like learning about earth science?

- A. I love it!
- B. I like it.
- C. It's OK, but not my favorite subject.
- D. It's not my favorite subject.
- E. I am not sure.

Getting Acquainted

How do you prefer to learn when working on projects?

- A. I prefer to work together in small groups of four.
- B. I prefer to work together in pairs.
- C. I prefer to work alone, but close to other people.
- D. I prefer to work alone, but not close to other people.
- E. I am not sure.

How do you learn science best?

- A. Reading books
- B. Viewing videos
- C. Hands on
- D. All of the above.
- E. I am not sure.

I am a Red Sox fan.

- A. True
- B. False
- C. I couldn't care less about baseball.

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