CLICKERS TO THE RESCUE

Technology Integration Helps Boost Literacy Scores

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Clicker technology can be a powerful tool for increasing student engagement as well as providing immediate feedback. These authors share the impact the use of clickers had in one classroom.

Low literacy achievement scores are a common problem in urban classrooms. This fifth-grade classroom was no different. Week after week, the students would spend a great deal of time reading their district-mandated basal reader while meticulously practicing their literacy skills by completing workbook pages and assignments. Katelyn, a graduate intern seeking initial teaching certification, sought ways to reach these highly diverse and poverty-stricken fifth-graders. It was both surprising and discouraging to discover the students' continuous poor performance on their weekly literacy assessments. She was desperate to find a way to unlock the mystery of text and assessment for her diverse learners. Katelyn soon discovered the power that classroom response system technology could have in her urban elementary literacy classroom.

The first few weeks with the students were filled with excitement and curiosity. This school was very focused on improving standardized test scores and overall student achievement since its school-wide test scores were well below the state average. The school used a formal basal reading textbook series consisting of a plethora of stories that students were expected to read and comprehend. There were workbooks that accompanied this series as well, containing vocabulary and spelling words, grammar activities, and story mapping graphic organizers. Even though the reading series covered a multitude of skills and concepts in a variety of ways, the literacy period was oftentimes greeted with unenthusiastic sighs and grumbling from the students. It was obvious that students were not interested in these stories, which in turn impacted their comprehension, engagement, and assessment scores. A pattern emerged after their standard story comprehension tests were graded each week. Almost all students, regardless of their academic levels, were failing these tests. Katelyn began brainstorming various ways to help improve her students' literacy assessment scores.

Classroom Response Systems Technology

Classroom Response Systems are also known as clickers. Clickers are small, wireless remote-like devices that allow individuals to respond to a given multiple choice, true/false, or yes/no question. This particular system works in conjunction with a computer and/or projector to display the results of a population. A receiver device is connected to the teacher's classroom computer by a USB

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cord. Questions are posed to the group through presentation software, such as PowerPoint, and clickers are used to send a signal to the receiver, which then displays the group's answers.

For example, a teacher might ask, "Which of these colors best resembles your favorite color?" Up to five answer choices would be displayed in the presentation slide. Each person in the room submits his or her answer using a personal clicker. Once voting concludes, the results are gathered and displayed in a graph (either bar or circle graph) for all to see. Some clickers have advanced capabilities for short text-style entry. The clickers that Katelyn used in this fifth-grade classroom did not have text capabilities, thus limiting answer choices to multiple choice, true/false, or yes/no.

Also, software is now available that allows group members to use their cell phones as a clicker device; members can text their answer choices and results can be tabulated and displayed using a special program. Clicker response systems allow data to be gathered and displayed easily, quickly and accurately providing both students and teacher with valuable feedback (González, Jover, Cobo and Muñoz, 2010; Llamas-Nistal, Fernández-Iglesias, González-Tato, and Mikic-Fonte, 2013).

Using Technology in the Classroom

Technology in the classroom can serve as an educational tool for both teachers and students. Technology can help make student performance easily assessable. Students can become self-regulated learners with the immediate feedback the clicker technology offers. Teachers, on the other hand, have the opportunity to gather information regarding which students still need extra help and which can move on to new concepts (Llamas-Nistal et al., 2013). Implementing this

type of technology in the classroom allows a teacher to gather more data pertaining to their students' achievement with more precision. No longer will the teacher have to grade everything manually; he or she can access data immediately. This data can be stored, saved, and analyzed with computers.

Day (2010) also explains the value of interactive student response systems in the classroom, stating that not only do these response systems engage the students, but they offer students immediate feedback. Day believes that effective learning takes place only when students receive this immediate feedback. When students take an active part in their learning, the learning process becomes more effective. The students in this fifth-grade classroom had immediate feedback through the use of the clicker response system technology. After a literacy question was posed, students submitted their individual answers using the clickers, and then the system generated a graph of all the responses, which was immediately projected for all to see. When students were able to see which questions they did not answer correctly, they were better able to identify what they needed to review for the test. On the other hand, the teacher was able to use this immediate feedback to see which questions or themes students were still struggling with and then provide the additional support needed for students to be successful.

Reading Comprehension

Recent research discusses various ways to keep students alert and responsive to aid in reading comprehension. These methods include connecting to students' prior knowledge, supporting strong vocabulary, setting specific times for writing and reading, engaging students in discussions about the reading, and incorporating teacher-directed

instruction accompanied by modeling (Mariotti, 2010). Katelyn conducted a project focused on using clicker response system technology while incorporating Mariotti's literacy strategies. A significant amount of time dedicated to student talk gave her students the opportunity to engage in rich literacy discussion. Research also revealed that technology implementation within the classroom can have a positive impact on student learning (Blasewitz & Taylor, 1999; Day, 2010; McClanahan, Williams, Kennedy, & Tate, 2012). Katelyn's goal was to find a way to improve students' literacy assessment scores by improving their lesson engagement time through the use of clicker technology.

Student Engagement

Student engagement can be a large component of student learning. Research reveals the impact of classroom response systems on student engagement. Debate exists regarding this

Pause and Ponder

- What technological devices and tools are available for use in your classroom? How well do you attribute their use to your students' academic achievement?

- Reflect on your students and what motivates their learning. What tools and devices used in your classroom motivate students the most?

- Consider your planned instruction for your students. How might the use of clicker response technology impact your instruction? Do you think this type of technology will be motivational for your students? Do you have low-achieving students who might benefit from this technological approach?

technology's influence on test scores, but many authors see a positive effect on student participation and engagement within the classroom. Marlow, Wash, Chapman, and Dale (2009) saw a trend centered on technology in the classroom. They stated that students enjoy and appreciate teachers' efforts when teachers incorporate technology into their lessons. Technology is such a significant part of students' lives in today's world that if teachers use technology in the classroom, students automatically become more in tune with what they are learning.

Another central idea to consider when studying the effects of classroom response systems is student familiarity with technology. Although students may not have had experience specifically with clicker technology, they are comfortable using iPods, remote controls, cell phones and other handheld electronic devices outside of school. Marlow, et al. (2009) believe that by allowing students to manipulate technology within the classroom, students feel more comfortable with the instruction. If students feel comfortable in the classroom, then they will be more willing to participate and engage in the learning.

Studies like the one completed by Lundeberg, Kang, Wolter, delMas, Armstrong, Borsari, and Hagley (2011) demonstrate the positive effects of clickers on student learning and engagement within the classroom. If students are

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"Clicker response system technologies offer a variety of uses in the elementary classroom."

given proper immediate feedback after each question, then perhaps they will become more motivated and interested in learning as they gain confidence and experience more success.

Katelyn decided to implement the clicker response system technology into the literacy review process in her fifth-grade classroom. She was curious to see whether her students would become more engaged in the learning, improve their reading comprehension, and as a result, score higher on their weekly literacy assessments. Some interesting discoveries were made.

The Clickers Project
Through a grant, the school was given two sets of clicker response systems to be utilized in the classrooms. Clicker response system technologies offer a variety of uses in the elementary classroom. Students can use them to take quizzes and study for assessments, and teachers can use them to provide opportunities for personal interaction with instruction and to poll student opinions.

Katelyn decided to use this response system in conjunction with Microsoft PowerPoint. Using PowerPoint, she was able to quickly and easily create review questions that would prepare students for their weekly textbook series literacy assessments. She monitored student achievement over a four-week period. At the start of each week, she would develop comprehension and skills questions from that week's text reading selection. She would then generate a PowerPoint slideshow that presented these questions

to her fifth-grade class. Questions prompted students to recall important information from the reading selection of the week, such as characters, plot details, conflict, and resolution, as well as vocabulary and grammar skills. Students participated in these review sessions once a week, prior to their literacy assessment.

Before implementation of the clickers in the classroom, the literacy review sessions usually consisted of a large-group oral discussion. These discussions were teacher-led and only allowed one student to answer each question. Implementing the clickers allowed all students to participate and answer each question during the presentation review.

Prior to this, the students had no experience with clicker response systems. Therefore, it was important to dedicate a lesson to explaining how to use the clickers and modeling the proper use of the devices. Clickers were passed out to each of the students in the classroom. Students were very intrigued with the new devices and were curious to know more about them. Katelyn explored the basics of the clickers with the students. During this introductory lesson, students were given instructions for voting. Students only had to click the device one time for a vote to register, which took them some time to get used to. Oftentimes, students would continuously press the button to select an answer. Students are able to change their answer if they wish because only the last vote cast is counted in the final tally. Once students chose from four possible answers and voting ended, the

results were displayed in either a bar or circle graph. Katelyn chose to use a circle graph. Students were then able to see what the majority of the class selected as the answer compared to the answer they chose. Katelyn then used her remote to highlight the correct answer. The teacher's remote is similar to the student's device, but it has additional controls to start and stop the timer and to display results.

Implementing the Clickers

The literacy review sessions were taught using whole-group instruction and began with a quick recollection of the week's story in the basal reader. Katelyn then started the PowerPoint presentation with teacher-made comprehension and skills questions. Questions appeared one at a time, and each had four answer choices labeled A through D. A small area at the bottom of the screen allowed participants to see how many students had cast their vote for that question. At the beginning of the session, the teacher had taken a population count in order to monitor the number of votes cast during each question, helping to ensure that every child was engaged and submitted a vote for each question. Once all students had voted, the teacher would close the voting process using the instructor's remote. The clicker software displayed the students' collective votes as a pie chart or a bar graph, the teacher revealed the correct answer, and a short classroom discussion was held. Only after all of the students answered the question and understood the correct answer did the class continue on to the next question. As a result, students were able to compare the votes of their classmates to their own selections and would oftentimes spark a debate if they believed their answer was correct. Not only did this gather the interest of all students, but it also encouraged them to be active

participants in their learning and to defend their answers.

One of the most memorable teaching moments happened during the last week of the clicker project. The story for the week was *Klondike Kate*. As soon as the students returned from physical education class, their faces lit up with excitement. They saw the large black bag containing the clickers sitting on the table in the front of the classroom. "Are we using clickers today?" one student asked enthusiastically, knowing the answer was yes. Students quickly filed in and sat in their seats, showing that they were ready and eager to begin.

The session began, as it typically would, with a quick review of main characters, setting, and plot events for the week. Frank, who was a student with specific behavioral needs, was working extremely hard to participate and engage in the story review (note: all names are pseudonyms). After each answer was displayed, he began to explain his reasoning for the answer he selected. Frank was one of many students who exhibited this excitement. As the class plunged into the session, students began to make the review into a game of their own. There was a sense of friendly competition between the students, which encouraged them to do their best during the review. Students would talk amongst themselves, exclaiming which answers they got right. Commentary from one student, José, was overheard by the teacher: "See, I told you A was the answer! D just does not make any

sense." He was attempting to persuade his classmate, Ashley, that he chose the correct answer. As we neared the end of the session, one question had the students' opinions split evenly down the middle. The question read "Why did Kate choose to take a boat to Yukon?" About half of the students believed the answer was A, "Kate did not have enough money to take another route," while the other half firmly believed that C was the correct answer: "Kate needed the room on the boat to store her supplies." Because there was no conclusive answer, Fernando, one student who voted for A, was asked to explain his reasoning to the class. He said that this information was explicitly mentioned in the text. As the students opened their books, students who chose C could be heard saying "Oh! The text does say Kate did not have enough money, that's why she took the boat!" Once Fernando was finished, another student, J'Michael, who selected C, was asked to explain his reasoning. Students were then able to vote again, which uncovered the correct answer, A. Through this process, it became apparent that students had a deeper understanding of the question and lesson concept involved.

Each review session ended with a student-led summary of the week's text selection. Students were able to richly describe the characters, plot events, and details from the week's story, which provided evidence that students were gaining a richer understanding of the reading contexts and skills.

"As the class plunged into the session, students began to make the review into a game of their own."

"Students' weekly literacy test scores increased when they participated in the clicker review sessions."

One of the benefits of the clicker technology was that it allowed the students to remain anonymous during the polling process. As a result, students did not feel pressure or anxiety about choosing the wrong answer and instead were able to focus on understanding the correct answer with sound reasoning.

For the benefit of the teacher and data collection, a simple built-in program allows the clickers to be numbered and registered to individual students. Even if the clickers are registered, students can only see the class results and not individual results, thus ensuring confidentiality and anonymity. However, after the session is over, the teacher can produce and print a report with each student's individual score results and track the progress of individual students over time.

Collecting the Data

Because Katelyn was really interested in whether or not the clickers would have an impact on her students, she used three different methods to collect data throughout this experience in order to verify her results. First, and perhaps most obvious, she looked at student test scores. She averaged the test scores prior to the use of the clickers in the classroom, and she compared this average to averages collected after the implementation of the clickers.

In addition, Katelyn utilized exit slips after each review session. The exit slips allowed students to share their attitudes and opinions about the clickers and pose any questions they had. The exit slips contained the following open-ended questions:

One thing I learned today…

I still need a little help understanding…

I would really like to learn more about…

I would change how we did…

The best part of class today was when we…

Because technology is such a large segment of students' daily lives, Katelyn was curious to know if using technology in the classroom would spark students' interest and increase lesson engagement. If students were excited about using the clicker technology in the classroom, perhaps this would have a positive effect on their test scores as well.

Katelyn also wanted to monitor student engagement. Previously, during review sessions without the use of clickers, students were frequently off task, holding side conversations, and visibly unengaged. Therefore, Katelyn was curious to see if these individual devices would help the students focus more on the task at hand. She utilized a behavior checklist to rate how visibly engaged students were during each review session. A 3 was the best possible score and was considered "visibly engaged." Students who received a 3 asked questions during the review session, maintained eye contact with the teacher and the projector, and kept side conversations to a minimum. A score of 2, or "partially engaged," represented students who showed signs of engagement, such as making eye contact and asking questions, but may also have off-task behaviors like having periodic side conversations, distracting others, or calling out answers. A score of 1 was assigned to students who were "rarely engaged." These students continued to talk to their neighbors during the review session, had little or no eye contact with the teacher, and rarely participated. These three pieces of information provided great feedback and evidence for Katelyn as to any impact that the use of clickers had on her students.

Results

The first thing Katelyn discovered was that students' weekly literacy test scores increased when they participated in the clicker review sessions. As previously stated, this assessment was a standardized test taken directly from the district-chosen curriculum basal series. Multiple-choice questions covered a variety of reading and language arts concepts. Comparing students' averaged test scores before and after the four-week period of implementing the clicker response system uncovered some thought-provoking results. This experience revealed that 59%, or 13 of the 22 total students involved, improved their test score averages. Of these 13 students, 9 were male. Only four female students increased their average test scores after participating in the review sessions. Figure 1 shows the students' increased averages according to gender.
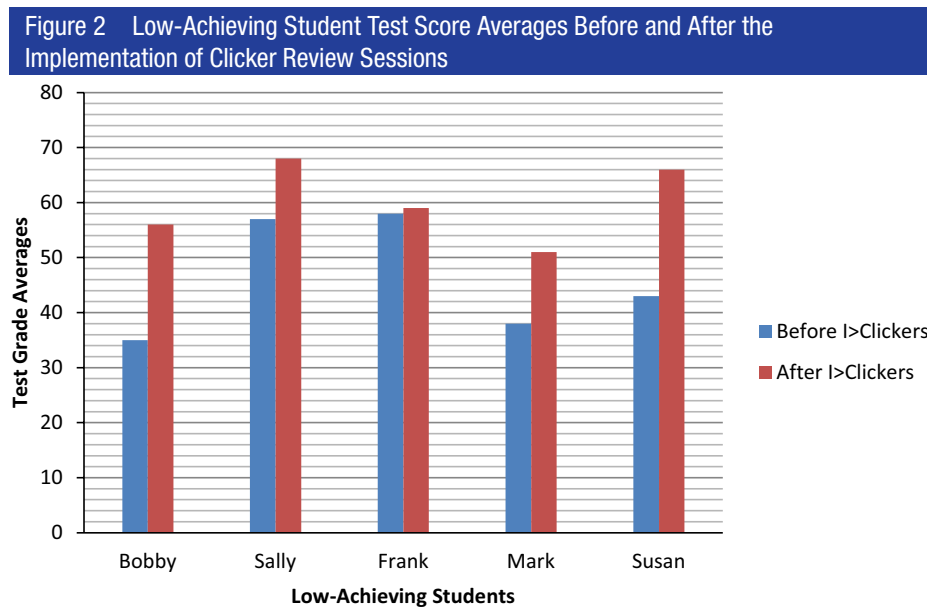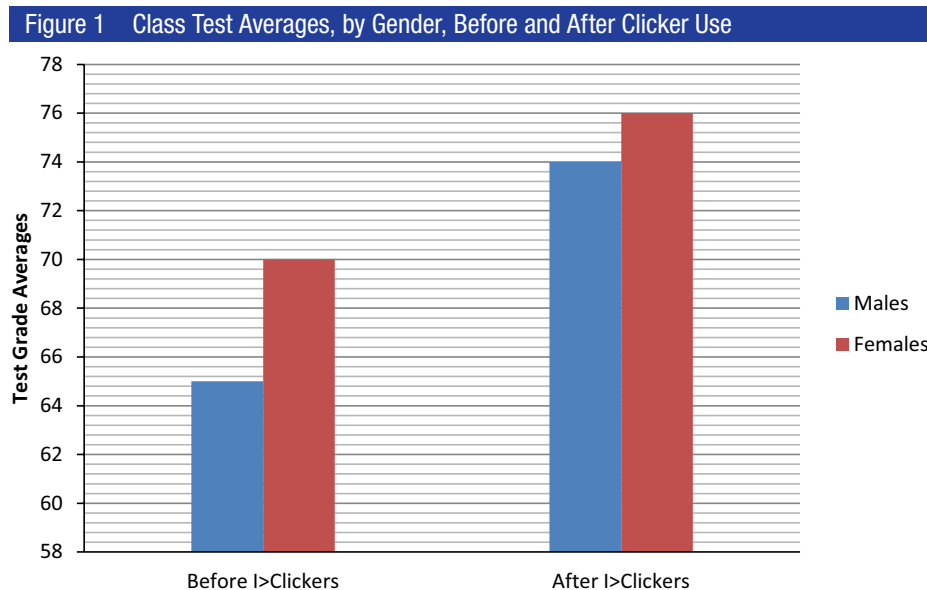
In addition to test scores separated by gender, consideration was also given to the academic level of each student. Prior to the study, students were divided into three leveled groups: high, average, and low achievers. The test score data showed that low-achieving students made up nearly 50% of the students who improved their test scores after participating in the clicker review sessions. This group earned nearly 75% of the total number of points increased on the tests (see Figure 2).

Another phenomenon studied during this period was student engagement. Since classroom response systems allow students to individualize their learning, Katelyn decided that monitoring students' engagement during the review sessions would be a worthwhile endeavor. Observing students throughout the review sessions produced profound results.

After reviewing the engagement data, Katelyn noticed that all of the students increased their engagement score by at least one point over the course of the four-week implementation period. This was a significant improvement, especially for the four students who were given a 1 (rarely engaged) prior to the first clicker review session. Lower-achieving students appeared to be more engaged as the weeks progressed (see Table). Since 50% of the students who improved the average of their weekly test scores were low achievers, engagement was a crucial aspect to consider in this improvement in assessment scores.

When students were separated based on their gender, it was discovered that male students began with an overall higher engagement score than female students. They were also able to maintain this achievement throughout the project. During the first week, males averaged an engagement score of 2.36. During the final review session, their scores were averaging 2.81. With an increase of 0.45 points over the four weeks of this study, the males in the class earned a higher overall point average. The females, on the other hand, began with a lower engagement score of 2.09 and increased by only 0.36 overall points. The final average of all four weeks combined showed that the males led the females in academic engagement by 0.40 points.

Distributing exit slips after students participated in the clicker review session helped Katelyn gain insight into what

Figure 1   Class Test Averages, by Gender, Before and After Clicker Use

Figure 2   Low-Achieving Student Test Score Averages Before and After the Implementation of Clicker Review Sessions

Note. All names are pseudonyms.

the students were feeling and thinking. Because questions were broad and open-ended, great insight was gained into their opinions. Reading each exit slip carefully uncovered common themes and vocabulary frequently used by the students. It was discovered that as the clickers were progressively used in the class, more students were expressing positive feelings regarding the use of this technology. At first, students were hesitant and did not always answer all five questions on the exit slip. However, as the weeks progressed, more students answered the five questions. After analyzing each student's response on the

Table   Engagement Scores of Low-Achieving Students

Name	Week 1	Week 2	Week 3	Week 4	Average
Bobby	1	2	2	3	2
Sally	1	2	2	3	2
Frank	2	3	3	3	3
Mark	2	3	3	3	2.75
John	1	1	2	2	1.5
Susan	1	2	2	3	2

Note. All names are pseudonyms.

exit slips, it was revealed that a large number of students thought this experience with the clicker technology was both beneficial and positive.

Students voiced their appreciation and enjoyment regarding the use of the clicker technology. They frequently described the clicker review sessions as "fun,"

TAKE ACTION!

1. Identify a group of learners in your classroom who would benefit from the use of student response systems technology, such as clickers. These students might be low-achieving or unmotivated learners.

2. Consider ways you could incorporate the use of student response systems technology into your own classroom. In what ways could you incorporate this technology into either your direct instruction or test prep and review?

3. Think about the benefits that immediate feedback might provide for both you and your students. How might the ability to identify student struggles impact your teaching? How could immediate feedback also impact your students' learning?

4. Begin researching how you can register and assign a clicker device to individual students. Consider how tracking and documenting student growth and achievement could improve instruction and impact student learning.

"exciting," and "learning." Taking into account the positive feedback received, these results can be linked with student engagement. Students' self-efficacy and confidence emerged as the weeks with the clickers progressed. If students believed the learning experience was fun and enjoyable, then they could become more easily engaged and ultimately increase their reading comprehension and literacy skills as presented here.

Closing Thoughts

Conducting this project in an urban fifth-grade classroom has led to new understandings and conclusions. Student response systems are a unique and interactive technology tool for use in the classroom. Research shows that student response systems, such as clickers, can encourage student participation and engagement with instruction. Because most students feel comfortable using technology, clickers can be a great addition to any classroom environment. Implementing clicker response system technology in the pre-existing literacy curriculum proved to be an effective strategy in this urban fifth-grade classroom. Students improved their weekly literacy test averages, became more engaged with the text, and felt more confident about literacy. A large majority of the class found this method to be beneficial and expressed interest in continuing its use in the future.

A notable feature of this project was that clickers allow teachers to better monitor their students' reading comprehension and literacy skills. Programs such as Fountas and Pinnell leveled books and Reading A-Z help teachers monitor reading fluency and comprehension. Now, in addition, teachers can use clicker technology to collectively monitor students' individual reading comprehension and literacy skills by assigning an identified clicker to each student and easily tracking students' progress. Teachers are constantly striving to improve their students' learning opportunities and experiences, and this technology has the possibility to enrich both. Research continues to show the relationship between student engagement and achievement (Lundeberg, Kang, Wolter, delMas, Armstrong, Borsari, & Hagley, 2011). Many schools have now obtained some type of classroom response systems, but many teachers feel intimidated or uncomfortable implementing them in their instruction. The clickers are easy to use and present a variety of instructional methods. This article demonstrates one way in which these clickers can be used, along with the successful and positive impact they had on student engagement and achievement.

English learners now increasingly represent larger percentages of students in classrooms across the country, as they did in Katelyn's classroom. The use of clickers, as presented in this article, provides a way to help reinforce English literacy skills for ELs as they see and hear assessments and move toward independence with the English language. Clickers provide a risk-free environment for these unique learners to practice their literacy skills.

Additional instructional methods using clicker technology include

assessment reviews across disciplines, brainstorming story elements during the writing process, assessing students' prior knowledge before instruction, polling learning community issues, discussing current events, and random checking for understanding. The list of instructional uses for clicker technology is limitless! Simply plug the system's receiver into a computer using a USB cord, hand out the clickers to students, create a PowerPoint displaying generated questions (one per slide) with answer choices, and see how it impacts your students!

Today's educational system relies heavily on high-stakes testing and student assessment. As a result, classrooms can turn into pressure cookers with intensive rote drill, practice, and assessment. Finding ways in which to make learning meaningful and memorable, especially for low-achieving students, is the challenge of every teacher across the nation. "Talented teachers know that there is more to successful reading than accurate and efficient strategy and skill use. The best strategy and skill teaching will be unsuccessful when students are unmotivated and unengaged or when they don't believe that they can succeed" (Afflerbach, Cho, Kim, Crassas, & Doyle, 2013, p. 447). Today's 21st-century learners are digital learners, and teachers need to incorporate technology whenever possible to help engage students in the learning environment.

Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's website:

Data S1.

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MORE TO EXPLORE

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