

**Is That Your Final Answer? The Effectiveness of Using Interactive  
Audience Response Systems as an Assessment Tool in Education**

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### **Abstract**

As part of the deployment of new technologies, Kalaheo High School has implemented the use of an interactive Student Response System (SRS) in a number of classes. These “clickable” digital devices allow teachers to obtain instant feedback from all students in a classroom to questions posed. The proposed study employed a mixed method approach to understand the experiences in a minimum of six classes in which teachers used the SRS as an assessment tool. The goal of this study was to determine if the use of the SRS promoted a more positive and/or more active and engaged learning environment. Data was collected from teachers about their opinions of the SRS tool after a semester’s use in the high school classrooms. The data was gathered through surveys, observations and interviews. Observations served to document how the technology was being used and did not include any video or audio recordings.

Data collection was ongoing throughout the semester beginning with scheduled classroom observations of teachers utilizing the SRS tool. Near the end of the fall semester after students had experienced the SRS multiple times each teacher was interviewed and asked to complete a paper-based survey on their experience using the tool. The questions addressed overall teacher impressions of how using the SRS impacted the student learning environment. The survey served to garner feedback related to any technical problems that teachers may have experienced as well as solicit opinions regarding the effectiveness of how the technology tool was used in their course. Upon review of the data gathered the major findings of this study supported the concept that using student response systems as an assessment tool in the high school classroom is effective.

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## **Chapter I**

### **Introduction**

Motivating students to learn is a challenge that many educators struggle to achieve as they face their classrooms every day. When students are motivated to learn, it is much more likely that they will retain the information delivered. One tool that has the potential to assist teachers in not only motivating students but also to serve as an assessment method is a wireless interactive Student Response System (SRS). “Student Response Systems (SRS) are an evolving in-class-student-polling technology designed to create an engaging and inviting learning environment that will maximize active learning, especially in large-enrollment lectures” (Lowery, R. , p.1).

At Kalaheo High School in Kailua, Hawaii teachers have expressed concerns over the lack of student motivation. The dilemma at hand has been coming up with a successful approach to motivate students to become more involved in their learning environments. In an effort to address this concern the school has purchased a SRS to test in the classroom to see if there are significant advantages to using it.

Tools such as the SRS are commonly seen in play on popular programs such as “Who Wants to be a Millionaire” or “America’s Funniest Home Videos” where audience participation, through the use of a remote voting tool, determines the outcome of a vote. Today, the affordability and mobility of such tools have provided educators an opportunity to use these systems in the classroom to administer exams, quizzes, take attendance or simply poll an audience. The use of these tools has transformed traditional

classrooms from a teacher led learning environment to a more interactive student led one that is all inclusive. As noted by Birdsall (2002),

Obtaining this kind of feedback and student participation in large classes is largely impossible without this kind of system. Even in small classes, which can be made highly interactive without technology, this type of system ensures that all the students think through questions, without leaving it to the vocal minority.

Using interactive technology tools that can spark a discussion in a classroom or allow a teacher to instantaneously assess student knowledge of a topic are some of the key benefits to using a SRS. Some published studies, including one performed in the Department of Biology at New Mexico State University, Las Cruces documented significant improvement in test scores, quiz results as well as student participation in classrooms using the SRS. “Increased use of the response systems in lecture had a positive influence on students’ performances on exam questions across all six biology courses” (Prezler et al.,2006).

Given the advantages found in earlier studies, the purpose of this study is to determine if using an SRS is an effective approach to motivating students in the classroom thus addressing the concerns that teachers at Kalaheo High School have expressed. The study relates experiences that teachers and students have when using a wireless interactive student response system in a high school setting. Kalaheo High School teachers agreed to participate in this study to determine if the use of the SRS promotes a more positive and/or more active environment in the classroom. Teachers used the SRS system as an assessment tool, a survey tool, and a peer learning tool.

The SRS tool used is called “Beyond Question Learning Set.” It is part of a series of instructional technology tools available from Smartroom Learning Solutions, Inc. Each set includes 50 handheld remote controls, two wireless sensors, and the software

application that is installed on a laptop computer. Lessons prepared for the teacher's use allow students to answer multiple choice, yes-no, true-false, and survey questions that are presented to the class via the computer and a multimedia projector.

The resulting data was analyzed and shared with Kalaheo High School administrators, the Technology Committee and teachers. If the resulting data gathered supported the use of such systems as a source of motivation for students in the classroom it would be recommended that more teachers have access to this technology. The results also serve to be helpful to other high schools considering adopting SRS technology.

## **Chapter II**

### **Literature Review**

The concept of polling an audience is not new, yet in recent years there has been an increase in the use of technology to facilitate such a process. In particular, interactive tools such as wireless electronic audience response systems are gaining more popularity as an interactive technology tool in educational settings. With an increase in use has come an increase in published literature on the effectiveness of using interactive audience response systems as an assessment tool in education. The goal of this literature review is to identify and summarize recent findings on the impact that the SRS has upon learning environments.

#### *Description of Student Response Systems (SRS)*

In researching electronic voting systems there is no standard terminology associated with such tools. They are commonly referred to as an Audience Response System (ARS), Electronic Voting System (EVS), Audience-Paced Feedback System (APFS), Interactive Audience Response System (IARS), Personal Response System (PRS) and Student Response System (SRS). For the sake of consistency throughout this review it will be referred to as a Student Response System (SRS).

Most people are familiar with the concept of audience polling devices if they have seen them in play on popular television programs such as “Who Wants to be a Millionaire?” or “American Idol” (see Appendix D).

Questions are typically posed that will require the audience to submit a response to a multiple choice or true/false question using a remote much like a television remote. The SRS works the same way in that the teacher designs questions that are presented to a class via a multimedia projector. The teacher requires only a laptop with the SRS software installed. Students use their individual wireless remotes to submit an answer which is registered on the teacher computer. The teacher can identify when the class has concluded voting when all remotes have registered an answer on the screen. At that point in time the teacher can review the responses as a whole and share the findings with the class or, if desired, wait until all questions have been answered to show results.

Student response systems are associated with four major components including (1) the computer (generally a laptop) installed with the software associated with the tool, (2) an LCD or video projector to display the questions and responses submitted by the students and (3) the wireless remote tools (including one instructor remote) that allow the users to individually respond to questions posed by the teacher and (4) a receiver to pick up the responses from the student remotes. The SRS is, simply stated, a tool. “Their primary function is to facilitate interactivity in the classroom” (Pritchard, 2006, p.5).

#### *Advantages of SRS*

Educators may feel it necessary to justify the need to become more interactive in the classroom as well as devote much needed funds towards these technology tools. Interactivity is exactly what the SRS promotes. Lowery, Romano and Guthrie (2006) cite Liu’s definition of interactive communication as “communication that offers individuals active control and allows them to communicate both reciprocally and synchronously” (p. 208). To address these legitimate concerns it is important to consider some of the

potential benefits to facilitating interactivity in the learning environment such as improved test results. As evidenced in a study published in the *Family Medicine Journal*, results indicated that using an audience response system improved quiz results.

Post-lecture quiz scores (maximum score 7) were  $4.25 \pm 0.28$  (61% correct) with non-interactive lectures,  $6.50 \pm 0.13$  (n=22, 93% correct) following interactive lectures without ARS, and  $6.70 \pm 0.13$  (n=23, 96% correct) following ARS lectures. The difference in scores following ARS or interactive lectures versus non-interactive lectures was significant ( $P < .001$ )” (Chavez, Loya, Friedman, & Schackow, 2004, p. 1).

It should also be noted that student outcomes can be affected in the SRS classroom.

It has already been shown that such a voting system when used as part of a particular pedagogical method in a particular disciplinary context (teaching first year mechanics classes in universities) produces large and statistically significant improvements in standardized test results (Draper et al 2001, p. 82).

### *Challenges*

Introducing new tools that facilitate interactivity may, for some teachers, prove challenging. The learning curve associated with many new technologies is often a hurdle that teachers face. The SRS is no different in this respect. “Software is usually the component that staff have the most contact with and is at the root of the common complaint that SRS’s have a ‘steep learning curve’” (Pritchard, 2006, p. 4). Other fundamental challenges that teachers face are in mastering the design and presentation techniques associated with the SRS. As noted by Beatty (2004) “An instructor must learn to think of herself as an engineer of learning experiences rather than as a dispenser of knowledge. She must learn to plan curriculum around questions and deep comprehension, rather than around lecture notes and content coverage” (p.5). Other challenges that have been noted include altering the traditional lecture approach and modifying teaching to

incorporate such a teaching tool. For those who do proceed and embrace the technology there are a variety of pedagogical approaches to using the interactive tool in the classroom.

### *Pedagogy*

Some more commonly accepted pedagogical methods associated with the SRS are (1) to launch discussion (2) to engage in formative and summative assessment (3) to engage peer instruction and/or peer assessment and (4) to perform exam review.

### *Discussion*

The rationale behind using an SRS to initiate discussion is evidenced in the supported literature. Consider the experience of David Lowe as cited by Lowery (2005). “I think the interactive methods are great for getting students started in thinking through the material, as well as getting them talking to each other about the material, which often leads to discussions that continue outside class” (p.9). Polling a class on their positions regarding a specific topic may initiate the type of student-mediated discussion that allows students to engage in cognitive learning. As opposed to a teacher-mediated discussion which does not differ much from the traditional lecture student-mediated discussions tend to produce more authentic and well thought out responses. As noted by Judson and Sawata (2002), “Students can be encouraged to defend or explain their answers promoting further student discussion” (p. 177).

### *Assessment – Formative and Summative*

The SRS is indeed an assessment tool that allows a teacher to track student comprehension before, during and after a lecture. Knowing, almost immediately, whether

a class understands a concept or not is one of the key benefits of this teaching tool and can serve to improve teaching effectiveness. “This timely feedback allows the instructor to better judge whether and how to amplify, clarify, or review” (Lowery, 2005, p. 3). As noted earlier, the SRS is a teaching tool not a teaching approach and the success of the SRS is dependent upon how the teacher elects to use it. “It is commonly reported that designing effective questions is critical to achieving desirable outcomes with formative questions and discussion sequences” (Pritchard, 2006, p. 9). This often seems to be the most challenging aspect of using the SRS. “Many who try teaching with a SRS discover that creating or finding ‘good’ questions is more difficult than it first appears” (Beatty et al. 2006, p. 31 ). The designing of appropriate questions for formative assessment can indeed prove challenging for many experienced teachers. It requires a bit of trial and error on behalf of the teacher. Once the delivery of appropriately designed formative questions is mastered the SRS can be used more effectively to determine whether students are learning.

In addition to formative assessment there is literature to support a broad range of pedagogical techniques associated with the SRS. Formative questions are often intended to encourage and/or launch discussion. As noted by Pritchard (2006) they are “those questions that aim to challenge misconceptions and reinforce (or form) new ideas” (p. 7). Formative questions can spark what some refer to as a “teachable moment” (Sabine 2005, p. 4). For many teachers, knowing how many students understand a concept and how many do not is important insight into how a concept has been explained. Perhaps a different presentation style or instructional approach is warranted if many students simply did not get it. This is an opportunity that can only be presented when there is full

participation on the part of student responses. More often than not, educators do not get full participation from their students in the traditional classroom. There is often a vocal minority that will contribute on a regular basis while others elect not to engage for a variety of reasons. Donald Liu, a professor in the department of Applied Economics at the University of Minnesota who has transformed his economics class using an SRS explains that it makes “everybody equal. No matter what your personality is. No matter if you are shy or not, everybody has an equal voice” (2005).

In addition to formative assessment methods to initiate discussion and introduce material, teachers also use the SRS to perform summative assessment. If remotes are registered then teachers can choose to use the tool to take attendance or administer quizzes or exams. When used in this fashion, the tool still provides the instant feedback and anonymity to a certain degree. Students can know instantaneously how they performed on an exam or quiz and teachers can record results without the hassle of sorting through papers reading and grading them (See Appendix E).

#### *Student Reactions/Perceptions*

In addition to the benefits that teachers have had with the SRS in the classroom, there is supporting literature that speaks to the reactions and perceptions of students who have used clickers or remotes in the classroom. In a recent University of Wisconsin study on Student Response Systems (Kaleta & Joosten 2007) sixty-seven percent of students agreed or strongly agreed that the use of clickers made them feel more engaged in class, increased participation (70%) and helped them to pay attention (67%). Some common benefits to students, that are generally understood as associated with using an SRS, include the anonymity factor and the instant feedback feature. Both serve to improve the

learning environment by eliminating the fear of giving an incorrect answer and allowing students to know instantaneously if they have full understanding of the topic or issue presented. As noted by Simpson and Oliver (2007) on student reactions and perceptions regarding electronic voting systems “the perceived benefits were closely aligned to the uses and advantages largely concerning engagement and stimulation, feedback (allowing the teacher to adapt their lesson plan), anonymity and the ability to compare oneself with peers” (8).

Caldwell notes the importance of peer instruction or peer discussion that occurs in the interactive classroom. “The strength of peer instruction is the interaction it fosters between students, who by virtue of their similar ages, language, and common experience, are often ‘better at clearing up each other’s confusions and misconceptions’ than their instructor” (Caldwell, 2007, p. 18). This kind of dialogue that takes place in small group discussions or within the larger classroom after a topic has been introduced is often associated with SRS use (See Appendix F).

#### *Anonymity*

Peer anonymity is perhaps one of the key benefits to students using the SRS in that their responses are known only to themselves. Unregistered remotes or clickers that have not been assigned (registered) to a student allow for complete anonymity in submitting responses. Common sense would dictate that if there is anonymity associated with a response then it is much more likely that that response will be authentic. In addition, students can submit their responses without fear or anxiety over being judged by their peers. Comparison with ones peers is noted as a positive feature in Kaleta’s and Joosten’s University of Wisconsin study. “Students reported that clickers allowed them to

participate in class discussion by answering questions without risking embarrassment for incorrect or naïve answers” (2007, p.5)

### *Instant Feedback*

The ability of the teacher to provide instantaneous feedback on the class responses enables individual students to feel less inadequate if they see that others have answered in a similar fashion, even if incorrectly. “If most of the class answers a question correctly, the students answering incorrectly may be motivated to read or think more deeply about the subject matter” (Woods and Chiu, 2003, p.2).

### *Interactivity and Engagement*

The overall impact on the learning environment is going to depend on a number of factors and those would include when the tool is used, what pedagogical techniques are used, the design of the questions posed and the overall engagement of the learners. The nature of the SRS is to increase interactivity and participation. The pedagogical strategies of both formative and summative assessment questions delivered via the SRS have the potential to alter the traditional lecturing style found in many classrooms today. Results from studies to date on the use of the SRS show that there is an impact on the learning environment resulting in increased student participation, engagement of learners, modification of lectures, instantaneous feedback for teachers resulting in more time spent on quality instruction and less time on grading and collating results. Pritchard (2006) notes that the ability to poll and display the responses of an entire class in near-real time is the backbone of the SRS supported pedagogy.

## **Chapter III**

### **Methodology**

Given the positive results from previous studies of SRS systems on motivation and learning in the classroom environment, the purpose of this action research study was to determine whether these response systems have a positive impact on student experiences in a high school setting.

#### *Research Design*

This study employed a mixed method case study approach to understand the experiences that teachers and students in a minimum of six classes had when teachers used the interactive student response system as an assessment tool. The goal of this study was to determine if the use of the SRS promotes a more positive and/or more active and engaged learning environment. Data were collected from participating teachers about their opinions of the SRS tool after a semester's use in the high school classrooms. The data was gathered through teacher surveys, informal interviews, and classroom observations. All data that was gathered throughout this study was done so by the school Technology Coordinator who also served as the researcher of this study.

#### *Sampling*

The criteria for selecting the participants for this study included teachers who had attended a training workshop called "The Interactive Classroom; Using the Beyond Question Learning Set" and teachers who had practical experience with the technology tool. The high school classes selected included AP World History, Digital Media, Biology, AP Biology, and Geometry. The participants involved in the study were both

new and veteran teachers. Class size varied but the range fell between 18 to 32 students. Each classroom teacher utilized the SRS a minimum of three times with some using it at least a dozen times.

### *Procedure*

All issues associated with initiating this study had been considered before the study began including selecting teachers who were willing to use the SRS in their classrooms, purchasing the technology to be used, and providing adequate training to teachers on pedagogical uses of the technology tool in the classroom. An initial training was provided on November 7, 2007 to all teachers involved in the study to ensure that they had the skills and understanding to effectively use the technology in their respective classrooms. The actual study began in early November and concluded by the end of January 2008.

Each participating teacher used the SRS as an assessment tool in preparation for exams, quizzes or to simply initiate discussion. Throughout the study, participating classes were observed using the SRS and teachers were informally interviewed. The purpose of the classroom observations and the teacher interviews was to gather qualitative data related to the learning environments when the SRS was in use.

### *Instrumentation*

Data collection was ongoing throughout the semester beginning with classroom observations of the SRS tool in use. In early February 2008 paper-based attitudinal surveys were administered to the six participating teachers to gather quantitative data on their opinions on the effectiveness of using the SRS in their respective classrooms.

### *Limitations*

Several factors were likely to contribute to the expressed teacher perceptions on use of the SRS in the classroom. As with many new technology tools there was the novelty of a tool that can affect one's perception of it. Pedagogical strategies were also a factor when evaluating the resulting data. Identifying the method associated with the use of the SRS is helpful in determining what enhances the learning environment. How a teacher utilized the tool certainly contributed to one's perception of its effectiveness. The quality of the lectures and the content varied and thus had to be considered when analyzing and summarizing the data. It must also be noted that some teachers utilized more of the features of the SRS than others. Some of these features include registering the remotes, tracking progress of students, generating seating charts, exporting results into spreadsheets, etc. Not all teachers took advantage of all of the features available to them. Most teachers utilized the interactive feature with questions being presented to the class as a whole and students responding via the remotes. Few teachers used the SRS software to track progress or export data into spreadsheets. (add the section on researcher bias?)

#### *Data Analysis*

This purpose of this study was to identify the *Effectiveness of using Interactive Audience Response Systems as an Assessment Tool in Education*. Results of the teacher surveys were analyzed and summarized by the coordinator of this study and the results shared with the Kalaheo High School Technology Committee. The outcome of the study was presented to the Kalaheo High School Leadership Team as well as distributed to teachers for informational purposes. The results of this study will be a contributing factor in determining how to spend technology funds in the future.

## **Chapter IV**

### **Analysis of Data and Results**

This chapter will identify the sequence of events that took place throughout this study including the initial training session, the survey results from the initial training, the classroom uses associated with the SRS, the paper-based teacher survey results and the individual comments from teachers related to their experiences with the SRS.

On November 7, 2007 a workshop was offered to teachers at Kalaheo High School called “The Interactive Classroom; Using the Beyond Question Learning Set”. The purpose of the workshop was to help facilitate the integration of technology in curriculum across all content areas and to train interested teachers in using the interactive technology tool called “Beyond Question.” The group that attended was comprised of English, Social Studies, Science and Math teachers. In addition, several of the high school counselors and one curriculum coordinator participated in the workshop. There were a total of 11 workshop attendees and there were two training sessions that took place. Each session occurred during the common prep time of teachers. Teachers who attended the workshop were asked to complete a written survey following the workshop. Below is a summary of the data generated from the teacher surveys related to the workshop.

#### *Results from Workshop Surveys*

Of the seven questions that were on the survey, five were Likert-scale type questions with possible responses of either A. Strongly Agree B. Agree C. Neutral D. Disagree or E. Strongly Disagree. The results are summarized in Table 4.1.

On the first question most (85%) who responded to the survey **strongly agreed** that they found the SRS (Student Response System) workshop helpful. The remaining 15% **agreed** that the workshop was helpful. On the second question 85% **strongly agreed** that they planned on using the SRS in their classroom with the remaining 15% selecting **agree**. When asked if they felt confident that they could use the SRS on their own 29% **strongly agreed**, 57% **agreed** and 14% responded **neutral**. There was complete agreement when they were asked if they believed that students would like using the SRS with 100% responding with **strongly agree**. When asked if they felt there was adequate technical support available to them to use the SRS in their classroom 85% **strongly agreed** and 15% **agreed**.

Two additional questions were asked to determine how often and for what purpose teachers might see themselves using the SRS. When asked how often they planned on using the SRS 72% answered **monthly**, 14 % **weekly** and 14% responded **once a semester**. When asked for what purpose would they use the SRS the possible responses included: to administer quizzes, administer exams, administer both quizzes and exams, initiate discussion, review for tests, or all of the above. Of the responses chosen, 42% chose to use it to **initiate discussion**, 29% plan on using it to **review for tests** and 29% selected **all of the above**.

Table 4.1 **Post workshop survey results**

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I found the SRS workshop helpful	6	1			
I plan on using the SRS in my classroom	6	1			
I feel confident that I can use the SRS on my own	2	4	1		
I believe my students will like using the SRS	7				
I feel I have adequate technical support to use the SRS in my classroom	6	1			

### *Classroom Uses*

Following the workshop in November, 2007 six teachers volunteered to participate in this action research study. Each participating teacher was provided a laptop, a projector, a set of 50 remotes and the accompanying software for the Beyond Question Learning Set. They were provided handouts to assist them with designing questions (See Appendix E) and they were also provided examples of what types of activities they could use the SRS for (See Appendix F). All teachers were informed that technical support, if needed, would be available when they were using the SRS.

During the course of this study participating classroom teachers used the SRS in their respective classrooms primarily as an assessment tool. Some teachers used it to promote discussion (peer instruction) and some used it to facilitate group activities. Others engaged in lecture driven formative assessments as well as summative

assessments including quizzes and tests. During the course of the study teachers were observed using the SRS and informal interviews took place with each teacher to get feedback on their attitudes towards the SRS for this study. At the conclusion of the study teachers were given paper-based attitudinal surveys and asked to respond to 12 questions related to the effectiveness of using the SRS in their classroom. Table 4.2 includes the results from that paper-based survey.

**Table 4.2 Paper-based teacher survey results**

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Students are more likely to express an opinion in class when the instructor asks questions using the Student Response System.				33%	67%
2. Students are more likely to express an opinion in class when the instructor asks questions that require them to raise their hand in response.	17%	83%			
3. Using the Student Response System in class increases student interest in the topic being discussed.				50%	50%
4. Using the Student Response System in class does NOT enhance students understanding of the material.	33%	67%			
5. Knowing that we are using the Student Response System increases the likelihood that students will want to attend class.			50%	50%	
6. Students prefer lectures and demonstrations that incorporate the Student Response System			17%	33%	50%
7. The Student Response System is just another gadget, and its use distracts students during class.	33%	67%			
8. Using the Student Response System increases the attention and participation level during class.				67%	33%

9. Students learn more about a topic when the Student Response System is used to gather and display immediate feedback from the entire class.			17%	67%	17%
10. Students prefer that quizzes and tests should just be handed out to individual students for their own student feedback and they are not interested in seeing the entire class's responses using the Student Response System.		67%			33%
11. I like using the Student Response System to administer practice questions because it indicates how well the students understand course content.				17%	83%
12. I wish more of my classes had the opportunity to use the Student Response System.			17%	50%	33%

Classroom observations and informal teacher interviews provided insight into how teachers utilized the SRS and if they had any technical challenges using the technology. Three of the six teachers required technical support to ensure that the software interacted with the handheld remotes. When this particular problem repeated itself several times the manufacturer was contacted and notified of the problem. Immediate support was provided by the manufacturer and updated software was shipped to the school to assist in remedying this problem. Once the new software was installed the problem was resolved. This however did cause some teachers to initially question the reliability of the tool. Some teachers expressed frustration with this particular problem during their informal interviews but ultimately there was overall agreement among all participants that the use of the technology tool was beneficial to their students and to them.

The observations also allowed for documentation of what pedagogical strategies were used. In the case of one observation of an AP Biology lecture, the teacher presented a review of the topics that would be on her students AP exam. Teachers frequently use this formative assessment technique to improve their own instructional methods and solicit student feedback throughout the teaching and learning process. For example, in this case the teacher observed that with some questions some students did not understand the concept or select the correct answer so she took that opportunity to return to the question and review the topic. Her aim was two-fold. She wanted to make sure that she was providing her AP students with the necessary content so that they would be successful on their AP exam. If students did not understand a topic or a particular aspect of the material she was able to identify this immediately and review the misunderstood material. In this sense, the teacher felt that there was no other method that she knew of that would give her this immediate feedback and complete data on all of her students.

Another instructional approach that was observed was direct instruction. A participating teacher used the SRS to educate high school freshman and sophomores on the necessary credits for graduation. The graduation credit requirements were introduced and presented via a PowerPoint presentation. The SRS was used in the presentation to periodically review this information. Students were quizzed on whether they understood what they needed to successfully meet their graduation requirements which periodically assessed whether or not the audience was clear on the information. This particular teacher was simply using the tool to deliver information and immediately review that information for clarity.

*Teacher Interviews*

Teachers participating in the informal interviews all expressed positive supporting comments regarding the SRS. When asked if they felt it was easy you use the SRS the responses were all favorable. Some examples of comments that were noted in interviews include:

- *“It was complicated at first but after playing with it for a while I figured it out”* (Biology Teacher).
- *“I found it really easy to use”* (Geometry Teacher).
- *“I know there is much more I can do with it but I found the basics easy”* (Social Studies Teacher).

When asked how you used the SRS the interviewees responded accordingly:

- *“I used it to administer my final exam in December 2007. My students had both a hard copy of their exam and when they all finished the hard copy exam they entered their answers using the remotes. This way they knew the results of their exam and their final grades immediately. I have also used it as a voting tool in my class. Recently students had to use Photoshop to demonstrate what they knew about editing photos. All students submitted an edited photo and then the class selected the best photo by using the remotes to vote”* (Digital Media Teacher).
- *“I only use the SRS to prepare for quizzes and tests”* (AP Biology Teacher).

When asked why they felt the tool was effective in their classroom all teachers noted the following factors as key to its success for both students and teachers:

- Anonymity
- Immediate feedback
- Workload for teachers reduced

- Tracking student grades

As shown in the above tables and from the feedback provided through surveys, interviews and observations there is clearly evidence of favorable experiences from participating teachers when using a SRS in the high school classroom.

## Chapter V

### Discussion and Recommendations

The goal of this study was to determine if the use of an interactive Student Response System promotes a more positive and/or more active and engaged learning environment in a high school classroom. There has been much research in higher education showing that when we increase the frequency and quality of teacher student interactions through the use of such interactive tools we see more active participation as opposed to passive involvement in the classroom. In other words, when students respond to questions via remotes they are more likely to participate versus simply raising their hand at will to respond to a question. These results were paralleled in this study at the high school level.

During the initial part of this study it was essential to provide teachers with a training opportunity to ensure that they were capable of using the technology effectively. Once teachers had a chance to learn about the technology they were given the opportunity to participate in this study. Before the study actually began the teachers were trained and then asked to provide feedback on their training. That feedback was necessary to make sure that the participants were able to work with the tool and ultimately use it in one or more of the methods they were trained in.

Some of the pedagogical methods that are most commonly associated with a SRS are lectures using formative questions where the teacher can get immediate feedback from students and if necessary review a topic for clarity. Another pedagogy associated with the SRS is summative assessment. Summative assessment methods include using the SRS for graded activities, such as multiple-choice quizzes or even tests. An alternative

method is to use the SRS to initiate discussion by asking for opinions or polling the group on what they think an answer might be without any prior knowledge of the topic. This often facilitates something called peer instruction whereby students begin to dialogue with each other about their individual opinions, thoughts and/or knowledge of the topic (See Appendix E).

### *Lessons Learned*

In general, there are two common pedagogical methods associated with the SRS. These are teacher led discussions and student led discussions. Both serve to increase participation and engage the students thereby enhancing the learning environment. The inclusion of the interactive technology proves to enhance the learning environment in a number of ways. When the SRS is used and students respond, the teacher knows immediately how many understand what is being imparted and how many do not. This provides the opportunity for the teacher to re-visit the concept(s) if necessary right then and there to ensure comprehension by all or more students. Further, the SRS supports full participation of the audience. A teacher knows how many students have responded and can prompt students to enter their responses if any fail to do so.

In teacher led lectures/discussions where the technology is not used time is needed to garner feedback from the students. Teachers have to grade exams and quizzes in order to know whether or not his/her students have understood what has been taught. Further, teachers soliciting verbal responses in class results in only some and not all of the students participating. Not all students will get involved in a classroom dialogue thus limiting the ability for the teacher to truly know if he/she has imparted the knowledge on all of the students.

### *Conclusions*

The opinions expressed by the teachers that participated in this study undoubtedly favored using this technology as a tool to engage their students and increase active participation from all of their students. All the participants believed that using the SRS resulted in more active participation on the part of students. Teachers also were able to conclude that their lectures were either adequate and/or rich in content or that their lectures lacked enough information and needed to be modified to reflect what was missing.

There were no participants in this study that felt that the tool was not a worthwhile technology.

### *Future recommendations*

Given the results of the this action research study the data supports the theory that further use of the SRS is warranted to increase student participation in the high school classroom. The findings of this study will be presented to the Kalaheo High School technology committee, the school's leadership committee as well as the faculty as a whole. Investing in additional student response sets will be determined by these groups as will funding sources for such purchases. A suggestion will also be made to provide additional training opportunities for teachers interested in using the SRS in the classroom.

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## APPENDIX A

**Follow up survey for teachers/counselors who attended the workshop/training on  
using the Beyond Question Learning Set in the classroom****Workshop date: 11/6/2007**

1. I found the SRS workshop helpful
  - a. Strongly Agree
  - b. Agree
  - c. Neutral
  - d. Disagree
  - e. Strongly Disagree
  
2. I plan on using the SRS in my classroom
  - a. Strongly Agree
  - b. Agree
  - c. Neutral
  - d. Disagree
  - e. Strongly Disagree
  
3. How often do you plan on using the SRS?
  - a. Weekly
  - b. Monthly
  - c. Once a week
  - d. Once a semester
  - e. Never
  
4. I feel confident that I can use the SRS on my own.
  - a. Strongly Agree
  - b. Agree
  - c. Neutral
  - d. Disagree
  - e. Strongly Disagree
  
5. I plan on using the SRS to
  - a. Administer quizzes
  - b. Administer exams
  - c. Administer both quizzes and exams
  - d. Initiate discussion
  - e. Review for tests
  - f. All of the above
  - g. None of the above
  
6. I believe my students will like using the SRS
  - a. Strongly Agree
  - b. Agree

- c. Neutral
- d. Disagree
- e. Strongly Disagree

7. I feel I have adequate technical support to use the SRS in my classroom
- a. Strongly Agree
  - b. Agree
  - c. Neutral
  - d. Disagree
  - e. Strongly Disagree

## APPENDIX B

Teacher Survey Questions  
Conducted by Polly Quigley

1. Students are more likely to express an opinion in class when the instructor asks questions using the Student Response System.
  - A. Strongly Disagree
  - B. Disagree
  - C. Neutral
  - D. Agree
  - E. Strongly Agree
  
2. Students are more likely to express an opinion in class when the instructor asks questions that require them to raise their hand in response.
  - A. Strongly Disagree
  - B. Disagree
  - C. Neutral
  - D. Agree
  - E. Strongly Agree
  
3. Using the Student Response System in class increases student interest in the topic being discussed.
  - A. Strongly Disagree
  - B. Disagree
  - C. Neutral
  - D. Agree
  - E. Strongly Agree
  
4. Using the Student Response System in class does NOT enhance students understanding of the material.
  - A. Strongly Disagree
  - B. Disagree
  - C. Neutral
  - D. Agree
  - E. Strongly Agree
  
5. Knowing that we are using the Student Response System increases the likelihood that students will want to attend class.

- A. Strongly Disagree
- B. Disagree
- C. Neutral
- D. Agree
- E. Strongly Agree

6. Students prefer lectures and demonstrations that incorporate the Student Response System.

- A. Strongly Disagree
- B. Disagree
- C. Neutral
- D. Agree
- E. Strongly Agree

7. The Student Response System is just another gadget, and its use distracts students during class.

- A. Strongly Disagree
- B. Disagree
- C. Neutral
- D. Agree
- E. Strongly Agree

8. Using the Student Response System increases the attention and participation level during class.

- A. Strongly Disagree
- B. Disagree
- C. Neutral
- D. Agree
- E. Strongly Agree

9. Students learn more about a topic when the Student Response System is used to gather and display immediate feedback from the entire class.

- A. Strongly Disagree
- B. Disagree
- C. Neutral
- D. Agree
- E. Strongly Agree

10. Students prefer that quizzes and tests should just be handed out to individual students for their own student feedback and they are not interested in seeing the entire class's responses using the Student Response System.

- A. Strongly Disagree
- B. Disagree
- C. Neutral
- D. Agree
- E. Strongly Agree

11. I like using the Student Response System to administer practice questions because it indicates how well the students understand course content.

- A. Strongly Disagree
- B. Disagree
- C. Neutral
- D. Agree
- E. Strongly Agree

12. I wish more of my classes had the opportunity to use the Student Response System.

- A. Strongly Disagree
- B. Disagree
- C. Neutral
- D. Agree
- E. Strongly Agree

## APPENDIX C

**CONSENT TO PARTICIPATE IN RESEARCH****Title of Study****The Effectiveness of using Interactive Audience Response Systems as an Assessment Tool in Education**

**Project Description:** During the fall 2007 semester two teachers at Kalaheo High School in Kailua, Hawaii will each use a wireless Student Response System (SRS) called “The Beyond Question Learning Set”. The purpose of this qualitative study will be to relate experiences that the two selected teachers and their respective students have when using the interactive student response system as an assessment tool in their respective classrooms. The goal of this qualitative study is to determine if the use of the SRS promotes a more positive and/or more active and engaging learning environment. At the conclusion of the fall semester, students’ opinions of the SRS tool will be surveyed.

**Principle Investigator:** Polly Quigley

**Position:** Kalaheo High School Technology Coordinator

You are being asked to participate in a qualitative research study.

Before you agree, the investigator must tell you about (i) the purposes, procedures, and duration of the research; (ii) any procedures which are experimental; (iii) any reasonably foreseeable risks, discomforts, and benefits of the research; and (v) how confidentiality will be maintained.

Your participation in this research is voluntary, and you will not be penalized or lose benefits if you refuse to participate or decide to stop.

If you agree to participate, you must be given a signed copy of this document and a written summary of the research.

You may contact Professor Ellen Hoffman, Ph.D. at the University of Hawaii Manoa College of Education any time you have questions about the research.

By signing this document means that the research study, including the above information, has been described to you orally, and that you voluntarily agree to participate.

Name of Participant \_\_\_\_\_

Signature of Participant \_\_\_\_\_ Date \_\_\_\_\_

## APPENDIX D

## Sample of Beyond Question Learning Set

follow up SRS survey - Beyond Question

File Edit View Class Question Help

Roster Desks Lesson Answers Remotes Graphs

Lesson: follow up SRS survey Total Points: 0

No.	Question	Type	Answer	Points
1.	I found the SRS workshop helpful. A. Strongly Agree B. Agree C. Neutral D. Dis...	A - E	A	0
2.	I plan on using the SRS in my classroom A. Strongly Agree B. Agree C. Neutral ...	A - E	A	0
3.	How often do you plan on using the SRS? A. Weekly B. Monthly C. Once a semester...	A - E	A	0
4.	I feel confident that I can use the SRS on my own A. Strongly Agree B. Agree C...	A - E	A	0
5.	I plan on using the SRS to A. administer quizzes B. administer exams C. admini...	A - G	A	0
6.	I believe my students will like using the SRS. A. Strongly Agree B. Agree C. Ne...	A - E	A	0
7.	I feel I have adequate technical support to use the SRS in my classroom A. Strong...	A - E	A	0

Reorder

Question 1 Type: A - E Answer: A Points: 0

I found the SRS workshop helpful.

A. Strongly Agree  
B. Agree  
C. Neutral  
D. Disagree  
E. Strongly Disagree

B I U Arial 20 Remove Question Add Question

Disregarding Answers

start Skype™ - ... thesis [Co... Teacher C... 2 Firefox srs info follow up S... 10:20 PM

## APPENDIX E

### Types of Questions to be used with an SRS

#### (Provided by the manufacturer of the Beyond Question Learning Set)

- **Factual Questions:** These questions might be used to see if students did the reading, remember important points from prior classes, or have memorized key facts.
- **Conceptual Questions:** While difficult, it is possible to write multiple-choice questions that demonstrate whether or not students understand important concepts and principles.
- **One-Best-Answer Questions:** These questions include multiple answer choices, more than one of which could be argued as correct. Students are asked to select the one best answer from these choices.
- **Opinion Questions:** Evaluative and opinion questions may not have correct answers, but asking these questions can engage students and provoke rich discussions, particularly in response to ethical, legal, or moral issues.
- **Data Gathering Questions:** An SRS can be used to quickly gather demographic, opinion, or other data from a class full of students. This is often useful in social science classes that utilize social or economic experiments in the classroom.
- **Questions Asking for Predictions:** In science classes, students can be asked to predict the outcome of an experiment prior to being shown the experiment. This gives the teacher a sense of the students' preconceptions and increases the surprise value of the experiment when students see just how many of their classmates expected different outcomes.

- **Games:** In social science classes, particularly economics, classroom games are played to illustrate points about human behavior. An SRS can facilitate data-gathering in such games.
- **Feedback on Teaching:** SRS's can also be used to ask students to provide direct feedback on how well a particular class is going. For example, one might ask students to rate their level of understanding of the lecture thus far on a scale of 1 to 4.

## APPENDIX F

### **Types of Activities to engage in with a Student Response System**

#### **(Provided by the manufacturer of the Beyond Question Learning Set)**

- **Attendance:** Clickers can be used to take attendance directly (e.g. asking students to respond to the question "Are you here today?") or indirectly by determining which students used their clickers during class.
- **Summative Assessment:** Clickers can be used for graded activities, such as multiple-choice quizzes or even tests. Some brands of clickers allow for a "student-paced" mode in which students answer questions on a printed test at their own pace.
- **Formative Assessment:** Clickers can be used to pose questions to students and collect their answers for the purpose of providing real-time information about student learning to both the instructor and the students. Students can use this feedback to monitor their own learning, and instructors can use it to change how they manage class "on the fly" in response to student learning needs. Some brands of clickers allow students to register their confidence level (high, medium, or low) along with their answer, providing more detailed feedback to the instructor. Some instructors assign participation grades to these kinds of formative assessments to encourage students to participate. Other instructors assign points for correct answers to encourage students to take these questions more seriously. Other instructors do a mix of both, assigning partial credit for wrong answers.

- **Homework Collection:** Some brands of clickers allow students to record their answers to multiple-choice or free response homework questions outside of class and submit their answers via the clickers at the start of class.
- **Discussion Warm-Up:** Posing a question, giving students time to think about it and record their answers via clickers, and then displaying the results can be an effective way to warm a class up for a class-wide discussion. Compared with the approach of taking the first hand that is raised after a question is asked, this approach gives all students time to think about and commit to an answer, setting the stage for greater discussion participation.
- **Contingent Teaching:** Since it can occasionally be challenging to determine what students understand and what they do not understand, clickers can be used to gauge that in real-time during class and modify one's lesson plan accordingly. If the clicker data show that students understand a given topic, then the instructor can move on to the next one. If not, then more time can be spent on the topic, perhaps involving more lecture, class discussion, or another clicker question.
- **Peer Instruction:** The teacher poses a question to his or her students. The students ponder the question silently and transmit their individual answers using the clickers. The teacher checks the histogram of student responses. If significant numbers of students choose the wrong answer, the teacher instructs the students to discuss the question with their neighbor. After a few minutes of discussion, the students submit their answers again. This technique often (but not always!) results in more students choosing the correct answer as a result of the peer instruction phase of the activity. This is a fairly simple way to use clickers to engage a large

number of students in discussions about course material. This approach can also set the stage for a class-wide discussion that more fully engages all students.

- **Repeated Questions:** In the peer instruction approach described above, students respond to a given question twice--once after thinking about their answer individually and again after discussing it with their neighbor. Some instructors ask the same question several times, with different activities in between rounds of voting designed to help student's better answer the question. For instance, an instructor might have the students answer the question individually, then discuss it with their neighbor and respond, then participate in a class-wide discussion and respond, and then listen to a mini-lecture on the topic and respond. For particularly challenging questions, this can be an effective technique for helping students discover and explore course material.
- **Question-Driven Instruction:** This approach combines contingent teaching and peer instruction. Lesson plans consist entirely of clicker questions. Which questions are asked depends entirely on how students answer the questions. An instructor might come into class with a stack of clicker questions, with multiple questions on each topic. As students perform well on clicker questions, the instructor moves on to questions on new topics. As students perform poorly, the instructor asks further questions on the same topic. The instructor does not have a lesson plan in the traditional sense when using this approach. Instead, the course of the class is determined reactively to demonstrated student learning needs.
- **"Choose Your Own Adventure" Classes:** In this technique, an instructor poses a problem along with several possible approaches to solving it--perhaps

approaches suggested by students during class. The instructor has the students vote on which approach to pursue first, then explores that approach with the students. Afterwards, the students vote on which approach to pursue next.