Enhancing Student Learning and Engagement Using Student Response Systems

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Many students live in a constantly changing, fast-paced, technological world that includes instant access to music, videos, images, information, and friends. The hours they spend in school, however, most often do not reflect a similar environment. Rather, they are often subjected to obsolete curriculum content, outdated textbooks and equipment, and antiquated teaching methods. Can the appropriate integration of technology, specifically, Student Response Systems (SRS), in the classroom positively affect learning and engagement? The purpose of this article is two-fold: to describe an action research study designed to assess the impact of the use of SRS upon middle-school students’ learning and engagement; and secondly, to suggest that teachers might further enhance student learning and engagement by utilizing classroom technologies such as SRS as a replacement for the paper-pencil pedagogies of the 20th century.

**Key Words:** technology, student response systems, student learning, engagement, middle school, social studies

**Introduction**

Many youth are experiencing a daunting dichotomy between the time spent in school and the time spent outside of school. While their experiences outside of school revolve around a constantly changing, fast-paced, technological world that includes instant access to music, videos, images, information, and friends, their in-school experiences may consist of obsolete curriculum content, outdated textbooks and equipment, and antiquated teaching methods. “Compared with students’ technology-infused lives outside of school, the traditional classroom is a somber place” (Prensky, 2008, p. 40). “When kids come to school, they leave behind the intellectual light of their everyday lives and walk into the darkness of the old-fashioned classroom” (Prensky, p. 42). Because of this disparity, many students are coming to school bored and disinterested in learning, and many teachers are finding it increasingly difficult to facilitate learning in ways that are engaging, meaningful, and achievement-oriented.

Can student learning and engagement be enhanced through the use of technology, specifically through the use of Student Response Systems (SRS)? Do teachers have a responsibility to seamlessly integrate a 21st century tool into the curriculum to better facilitate student learning? The purpose of this article is two-fold: to describe an action research study designed to assess the impact of the use of SRS upon middle-school students’ learning and engagement; and secondly, to suggest that teachers might further enhance student learning and engagement by utilizing classroom technologies such as SRS as a replacement for the paper/pencil pedagogies of the 20th century.
Technology in the Classroom

A paradigm shift is described by Anne Shaw (2009) as occurring in today’s educational system. Education is moving away from 20th century teaching methods that include direct instruction, memorization, textbooks, and passive learning toward learning that is collaborative, interactive, interdisciplinary, global and real-world project-based. She believes knowledge is not memorization of facts and figures, but is constructed through research and the application of what is learned. According to Shaw, today’s schools should incorporate the 21st century skills that include higher order thinking skills, multiple intelligences, synthesis, analysis, and evaluation. Technology is becoming the means through which these 21st century skills are being achieved as online instruction and assessments, interactive whiteboards, blogs, SRS, podcasts, and WebQuests are being integrated into the curriculum to more fully engage learners (Shaw).

Recently, SRS have become quite popular in Kindergarten-12 classrooms as well as at the university level. An SRS is an individual remote control keypad that allows each student to answer questions (typically multiple choice) displayed on a screen. An electronic receiver in the instructor’s computer captures the individual responses and displays immediate results in the form of a bar graph on the presentation screen (Premkumar & Coupal, 2008). Both the teacher and students receive immediate feedback, allowing for increased interaction and discussion opportunities (Johnson & McLeod, 2004). The SRS research has shown promising results regarding student achievement, engagement, and attitudes toward learning.

The Impact of SRS on Achievement

A number of studies that examined the impact of SRS on student achievement found evidence of quantitative learning gains directly tied to the use of SRS technologies (Draper and Brown, 2009; Morling, McAuliffe, Cohen, and DiLorenzo, 2008; Caldwell, 2007; Ribbens, 2007). A study—discussed in Morling et al (2008)—chronicles a scenario in which introductory psychology students used SRS to answer multiple-choice questions and received immediate feedback on their answers. Results showed the use of SRS had a small, but positive effect on exam scores. A study by Caldwell (2007) found the number of students earning A’s in a math course increased by almost 5% when SRS were used. In another study, in a large introductory biology course, Eric Ribbens (2007) found after using SRS, students’ grades averaged 8% higher than the large lecture session held two years earlier when SRS were not used. Ribbens noted:

My biology class got better grades. I had about the same number of D’s and F’s, and only a few more A’s. But the large, soft middle of my course developed new tone and bulged up from C’s into B’s (p. 62).

A survey in which over 6,000 students showed a vast advantage in learning gains measured using a standardized pre- and post-test for courses using “interactive engagement” was also conducted in a study by Hake (1998). Based on these studies, it appears the learning features afforded by SRS, including: immediate feedback, increased interaction and discussion opportunities, served to enhance student achievement.

The Impact of SRS on Student Participation, Engagement, and Attitudes Toward Learning

The research regarding technology and its impact on attitudes toward learning and student engagement has become more extensive in recent years as well. It has been demonstrated, for example, that the use of interactive whiteboards in U.S. classrooms is a promising approach for engaging students who have grown up on the Web (Philips, 2008). Lotta
C. Larson (2009) found that the use of online learning communities in a fifth-grade classroom to discuss and share opinions about literature was very effective. Students who were typically shy or struggling readers in traditional literature circles were less hesitant to share their ideas in the online group setting.

Research has also been conducted on the impact of SRS on student participation, engagement, and attitudes toward learning in the classroom. Because SRS are often used for formative and self-assessment purposes, it is important to note the connections between such assessment methods and student engagement, attitudes (efficacy), and participation in the classroom. A 2008 study by Susan Brookhart, Connie Moss and Beverly Long, concluded effective teachers create situations that maximize student learning potential, specifically by providing students and teachers with regular feedback on how well students understand key concepts and skills. The authors argue formative assessment: empowers students; makes teachers more effective; and restores students’ natural love of learning. As this assessment is non-judgmental in approach, students are more likely to think for themselves and to openly share their understandings. According to Brookhart, Moss, and Long, students become “the driving force in their own learning” (p. 53). It appears SRS can become an important tool in fostering student engagement through formative and self-assessment methods.

Related to the notion teachers should create learning environments that enhance student learning, April Trees and Michele Jackson (2007) stated that the goal of SRS is to change classroom culture from one in which students are passive observers to one in which students are actively engaged participants. They found that students in large, university-level lecture classes felt the anonymity fostered as a result of using SRS created a low-pressure, safe learning environment. Likewise, Jane Caldwell (2007) found that students reported that they were twice as likely to answer a question if answers were submitted by SRS. She further noted SRS increase students’ participation by giving all students an opportunity to answer a question asked in class, unlike traditional situations where only a few students have the chance to answer. Additionally, Caldwell also stated instructors witnessed less sleeping and more alert students.

In one study, it was demonstrated that the anonymity of SRS gave students the confidence to express themselves even if they thought their opinions and beliefs were different from that of their instructor Uhari, Renko and Soini (2003). Most students reported using SRS during lectures improved their activity, and 80% felt that it improved their learning. Ribbens (2007) found that, in addition to an 8% increase in grades, attendance increased by about 20% in his biology classes, inferring that students seemed to enjoy the class more when SRS were used. These studies provide evidence that creating a learning environment, which fosters active learning in a safe environment, appears to augment student participation, engagement, and positive attitudes toward learning.

**Purpose of this Study**

Most of the studies involving SRS have been carried out in higher education settings, while few have been conducted at the elementary or middle school level. The results from the university-level studies illustrate that SRS tend to increase student participation and engagement in the classroom, while at the same time increase student efficacy about learning. Because of the limited research involving the use of SRS in the elementary and middle school, the researchers wanted to determine whether the utilization of SRS in a sixth-grade social studies classroom
would contribute to academic achievement as well as enhance student engagement and attitudes toward learning.

**Research Participants**

The participants included 46 sixth-grade students who attended the same middle school in southeastern Wisconsin and were assigned to the researcher’s social studies classes on ancient civilizations. The researcher taught one class of 22 students and one class of 24 students. In this study, 21 students were male and 25 were female. Of the 46 students participating in the study, two were Asian, one was African American, and 43 were Caucasian. All 46 students were proficient in the English language. This group was comprised of three students who receive accelerated education in math, two students who receive accelerated education in literacy, and thirteen students who receive accelerated education in both math and literacy.

**Methods**

An action research methodology was utilized in this study. Action research refers to systematic inquiry conducted by a teacher in the context of his or her classroom environment with the specific intent of informing educational practice (Ferrance, 2000). This study was conducted in two of the researcher’s sixth-grade social studies classes. The same instructor taught both classes in the morning for 45 minutes each.

To analyze the impact of SRS compared with small-group review on student engagement and achievement, one class reviewed for a summative assessment on ancient Egypt by playing a Jeopardy game in groups of five or six and one class reviewed using SRS. It is recognized that these two methodologies are unique in that the Jeopardy review represents a competitive collaborative process and the SRS is a more individualized thinking process. Because this particular group of students has had previous experiences with both of these strategies, the goal of the study was to determine whether one strategy had a greater impact on student learning and engagement.

Both classes reviewed content on the day prior to the summative assessment and both classes were administered the same test the following day. For the Jeopardy game, the researcher asked each team a question displayed on a SMARTboard and gave the team 30 seconds to answer. If an incorrect answer was given or if time ran out, the other three teams were given the opportunity to “steal” the question for points. The researcher was able to clarify information for the Jeopardy review group if students raised their hand to ask a question or if it took more than one group to correctly respond.

The students in the second social studies class reviewed for the ancient Egypt summative assessment using SRS. TurningTechnologies developed both: the software and SRS system. The same review questions were given and displayed on the SMARTboard, except that in this group, each student was provided with a SRS to answer within the time limit of 30 seconds. The SRS review was also designed in a game format; however, the students were not aware of who was on their team until the end of the review session; they only knew that their individual scores would be contributing to their team score as a whole. The TurningPoint student response software computed combined individual totals to determine team scores. Because the TurningPoint software displays instant results in the form of a bar graph for both the teacher and class to see, the researcher was able to clarify or re-teach information that was misunderstood or
answered incorrectly by the majority of students during the review session.

The same study was conducted for the next unit on ancient Israel. This time, however, the students in the first social studies class reviewed using SRS, and the students in the second class reviewed through the small-group Jeopardy game. Once again, both groups were given the same review questions displayed on the SMARTboard and both reviewed one day prior to the summative assessment on ancient Israel. Both classes were administered the same summative assessment.

Following the ancient Israel unit and summative test, students in both classes were given a twelve-question student survey to complete in class. The students were told that the survey was going to be used to help the researcher better understand which form of review was most helpful and beneficial to students. The survey consisted of 12 questions geared toward understanding student engagement and attitudes toward learning when using different forms of review. Six of the survey questions asked students about levels of engagement during review, while the remaining six questions focused on students’ attitudes toward learning (See Appendix A).

Data Collection and Analysis

Summative test scores between the two classes were compared to determine whether one group of students performed statistically better than the other for the unit on ancient Egypt. Summative test scores for the unit on ancient Israel were also compared. Data also were collected from the survey competed by students at the conclusion of the second unit test on ancient Israel. The checklist-style survey (see Appendix A) directed students to answer twelve questions about their perceived levels of engagement and attitudes toward learning. For each of the 12 statements, students were simply asked to check which form of review they preferred, Jeopardy or SRS. Finally, to further determine the impact of SRS on student engagement and attitudes toward learning in the classroom, the post-test, 12-question checklist style survey in which students were asked to rate their levels of engagement and attitudes toward learning when using SRS for test review and when participating in a Jeopardy game, was calculated using a frequency distribution.

Student Achievement

To determine if SRS had any statistical significance on student achievement when used for review prior to a summative test compared with Jeopardy review, a one-tailed, two independent samples t test was conducted. For both tests on ancient Egypt and ancient Israel, one class period represented the control group who reviewed prior to the test with small group Jeopardy and another class represented the experimental group who reviewed prior to the test with SRS. This process was repeated for the ancient Israel unit test in order to provide more data to the researcher. For the test on ancient Israel, the control and experimental groups were switched.

For this one-tailed, two independent samples t test, the researcher chose to use a directional hypothesis predicting that a group of sixth-graders using SRS to review for a summative assessment (experimental group) would score higher on the assessment, compared with a similar group of sixth-graders using small group Jeopardy review (control group). The alternative hypothesis was:

\[ H_A : \text{Mean}_E > \text{Mean}_C \]
Where  
\[ H_A = \text{Research hypothesis (the alternative hypothesis)} \]
\[ Mean_E = \text{Mean of the experimental group (clickers)} \]
\[ Mean_C = \text{Mean of the control group (Jeopardy)} \]

The null hypothesis for this study therefore was:
\[ H_o: Mean_E = Mean_C \]

Where  
\[ H_o = \text{Null hypothesis} \]
\[ Mean_E = \text{Mean of the experimental group (clickers)} \]
\[ Mean_C = \text{Mean of the control group (Jeopardy)} \]

The researcher used the student summative assessment test scores to compute the \( t \) value using SPSS. It was the researcher’s goal to have a \( p \) value (level of significance) of 0.05, meaning that the probability of obtaining these results by chance alone was only five percent.

With regard to student achievement, summative test scores between the two classes were compared to determine whether one group of students performed statistically better than the other for the unit on ancient Egypt. Summative test scores for the unit on ancient Israel were also compared. When reviewing prior to a summative test using SRS (experimental group) and Jeopardy (control group), no statistical significance was found. For the Israel test, the researcher failed to reject the null hypothesis. Following the same approach on the Egypt test, the researcher found these results were also not statistically significant. Again, the researcher failed to reject the null hypothesis.

Table 1

Student Achievement

<table>
<thead>
<tr>
<th>Summative Test Ancient Egypt:</th>
<th>Summative Test Ancient Israel:</th>
</tr>
</thead>
<tbody>
<tr>
<td>( t = -0.488 )</td>
<td>( t = 0.902369 )</td>
</tr>
<tr>
<td>( p = 0.686 &gt; 0.05 )</td>
<td>( p = 0.186 &gt; 0.05 )</td>
</tr>
</tbody>
</table>

**Students’ Attitudes Toward Learning**

A two-proportion \( z \) test was used to determine whether student attitudes toward learning were impacted more significantly by SRS review or Jeopardy review. To determine student attitudes toward learning, question twelve of the student survey was examined. Question 12 states: “If I had to take the test \textit{immediately} after reviewing for it in class, I would feel better prepared to do so after reviewing with \text{______}.” Students had to check their preference, Jeopardy review or SRS review. There was a statistical significance when comparing SRS review prior to a summative test to Jeopardy review, indicating that SRS were preferred to Jeopardy when it came to feeling more prepared for the summative assessment. Table 2 displays these results.

**Students’ Perceived Level of Engagement**

A two-proportion \( z \) test was also used to determine whether student levels of engagement in the classroom were impacted more significantly by SRS review or Jeopardy review. Question
ten of the student checklist survey, “I pay better attention when reviewing with ________” (jeopardy review or SRS review), was analyzed to determine student levels of engagement. With regard to students’ feelings of engagement in the classroom, a statistical significance was revealed, indicating that SRS were in fact preferred to Jeopardy when it came to feeling more engaged and attentive in the classroom. Table 3 displays these results.

Table 2
Student Attitudes Toward Learning

<table>
<thead>
<tr>
<th align="left">Survey Question 12:</th>
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<tbody>
<tr>
<td align="left">If I had to take the test immediately after reviewing for it in class, I would feel better prepared to do so after reviewing with _______.</td>
</tr>
<tr>
<td align="left">z = 3.75</td>
</tr>
<tr>
<td align="left">p = .0000873 &lt; 0.5 (level of significance)</td>
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</tbody>
</table>

A frequency distribution for all 12 of the survey questions regarding student attitudes toward learning and feelings of engagement was used to obtain additional information. Questions 1, 3, 6, 9, 10, and 11 of the survey asked students about levels of engagement during review, while questions 2, 4, 5, 7, 8 and 12 of the survey focused on students’ attitudes toward learning.

Table 3
Students’ Levels of Engagement

<table>
<thead>
<tr>
<th align="left">Survey Question 10:</th>
</tr>
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<tbody>
<tr>
<td align="left">I pay better attention when reviewing with _______________.</td>
</tr>
<tr>
<td align="left">z = 3.75</td>
</tr>
<tr>
<td align="left">p = .0000873 &lt; 0.5 (level of significance)</td>
</tr>
</tbody>
</table>
Results showed that overall, students preferred SRS to Jeopardy review 59.96% to 40.04%. With regard to perceived levels of engagement, results showed that students felt more engaged when using SRS 58.33% to 41.67%. With regard to attitudes toward learning, students felt more positive about their learning when reviewing with SRS than when reviewing with Jeopardy 61.59% to 38.40%. Finally, the results demonstrated that overall, males preferred SRS (68.65%) to Jeopardy (31.35%) and females also preferred SRS (54.00%) to Jeopardy (46.00%).

Discussion

Student Achievement
While there was not a statistical significance between the two classes with regard to test scores and academic achievement, three participants in this study who consistently struggled academically demonstrated improvement in test scores when using SRS. Although slight, academic gains for these particular students are important and noteworthy. This finding is consistent with Zucker’s (2009) work that although technology is not the “silver bullet” regarding student achievement, it can help.

Attitudes Toward Learning and Engagement
In assessing students’ perceptions of whether the use of SRS or jeopardy review caused them to have more positive attitudes toward learning, a statistical significance was found. The study showed that the use of SRS generated more positive student attitudes toward learning. This supports the work of Kathy Kenwright (2009) that since SRS allow students to immediately observe how their level of understanding compares to that of their classmates, they can better self-assess their own learning needs. Self-efficacy and confidence follow.

When determining students’ perceived levels of engagement, a statistical significance was once again revealed. Table 3 displays these results. Students felt more engaged in their learning when using SRS compared to a Jeopardy-review prior to a summative assessment. While Jeopardy provided active student participation for only a few students, the SRS review allowed for active student participation for all. Every student had access to a SRS and was able to anonymously and enthusiastically participate. As a result, every student in the classroom was actively engaged in the learning experience. For each question, the students went from quiet concentration as they silently read questions and clicked in their responses to cheers, laughter, and celebration as the correct answers were ultimately revealed. While engagement was observed during Jeopardy-review and students did cheer, it wasn’t a collective effort by all in comparison to the SRS sessions. It was apparent students moved from a passive state to an active and engaged one when SRS were utilized. These data support previous research that the use of technology, specifically SRS, appears to facilitate student engagement and participation (Brookhart, Moss and Long, 2008; Larson, 2009; Trees and Jackson, 2007; Caldwell, 2007; Ribbens, 2007; and, Uhari, Renko & Soini, 2003.)

Limitations of this Study
The study was conducted with 46, sixth-grade students who were assigned to the researcher’s social studies classes by the middle school administrators. Both the small number
of students and the fact that these students were not randomly assigned to the social studies classes was a limitation of the study. Furthermore, the participants of the study included three students who received accelerated education in math, two students who received accelerated education in literacy, and thirteen students who received accelerated education in both math and literacy. Students in accelerated classes often have good test taking and study skills. Caution must be used when interpreting the impact of SRS on student achievement in the course of summative assessments.

Finally, it is recognized that the Jeopardy game and the use of SRS to review content are two distinctly different teaching and learning methodologies. The Jeopardy game is essentially a competitive, collaborative experience, although some students may choose not to participate. Alternately, the SRS review is based on an individualized approach to assessment in which each student generates a response. The study did not control for the differences in these methodologies, nor did the study consider students' prior experience using the SRS technology.

**Recommendations for Future Research**

This study provided strong evidence for the effectiveness of SRS in promoting positive attitudes toward learning and increased engagement in the middle school classroom. While no statistical significance was found regarding academic achievement, some promising observations were made. Anecdotally, the researcher noted that three middle-school students who consistently struggled academically demonstrated improved test scores when they used SRS to review. Can we infer, then, that technology, particularly SRS, can be strategically utilized to more effectively reach every learner?

Future research on SRS and their impact on academic achievement should focus on the academically struggling student. Because this study was conducted with 20 of 46 participants who qualified for accelerated education, the implications for the struggling student were somewhat masked. Researcher observations and test results, however, indicated some strong positive and promising implications for the struggling student, and warrant the need for additional studies related to the use of SRS with academically challenged students.

Additional research can also be focused on the use of SRS in multiple content areas, perhaps in interdisciplinary contexts that integrate social studies with other discipline areas. In addition, further study could examine the use of SRS in more collaborative learning environments. Currently, most SRS use is by individual students; however, teachers could design innovative learning experiences that encourage students to use SRS in small group work. SRS use by groups of students could then be studied to determine the impact of collaboration on learning.

**Implications**

“If we teach today’s students as we taught yesterday’s, we rob them of tomorrow” (John Dewey, 1944, p. 167). Yesterday’s direct instruction, memorization, repetition, and regurgitation may have been efficient, but these methods are hardly effective for 21st century learners. Although images of neat rows of desks with orderly rows of children laboring over worksheets are memorable, they may be outdated in today’s educational institutions. If educators persist in utilizing antiquated teaching techniques, today’s students will tune out, stop out, and drop out.

Teachers have a unique responsibility to reinvent and redesign learning environments that are responsive to the needs of 21st century learners. Schools need to be places of learning that
are characterized by excitement, enthusiasm, high expectations, and engagement. This study provided a preliminary glimpse that the use of SRS in a middle school classroom assisted in promoting such an environment. Teachers must continuously enhance teaching and learning until every child demonstrates a high level of achievement and engagement. It is apparent technology will continue to play a significant role in attaining this goal.

References


response system in lectures. *BMC Medical Education, 3*(12).


**Web-Based References**


# APPENDIX A

<table>
<thead>
<tr>
<th></th>
<th>SRS</th>
<th>Jeopardy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I participate the most when I review for a test in class with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Which form of review helps you prepare better for the test?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Which form of review is more exciting?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Which form of review helps you feel more confident about taking the test the next day?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I learn better when I review for a test with ______.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Which form of review is more engaging?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I felt I did better on the test I took after reviewing with ______.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Which form of review makes you feel more confident before taking the test?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I am more interested in class when we review with ______.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I pay better attention when reviewing with ______.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Which form of review are you more actively involved with?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. If I had to take the test immediately after reviewing for it in class, I would feel better prepared to do so after reviewing with ______.</td>
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</tbody>
</table>
Author Bios

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