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AN EVALUATION OF A STUDENT RESPONSE SYSTEM USED AT BRIGHAM
YOUNG UNIVERSITY

by

Coral Richards Hanson

An evaluation report submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of
Master of Science

Department of Instructional Psychology and Technology
Brigham Young University

July 2007

BRIGHAM YOUNG UNIVERSITY

GRADUATE COMMITTEE APPROVAL

of a thesis submitted by

Coral Richards Hanson

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ABSTRACT

AN EVALUATION OF STUDENT RESPONSE SYSTEMS USED AT BRIGHAM YOUNG UNIVERSITY

Coral Richards Hanson

Department of Instructional Psychology and Technology

Master of Science

The purpose of this project is two fold: (a) to evaluate the technology (hardware and software) of the student response system (SRS) used at Brigham Young University (BYU) and (b) to evaluate which instructional methods being used with the SRS students' feel are most helpful. In the past, the student response systems supported by BYU have not fully met the needs of professors and problems with the systems have limited professors' uses of the SRS.

Ten professors were randomly selected to participate in the evaluation using a stratified random sampling technique. The data collection methods consisted of classroom observations, interviews with the ten selected professors, focus groups with students in the professors' classes, a student survey, and a professor survey. Data were collected throughout Winter semester 2007.

The new system, iClicker, functioned well for the majority of professors. Some technical problems were encountered, but professors were typically able to resolve them as they gained more experience with the system. The most frequently stated problem for professors was with iGrader, which limited some professors' uses of the system. Students, however, experienced few technical problems with their clickers. The most frequent problem cited from students was the clicker shutting off easily.

Students were generally positive about the helpfulness of the instructional methods professors were using. The instructional method students found most helpful was receiving immediate feedback. They also felt their comprehension of course material, attendance to lecture, attentiveness/engagement during lecture, participation in lecture, and achievement in the course had increased from using the SRS. However, a significant factor in students' perceptions of the clicker's helpfulness was the cost of purchasing the clicker. The least positive students felt that the cost of purchasing the clicker outweighed the benefits of using a student response system. These students rated the instructional methods as less helpful and rated their comprehension, attendance, engagement, participation, and achievement increasing less than those that felt the cost was worth the benefit.

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I would also like to thank my father, P. Scott Richards, for his help and guidance in the data analysis and organization of this report. His expertise greatly enhanced the meaningfulness of this project. Finally, I dedicate this thesis to my wonderful husband, Shaun. He has supported me and cheered me on as I have worked to complete this project. Without him there, it would not have been possible for me to carry this through to completion.

Table of Contents

Abstract.....	iv
Acknowledgment	vi
Table of Contents.....	vii
List of Tables	xi
List of Figures.....	xiii
Chapter 1: Introduction.....	1
Background.....	1
Purpose.....	3
The Evaluand	4
Evaluation Questions	4
Criteria and Standards.....	5
Stakeholders and Information Users.....	6
Evaluator Background	8
Issues and Concerns.....	8
Chapter 2: Review of Literature	10
History of Student Response Systems in Higher Education.....	11
Underlying Pedagogy of Using a SRS.....	12
Instructional Methods Used and Reported Effects on Students.....	13
Technical Problems Affect Students' Perceptions of the SRS	18
Chapter 3: Evaluation Design.....	20
Participants.....	20
Data Collection Methods	20
Professor interview	23

Classroom observation.....	24
Student focus group	25
Student survey.....	25
Professor survey.....	26
Data Analysis	26
Reporting Strategies.....	28
Schedule and Budget.....	29
Resources	29
Chapter 4: Findings and Discussion	30
Organization of Findings	30
Evaluation Questions 1, 2, & 3: Limitations for Professors	30
Software	32
Receiver	33
Student clicker	34
Instructor remote.....	34
Ease of use	35
Likes and dislikes of iClicker	37
Technical problems that limited uses of iClicker	40
Other features professors would like in iClicker	42
Evaluation Questions 4 & 5: Limitations for Students	43
Evaluation Question 6: Helpfulness of Instructional Methods.....	47
Overall results of instructional methods	47
Results by professor	52
Results by year in school	60
Evaluation Question 7: Areas Students Feel Using SRS has Increased	62
Overall results	62
Results by professor.....	65
Results by year in school	68
Evaluation Question 8: Cost of Purchasing the Clicker.....	69
Evaluation Question 9: Advantages and Disadvantages of Using a SRS.....	72
Advantages.....	72
Disadvantages	75
Chapter 5: Conclusions and Recommendations	78

Conclusions.....	78
Program Improvements/Recommendations.....	79
Technical problems.....	79
Instructional methods.....	80
Successes of the Evaluation.....	81
Challenges Encountered During the Evaluation.....	82
Limitations of the Evaluation.....	82
Meta-evaluation.....	83
Chapter 6: Article to be Submitted for Publication.....	85
Introduction.....	85
Participants.....	90
Data Collection Methods.....	90
Data Analysis.....	91
Results.....	92
Evaluation Question 1: Helpfulness of Instructional Methods.....	92
Overall results of instructional methods.....	93
Results by professor.....	95
Evaluation Question 2: Areas Students Feel Using SRS has Increased.....	99
Overall results.....	99
Results by professor.....	101
Evaluation Question 3: Cost of Purchasing the Clicker.....	103
Conclusions.....	106
References.....	108
Appendix A: Classroom Observation Form.....	111
Appendix B: Student Survey.....	112
Appendix C: Focus Group Questions.....	113
Appendix D: Professor Interview Questions.....	115
Appendix E: Professor Survey.....	116

Appendix F: Interim Report.....117

Appendix G: Schedule and Budget.....139

Appendix H: Final Meta-Evaluation.....140

List of Tables

Table 1: Criteria and Evaluation Questions Answered.....	7
Table 2: Criteria, Evaluation Questions Answered, and Data Collection Method	21
Table 3: Description of Data Collection and Data Analysis Methods.....	27
Table 4: Summary of the Number of Respondents for Each Data Collection Method	30
Table 5: How well iClicker has Functioned or Met Professors' Needs.....	31
Table 6: Professor Stated Technical Problems with iClicker	33
Table 7: How Easy was it to Begin Using iClicker	35
Table 8: Feature of iClicker Professors Like	38
Table 9: Features of iClicker Professors Dislike	39
Table 10: Have Technical Problems Limited the Use of iClicker for Professors?.....	41
Table 11: Other Features of SRS that are Necessary for Professors.....	42
Table 12: Student Reported Technical Problems.....	44
Table 13: Student Perceived Limitations Caused by the Technical Problems	46
Table 14: Instructional Methods from the Student Survey	48
Table 15: Overall Descriptive Statistics for each Instructional Method.....	49
Table 16: Instructional Methods Students from Focus Groups Found Helpful.....	50
Table 17: Descriptive Statistics for Instructional Methods Grouped by Professor	54
Table 18: Descriptive Statistics for Instructional Methods Grouped by Professor, Cntd..	55
Table 19: How Professors were using iClicker.....	57
Table 20: Descriptive Statistics of 5 Areas from Survey.....	63
Table 21: Descriptive Statistics of 5 Areas from Survey Grouped by Professor.....	66
Table 22: Advantages of Using a SRS for Students	73

Table 23: Advantages of Using a SRS Stated by Professors	74
Table 24: Disadvantages of using a SRS Stated by Students	76
Table 25: Disadvantages of Using a SRS Stated by Professors.....	77
Table 26: Criteria and Evaluation Questions Answered.....	87
Table 27: Criteria, Evaluation Questions Answered, and Data Collection Method	91
Table 28: Instructional Methods from the Student Survey	93
Table 29: Schedule and Budget	139

List of Figures

Figure 1: Overall mean ratings for each instructional method	49
Figure 2: Line graph of mean ratings of instructional methods grouped by professor.....	53
Figure 3: Mean ratings of the instructional methods for each professor	58
Figure 4: Professors with Similar Instructional Methods	59
Figure 5: Mean Ratings of Instructional Methods by Year in School	61
Figure 6: Students Responses from Focus Group of 5 Areas	63
Figure 7: Students Ratings of 5 Areas by Professor	65
Figure 8: Student Mean Ratings of how much the 5 Areas Increased Across Professor...	67
Figure 9: Cost and Students Mean Ratings of Instructional Methods	69
Figure 10: Cost and Student Mean Ratings of 5 Areas.....	70
Figure 11: Student Mean Rating of Cost by Professor	71
Figure 12: Line graph of Mean Ratings of Instructional Methods Grouped by Professor	96
Figure 13: Mean Ratings of the Instructional Methods for Each Professor	97
Figure 14: The Professors who used SRS Similar Ways Mean Ratings of IM	98
Figure 15: Student Responses About if They Felt the 5 Areas Increased	100
Figure 16: Students Mean Ratings by Professor of if 5 Areas Increased	102
Figure 17: Mean Ratings of How much the 5 Areas Increased Across Professor.....	103
Figure 18: Students Mean Rating of the Cost of Purchasing the Clicker Worth Benefit	105

Chapter 1: Introduction

Background

The Center for Teaching and Learning (CTL) specializes in assisting Brigham Young University (BYU) faculty in successfully creating and implementing teaching and learning technology. The CTL serves the campus community by “assisting faculty and departments in their efforts to improve teaching and learning and advancing truth and knowledge about teaching and learning through research, innovation, and evaluation” (About CTL, n.d., ¶ 1). The CTL began piloting the first *student response system* (SRS) several years ago. A student response system is a combination of hardware and software that allows students to respond to questions posed by the instructor using a response pad, which resembles a remote control, in class. Student responses are collected by a receiver that is attached to the computer and then compiled by the software on the computer. The instructor can then choose to display the results using the program software.

The first student response system piloted by the CTL was Hyper-Interactive Teaching Technology (HITT). The HITT system utilized infrared technology, which did not easily accommodate large lecture halls. Due to the limitations of the system, a change was made to a new SRS called TurningPoint. TurningPoint is similar to most of the other student response systems that utilize radio frequency in its receivers and transmitters, which enables use in larger classrooms with only one receiver. TurningPoint software integrated with Microsoft Office, allowing questions to be created, administered, assessed and reported from Microsoft PowerPoint without ever leaving the program. The integration of the TurningPoint software with Microsoft Office intended to make the program easier to use and provide more features professors could utilize in their courses.

This, along with the use of radio frequency to transmit and collect student responses were two of the main reasons for adopting this specific system.

The reason the CTL chose only one system to support was to standardize the use of a specific student response system and to eliminate students being required to purchase multiple transmitters for their courses. Professors at BYU started using TurningPoint Winter semester 2006. In that same semester, a preliminary study was done that examined faculty members' reasons for using the system as well as how effective the system was in helping them ask their desired questions to students. The study also looked at students' experiences regarding their participation in class using the SRS. It asked them questions regarding their general willingness to participate in class and examined how reluctant participators viewed the use of the SRS versus non-reluctant participators (Graham, Tripp, Seawright, & Joeckel, in press). The study revealed many problems professors had with the TurningPoint software and hardware as well as students' concerns about uses of the system. This feedback about technical problems with TurningPoint, as well as other reports from professors caused administrators at the CTL to begin looking for a new system to support that would better meet the needs of professors and students.

The plan to select a new system prompted administrators at the CTL to request an evaluation of the technology of the student response system and its uses. The new system that was selected to be piloted Winter semester 2007 is called iClicker. An evaluation was appropriate during Winter semester 2007 because it was the first semester where the new system (iClicker) was used by professors. This evaluation of the student response system iClicker directly relates to the CTL's goals by assisting faculty members at BYU

in implementing and using the iClicker system and also by advancing the understanding of effective instructional methods used with student response systems.

Purpose

The purpose of the evaluation of the student response system (iClicker) at Brigham Young University was to evaluate how well the technology (hardware and software) of the system was functioning and how well the system met the needs of professors and students. The CTL wanted to ensure that professors and students were satisfied with the new system and that this specific system did not limit how professors wanted to use a SRS in their classes. They also wanted to ensure that professors did not encounter serious technical problems that limited their usage of the SRS.

In addition to evaluating how well the technology was functioning for professors and students, the CTL also identified the need to provide instructional support to professors on ways of using a SRS in their course as a purpose of the evaluation. Professors often called the CTL asking if they should start using a SRS in their course and ask for information about how other professors have used it or the advantages of using one. Because the CTL did not have information about this to provide to professors, it requested this evaluation also evaluate which instructional methods used by professors students found helpful, and if students feel using a SRS in class helped increase their comprehension, attendance, engagement, participation, and achievement in the course. Administrators at the CTL felt students should perceive a benefit from using such a system in class. Based on the perceived benefit of certain instructional methods, the CTL will be able to develop support for professors on instructional methods to use with the student response system.

The Evaluand

The evaluand is the technology (hardware and software) of the student response system (iClicker). The evaluand is also the instructional methods professors used with the student response system at BYU. The following is the CTL's description of iClicker and its capabilities:

iClicker is an in-class response system that allows educators to administer quizzes, receive feedback, take attendance, and otherwise test student knowledge without paperwork. iClicker uses radio frequency devices and can be integrated into any presentation application, allowing flawless integration into current teaching practices. Some of iClicker's main features include these: Educators can receive up-to-date results on the level of student understanding and what students think of the course, No software installation, as response data can easily be imported into other applications such as Excel and Blackboard, and no hardware installation, only the portable base unit is needed to administer iClicker. (iClicker, n.d.)

The CTL did not have a description of specific instructional methods that may be used with iClicker.

Evaluation Questions

The evaluation had several general goals. Generally, the goals were to determine if the technology (hardware and software) of iClicker was functioning properly and not limiting professors and students. Another goal was to determine what instructional methods professors were using that students found most helpful and if students felt the SRS helped them increase their comprehension, attendance, engagement, participation,

and achievement. The following specific questions also guided the evaluation

(EQ=Evaluation Question):

EQ1. Did professors experience technical problems in the hardware or software of iClicker and how well did iClicker function for them?

EQ2. What features of iClicker do professors like and dislike?

EQ3. Have any technical problems limited professors' usage of the system?

EQ4. Have students experienced any technical problems with iClicker?

EQ5. Have any technical problems limited students' usage of the system?

EQ6. What instructional methods used with the SRS do students find helpful?

EQ7. Do students feel using a SRS has increased their comprehension of course material, attendance at lecture, attentiveness/engagement during lecture, participation in lecture, and achievement in the course?

EQ8. Do students feel the cost of purchasing the clicker is worth the benefit they receive from using it?

EQ9. What are the advantages and disadvantages of using a SRS for professors and students?

Criteria and Standards

The CTL stakeholders' criteria that were used for the evaluation of the technology included the following: users (students and professors) of the evaluand should not experience technical difficulties that limit the instructional methods; the hardware (i.e., the transmitters) should (a) not malfunction, (b) be durable, (c) give feedback when answers are sent and received, and (d) send responses accurately; receivers should (a) collect all of the responses, (b) do so accurately, and (c) should not malfunction; the

software should be (a) user-friendly for professors, (b) perform the functions that professors want to use the system for, and (c) not malfunction. Questions regarding the functionality of the technology were the highest priority because if the technology did not function properly, the outcomes of the instructional methods used would be affected.

The stakeholders' evaluation criteria for the instructional methods used with the SRS included the following: students should (a) perceive the instructional methods being used with the SRS as helpful, (b) feel using the SRS has helped increase their attendance to lecture, comprehension of course material, achievement in the course, participation in lecture, and attentiveness/engagement during the lecture, (c) perceive that there are benefits of using the SRS no matter their demographics (i.e., year in school), and (d) perceive the benefits of using a SRS as worth the cost they pay for the transmitter.

There should also be more advantages than disadvantages to professors and students using a SRS in the classroom. See Table 1 for how each evaluation question above addresses the specific criteria.

Specific standards regarding stakeholders' criteria were not determined at the beginning of the evaluation because they wanted to wait until seeing the data from the evaluation before determining their standards.

Stakeholders and Information Users

Administrators at the CTL asked for the evaluation and are therefore the clients. Professors using the student response system and students enrolled in courses using the student response system were also stakeholders in the evaluation. While the evaluation did address the CTL's needs, it did not directly address each professor's or student's needs; although, they were stakeholders who were impacted by the evaluation.

Table 1

Criteria and Evaluation Questions Answered

<i>Criteria</i>	<i>Evaluation questions that will answer the criteria</i>
<p>(1) No technical problems experienced that limit users.</p> <p>The hardware—i.e., the Transmitters should:</p> <ul style="list-style-type: none"> (1) not malfunction (2) be durable (3) give feedback when answers are sent and received (4) send responses accurately. <p>Receivers should:</p> <ul style="list-style-type: none"> (1) collect all of the responses (2) collect responses accurately (3) not malfunction. <p>The software should:</p> <ul style="list-style-type: none"> (1) be user-friendly (2) perform the functions that professors want (3) not malfunction 	EQ1-5
<p>(1) Students perceive the instructional methods being used with the SRS as helpful.</p>	EQ 6
<p>(2) Students feel using the SRS has helped increase their: attendance to lecture, comprehension of course material, achievement in the course, participation in lecture, and attentiveness/engagement during the lecture.</p>	EQ 7
<p>(3) Students perceived benefits of using the SRS no matter their year in school.</p>	EQ 6
<p>(4) Students perceive the benefits of using a SRS as worth the cost they pay for the clicker.</p>	EQ 8
<p>(1) More advantages than disadvantages to professors and students using a SRS in the classroom.</p>	EQ 9

The client requested a formative evaluation. This evaluation was viewed as formative because the results will be used to conduct further evaluations of the technology of future student response systems the CTL supports, the instructional methods used with student response systems, and how the student response system met the needs of professors and students. Stakeholders at the CTL did not want to focus accountability on any specific person because the evaluand is used by too many people to focus accountability on one person or organization. Right-to-know audiences include administrators at the CTL, BYU University administration, professors, and students at BYU.

Evaluator Background

I was assigned to conduct the evaluation on the student response system iClicker. My background is in Instructional Psychology and Technology. I am currently working on my master's degree in this program. I have taken coursework in evaluation, assessing learning outcomes, research methods and statistics, as well as instructional design. My program deals with incorporating technology into education, which directly relates to this evaluation. Currently, I work for the Center for Teaching and Learning on the evaluation team that conducts evaluations of products the CTL has developed for faculty members across BYU. This is the first evaluation on student response systems I have conducted. There has not been any previous evaluation on this evaluand from the CTL who requested the evaluation.

Issues and Concerns

The client selected me for this project because I was not affiliated with professors using the student response system and was not involved in the decision about which

specific student response system to support. This evaluation serves as both a work project and a master's project for me. Very few conflicts of interest arose during the evaluation because of the flexibility given to me from the client to meet the requirements of my master's project and also complete the project for work.

Chapter 2: Review of Literature

Many studies have been conducted on student response system use in higher education. However, it was difficult to find any that specifically asked students what instructional methods they found to be helpful. The studies described the instructional methods that were used and would generally ask students if they felt their interaction in class or class preparation had increased or tried to measure a change in students' achievement or other areas from using a SRS (Draper & Brown, 2004), but did not specifically ask about the helpfulness of the instructional methods. While this is still valuable information as we did ask students if they felt specific areas, such as achievement, had increased as a result of using the student response system, it was based solely on students' own perceptions. In addition, the context of the use of clickers at Brigham Young University is very similar (many courses with a large class size and adopting a clicker system to introduce more interaction and engagement into the class) to other universities cited in the studies contained in this literature review. The majority of the courses in this evaluation fell into the category of a large lecture class.

Despite the fact that other studies did not specifically ask students about their perceived helpfulness of instructional methods used, these studies do provide helpful information about instructional methods and the effects on students of using the instructional methods with a student response system. As a result, this literature review has been divided into the following four sections: first, the history of student response system use in higher education; second, the recognition of the need to focus on the underlying pedagogy of using a student response system; third, the effect of technical

problems on students' perceptions of the student response system; and fourth, specific instructional methods used and their reported effects on students.

History of Student Response Systems in Higher Education

Although the popularity of using student response systems (SRS) on university campuses has increased since the mid-1990s, the use of such systems in higher education dates back to the 1960s (Judson & Sawada, 2002). During the beginnings of student response system use at universities, learning theory and behavioral objectives were primarily focused on stimulus-response theory or a behaviorist approach to learning. Educators were typically concerned with the system's ability to provide instant feedback to students and professors. Even today, much of the use of these systems focuses around this feature of immediate feedback. Back then, as is still common now, instructors would use the feedback to aid in the flow of instruction, adapting their lectures according to responses (Judson & Sawada, 2002). These sources of feedback created the basis of the behavioral approach to using the student response system early on. These approaches are still used today in university lecture halls. However, much of the research from the 1960s and 1970s did not show any significant differences in mean achievement between students in control sections and students in treatment sections using the SRS that employed these methods. Data from exams and other assessments did not provide support for increased academic achievement from the use of the SRS; however, students provided strong support for the SRS in many studies. Other benefits emerged from students' reports, such as positive attitudes toward the class, feeling the system was useful, feelings of increased understanding, and increased attendance despite no evidence of increased achievement in the course (Judson & Sawada, 2002).

Underlying Pedagogy of Using a SRS

Recent research on the use of student response systems has shifted its focus from a behavioral stimulus-response approach to creating interactive learning environments in the classroom employing more constructivist-oriented approaches. Current trends in learning theory and research have no doubt contributed to this shift, but the reasons for adopting student response systems still vary. Common reasons for current adoption of a SRS include increasing student engagement in large lectures, improving student performance, increasing teacher-student and peer interaction, providing immediate feedback from students to teacher, guiding learners through the material, monitoring of individual students from responses, improving retention and demographic comparisons, enhancing group discussion, facilitating group discussion in large lectures, assessing teaching and learning methods in real-time allowing professors and students to gauge student understanding, increasing student engagement, and using it for classroom administration techniques (Barrett, Bornsen, Erickson, Markey, & Spiering, 2005; Beatty, Gerace, Lenoard, & Dufresne, 2006; Blackman, Dooley, Kuchinski, & Chapman, 2002; Draper, Cargill, & Cutts, 2002; Greer & Heaney, 2004; Liu, Liang, Wang, & Chan, 2003; Silliman & McWilliams, 2004; Williams, 2003; Wit, 2003; Woods & Chiu, 2003).

Despite the varied reasons for adopting such a system for in-class use, many researchers have recognized the need to focus on effective underlying pedagogy of using a SRS (Judson & Sawada, 2002; Draper & Brown, 2004). Judson & Sawada (2002) state the purpose of their review of the research on student response systems is not to show incorporating technology as the key, but to point to the instructional practices of educators using such a system. Wit (2003) stated, "Introducing technology in the

classroom just for the sake of it does not necessarily help the learner and can be sheer folly” (p. 14). With the current shift in focus to the underlying pedagogy of using student response systems and many different reasons for using the systems, instructional methods being employed are far spread.

Instructional Methods Used and Reported Effects on Students

There are a variety of instructional methods that may be used with a student response system. As discussed earlier, the behaviorist approach in the early years of SRS use has been replaced with a more constructivist-oriented approach (Judson & Sawada, 2002). Much of the research focuses on creating an interactive learning environment for students and moving away from the traditional large lecture format of talking at students for the entire period with students passively listening, which is seen as a weak method of instruction because of the lack of interactivity (Draper & Brown, 2004). Instructors should realize that there are many factors along with their instructional methods that contribute to the success of their learning outcomes from using such a system (Draper & Brown, 2004). In light of the many factors that can contribute to the success of using a student response system, the instructional methods used are still a significant contributor to the success, as discussed earlier about the importance of focusing on the instructional approach and not just incorporating technology for the sake of it. The studies that follow summarize several instructional methods and other factors to consider when adopting a SRS.

The use of a student response system in a study by Boyle, Nicol, Hamilton, and Dempster (2002) was employed in several beginning engineering courses. The SRS was used in this study because it was seen as the simplest way of introducing active learning

into a large classroom without dividing the course into smaller sections, which would require more instructors and resources. Researchers created two-hour, highly interactive lectures each week with about 120 students in each to replace the traditional one-hour lectures. Specific instructional methods employed by researchers were mini-lectures, demonstrations and question-and-answer sessions with the SRS, technical videos, computer simulations, and problem solving. Typical SRS use in this study was to poll the class using multiple-choice questions. Answers were collected, and then displayed and used to further class discussion. As you can see, there were other pedagogical strategies used in conjunction with the SRS; however, students reported that employing the use of the SRS forced them to pay attention and they had to think more and were more actively involved during the SRS classes than during traditional classes (Boyle, Nicol, Hamilton, & Dempster, 2002). They also felt the use of the SRS method helped them to “develop a better understanding of the subject matter when compared to traditional lecture-based courses” (p. 16/3).

In a similar study by d’Inverno, Davis, and White (2003), the use of the SRS was also used to introduce more active learning in large lectures in engineering and computer science classes. The approach to using clickers in the engineering courses was to still be able to deliver the whole syllabus for that lecture rather than just a section of it, which commonly happens when clickers are used during lectures. Students were given a skeletal outline of the lecture notes, which required them to fill in some information from the lecture, but also freed up more time for using the clickers. The clickers were always used at the end of class in this study. The results from their end-of-semester survey showed a split of students who favored the clickers’ use and those who did not. Also, students

reported feeling rushed in order to get to the clicker session at the end of class and said it would be beneficial to use it at other points in the lecture instead of just at the end (d'Inverno, Davis, and White, 2003).

In the computer science courses, the clicker was used for after-class tutorials. Students who were struggling with material in class would voluntarily attend these tutorials. The tutorial would begin with a question in which students were able to work in small groups to solve, and then they would answer with their clicker. Student responses from clicker questions revealed gaps in understanding, which resulted in the tutorial lecturer adapting the tutorial based on the students' needs (d'Inverno, Davis, and White, 2003). These tutorials were very positively rated by students. This particular approach with the tutorial format differed from a traditional lecture because there was not any preset material that had to be covered. The material covered was based solely on the needs of the students attending the tutorial. This study demonstrates another interesting instructional method of using the student response system that was positively received by students (d'Inverno, Davis, and White, 2003).

Another group of researchers, Blackman, Dooley, Kuchinksi, and Chapman (2002), employed the use of the SRS to improve student lesson preparation and overall performance in their course as compared with non-SRS sections. Student response system sections all followed the same basic class design. Each lecture began with a five- to six-question quiz, administered using the SRS, to assess how well the students had prepared for the lecture that day. Questions were simple and focused on terminology and definitions. During class, a variety of SRS questions were used to evaluate how well the students understood the material covered during the lecture. The results were then

emailed to the students so they could review their answers and get help, if necessary. Sections of the course that did not use the SRS were also administered random pop quizzes by paper throughout the semester. On the post-course survey, 50% of the students in the SRS sections felt the system had caused (forced) them to improve their class preparation. An analysis of the SRS sections versus non-SRS sections showed no difference in performance in terms of grades during the semester, although 56% of students preferred being in the SRS section rather than the non-SRS section. This small majority may be due to the fact that the system was used to, in a sense, “force” class preparation and attendance which may have resulted in students having a more negative perception of using a SRS. Two benefits that researchers had not anticipated were that the feedback from the system enabled professors to ensure all students understood the material before moving on and the resulting enhancement of classroom discussions. Researchers stated that good class discussions “were sometimes generated by tricking students and having two correct answers in the question” (Blackman, Dooley, Kuchinski, & Chapman, 2002, p. 28).

Other studies used the system similarly to allow students to directly inform the instructors of the pace of their instruction and to allow instructors to use responses from questions to determine how well students understood the material. For example, students were able to send feedback to the instructor as to whether he needed to speed up the lecture or slow it down. Other instructors would use the feedback after asking a question to students about the material to determine if they needed to go over the material again or if they could move on to new information (Judson & Sawada, 2002).

The analysis of the SRS section's grades versus the non-SRS grades showed no significant differences in the Blackman et al. (2002) study, which supports the fact that measuring student achievement by one factor is very difficult. Many studies have tried to measure differences in courses using the SRS versus those that do not use the SRS by trying to measure student achievement. Another study where the use of a student response system was employed for family medicine residents reported significant differences from the basic lecture groups (no SRS use, no interactive component) and the SRS lecture group in students' quiz scores. There was also another lecture group that incorporated the use of asking questions to students (interactive component) in the study. There were no significant differences in mean quiz scores reported between the lecture group that had the interactive component without the SRS and the lecture group with the SRS (Schackow, Chavez, Loya, & Friedman, 2004).

Student achievement is a difficult construct to measure. Usually it is measured by traditional measures of student assessment, such as grades and test or quiz scores. Other means of measuring student achievement have not been implemented or are too difficult to practically measure. Other studies have taken the approach of measuring students' perceptions of their learning or achievement from using a SRS. These studies typically asked students if they felt using the SRS improved their learning, comprehension of course material, or confidence in the course (Uhari, Renko, & Soini, 2003; Cue, 1998; Beekes, 2006). Historically, studies that attempt to measure the effects of using an SRS by measuring differences in student achievement have not proven to be rich avenues of research (Beekes, 2006; Blackman et al., 2002; Cue, 1998; Draper & Brown, 2004; Judson & Sawada, 2002; Uhari, Renko, & Soini, 2003). I have included references to

these studies in this report to make the literature review more thorough; however, in this evaluation, we decided to measure students' perceptions of this area rather than trying to give an operational definition to students' achievement or comprehension. We wish students to be self-evaluators of their own learning, since traditional methods of measuring student achievement are at best minimal.

Technical Problems Affect Students' Perceptions of the SRS

In this evaluation, we recognized the technology functioning properly as a "hygiene" issue, meaning that the technology must function for the instructional methods to have an effect. It could be seen as a "physiological need," referencing Maslow's Hierarchy of Needs (Maslow, 1970). The physiological needs are the most basic and must be fulfilled before an individual will seek to fulfill their other needs. The same is true for the technological needs of using a student response system. The technology must function (be fulfilled) in order for the higher needs of effective instructional methods to be met. So, although it is extremely important to focus on how the system is used, it is more important to focus on actually having a system that works. In the study by Draper & Brown (2004), technical problems highlighted in the study demonstrated how such problems can adversely affect students' perceptions of using a student response system. The study was concerned with increasing interactivity, specifically in large traditional lecture halls. Researchers began incorporating the use of the SRS in lectures and assistants were provided to transport and set up equipment. Students were not required to purchase their own transmitter but were provided them by the department. Transmitters were checked out to students for the entire semester and students were charged a fee if the transmitter was not returned at the end of the semester. Minimal instructional

resources on how to pedagogically use the system were provided to faculty members (a short article and talk given to an internal conference on teaching methods using the SRS were placed in the University newsletter). One negative response from students was that they felt the system was being used for its own sake. In this specific class, students witnessed several problems with setting up the equipment and so witnessed more disadvantages of using the system (Draper & Brown, 2004). This factor illuminates the necessity of having technology that functions properly in order for there to be pedagogical benefits of using the SRS.

Technical problems or limitations in the system also riddled another study by Hatch, Jensen, & Moore (2005). The three major problems they identified were set-up time, take-down time, and registering the clickers. An additional 20 minutes (approximately) were needed for set-up and take-down of the system, which reduced the amount of time the instructor had to talk with students about questions or other concerns. The next major problem was in getting students' clickers registered. The effort of getting them registered took about three weeks and even then, ten percent of them still failed to be registered. The last major problem was that the clicker failed too often to be used for assessment, which was the main intended use of the clickers. Despite the many technical issues, students were still generally positive about the clickers. However, the clickers were not being used for giving points; which, if they had been losing points because of technical problems, students may have been more likely to be more negative regarding SRS use (Hatch, Jensen, & Moore, 2005). Technical problems can place serious limitations on the instructional methods instructors would like to use with the system, hence the importance of using a system that works.

Chapter 3: Evaluation Design

Participants

Participants in the evaluation consisted of professors using the student response system iClicker and students in their classes at Brigham Young University.

Approximately 600 students and 16 professors made up this group.

Data Collection Methods

This evaluation consisted of four main phases of data collection. The first phase was to interview professors using the SRS. The second phase was to observe the classrooms of the professors' that we had interviewed, in order to gain an overall sense of how the SRS was being used, as well as the feeling of the classroom while the SRS was being used. The third phase was to hold six focus groups with students and the last phase was to distribute two different online surveys; one for professors and one for students. Conducting classroom observations, focus groups, and an online survey was intended to triangulate the data and better inform each method and the evaluation. Table 2 shows each data collection method, the data to be collected, and what evaluation questions it was designed to answer. These methods of data collection were selected because they worked well for the time restraints and the number of evaluators conducting the evaluation. Also, as the lead evaluator, I had experience in conducting these types of data collection methods and wanted to employ methods with which I was familiar.

Table 2

Criteria, Evaluation Questions Answered, and Data Collection Method

<i>Criteria</i>	<i>Evaluation Questions that will answer the criteria</i>	<i>Data Collection Method</i>	<i>Data to be collected</i>
(1)No technical problems experienced that limit users. The hardware: Transmitters should: (1) not malfunction, (2) be durable, (3) give feedback when answers are sent and received, and (4) send responses accurately. Receivers should: (1) collect all of the responses, (2) accurately, and (3) not malfunction. The software should be: (1) user-friendly, (2) perform the functions that professors want, (3) not malfunction.	EQ 1-5	Online surveys, interviews, focus groups, and classroom observations	Quantitative data on the degree to which the technology meets professors needs. Qualitative data on technical difficulties encountered with the SRS and features or problems with SRS that have limited their use of the SRS.
(1) Students perceive the instructional methods being used with the SRS as helpful.	EQ 6	Student focus groups and online survey.	Students' ratings (quantitative) on the helpfulness of specific instructional methods being used with student response systems. Qualitative data on instructional methods students perceived as helpful.
Students (2) feel using the SRS has helped increase their: attendance to lecture, comprehension of course material, achievement in the course, participation in lecture, and attentiveness/engagement during the lecture.	EQ 7	Online survey and student focus groups	Students' ratings (quantitative) on how much they felt 5 areas increased because of using a SRS. Qualitative responses on if students felt 5 areas increased because of using a SRS.
Students (3) perceived benefits of using the SRS no matter their year in school.	EQ 6	Online survey	Demographics of the students (year in school)
Students (4) perceive the benefits of using a SRS as worth the cost they pay for the clicker.	EQ 8	Online survey	Students' ratings (quantitative) of if they felt the benefit they received was worth the cost of purchasing the clicker.
(1) More advantages than disadvantages to professors and students using a SRS in the classroom.	EQ 9	Online surveys , focus groups, and interviews	Qualitative data on perceived advantages and disadvantages of students and professors of using a SRS.

I administered the surveys and conducted the majority of the interviews and focus groups with faculty members and students. I also conducted many of the classroom observations. Another student evaluator, Brigham Dye, who was also employed at the CTL, helped with some of the focus groups and classroom observations. I trained Brigham in the classroom observation protocol by giving him the observation protocol checklist and explaining what I looked for as I answered the questions on the checklist (see Appendix A), to ensure consistency between our ratings.

The data collection instruments were piloted to ensure their reliability and validity. Another evaluator at the CTL, not involved in the evaluation, read through the instruments and compared them to the stakeholders' criteria to also help ensure the reliability and validity of the instruments. The evaluator suggested combining two questions on the professor survey, as they appeared to be duplicating themselves. I re-examined the questions on the survey and eliminated one of the questions to avoid the duplication.

The anonymous online student survey was administered to students through email in courses that used the student response system TurningPoint at the end of Fall semester 2006. This was done to pilot the survey, and none of the responses collected were used in the evaluation results. As a result of piloting the student survey, it was determined that changes needed to be made to it to ensure better reliability and validity. The length of the survey seemed to be discouraging students from accurately responding to, completing, or even taking the survey. The survey was condensed into a still meaningful, shorter version by generalizing the instructional methods we asked about, reducing them from 25 to 11. Also, instead of asking if each instructional method helped increase their comprehension

of course material, attendance at lecture, attentiveness/engagement during lecture, participation in lecture, and achievement in the course, we simply asked students if they felt using the SRS had helped increase these areas, independent of the instructional methods (see Appendix B).

The professor interview questions and student focus group questions were also piloted at the end of Fall semester 2006. No names or identifying information were recorded. The results were only used to note changes that needed to be made to the instruments and to see if the questions elicited the desired information. Changes were only made to the student focus group questions to mirror the changes that were made to the student survey (see Appendix C).

At least two possible contextual issues were identified that could affect the reliability of the instruments. First, students' feelings toward the subject matter could influence their ratings of the helpfulness of using a SRS. For example, a student that does not enjoy chemistry may rate the use of the SRS as less helpful because of their feelings toward the subject, or if a student had a problem with the professor, they may respond in a more negative tone than they would if it was a different professor using the same methods with the SRS. Second, if the data was collected during the semester at a time when students and professors were busy, they may have rushed through the questions without responding accurately in order to finish and move on to other tasks they needed to complete. Of course, there may be other unknown factors that may have affected the reliability and validity of the instruments.

Professor interview. Data was collected from ten professors through interviews and follow-up interviews. I emailed all 33 professors using the SRS Winter semester

2007 and 16 consented to participate in the evaluation. Of those 16, ten were selected to be interviewed using a stratified random sampling. Professors who consented to participate were categorized by college and then randomly selected from each college. I sampled the professors in this way to ensure a variety of subject matters in the evaluation. A professor in the social sciences may approach the use of the SRS differently than a professor in the natural sciences and I wanted to have a representative sample of professors in different subject matters using the SRS.

The first interview took place near the middle of January and follow-up interviews took place near the middle of March, after several classroom observations had taken place, in order to allow evaluators to clarify information from the initial interview and observations. The same six interview questions were asked for both interviews. In general, the questions asked about technical problems with the system, advantages and disadvantages of using a SRS, and features of iClicker they liked and disliked (see Appendix D). Interviews lasted approximately 15 to 30 minutes.

Classroom observation. Classroom observations began at the beginning of Winter semester 2007 and continued throughout the semester. The classroom observations were conducted in the same classes of the professors who had been interviewed, for a total of ten classes observed. Classroom observations were a method to assess the actual use of the student response system in the classroom and for the evaluators to gain an overall sense of the feeling of the class during their use. A document containing observation protocol was used to record what was experienced in the classroom observations to help ensure consistency between observations (see Appendix A).

Student focus group. Six focus groups were conducted near the end of March and lasted approximately 50 minutes each. Students were recruited from the same courses where the professor had been interviewed (N=10 courses). A stratified random sampling technique (all students in each class list were randomized and then fifty were randomly selected from each of the ten classes) was used to select 500 students to email and ask for their participation. In the email, the purpose of the focus group and evaluation was explained to students. Students were not asked for any identifying information during the focus group. Students were asked what instructional methods they found helpful, if they felt using the student response system helped increase their comprehension, attendance, engagement, participation, and achievement. They were also asked if they had experienced any technical problems, if those technical problems limited the use of the SRS, advantages and disadvantages of using a SRS, and if there were any other ways the professor could use it that would be beneficial to them (see Appendix C).

Student survey. The online student survey was sent to all of the students in the courses using a SRS where the professors (N=16) consented to their students' participation. All 16 consenting professors' classes (number of students = approx. 2,800) were used because typical response rates are around 10-15% and I wanted to ensure an adequate sample size. The survey was anonymous and was distributed via email near the end of March. The email explained the purpose of the evaluation and survey and asked students for their participation. It collected data on students' experiences with the technology and their perceived helpfulness of the instructional methods being used, as well as the advantages and disadvantages of using the SRS (see Appendix B).

Professor survey. The survey for professors was administered near the end of March to all 33 professors who were using iClicker. It was sent to all of the professors to gain a broader sample of professors' experiences with iClicker. The survey was anonymous and was administered to collect data about how well iClicker was functioning, technical problems, and advantages/disadvantages of using a SRS (see Appendix E).

Data Analysis

I transcribed the audio recording from the professor interviews and student focus groups using Microsoft Excel. While transcribing, I replayed the taped passages multiple times to ensure I recorded the data correctly. The initial transcribing and reading through of the qualitative data helped me gain a preliminary understanding of the data. I then imported the transcripts into NVivo, a qualitative analysis program, and coded the transcripts by question, identifying themes in the data under each question. To identify themes in each question, I looked for patterns in each response. For instance, when a student mentioned a specific technical problem, I made that problem a theme and looked for similar themes in other responses. When I came to new technical problems, those became new themes under that question. I used the same method of analyzing the data with the open-ended responses from the two surveys.

As for the quantitative data from the two surveys, I initially computed descriptive statistics to help me gain a general understanding of the data. I then used the descriptive statistics to analyze the spread of the quantitative responses for each question by applying a Pearson R correlation and a one-way analysis of variance. The Pearson R correlation was used to compare the correlation between students' mean rating of the helpfulness of

the instructional methods and how strongly they agreed or disagreed with the cost of the clicker being worth the benefit they felt they received. The one-way analysis of variance was used to examine differences in students' mean ratings of the helpfulness of the instructional methods by their year in school. Only descriptive statistics were used with the data from the professor survey to determine the average and spread of the data (see Table 3).

Table 3

Description of Data Collection and Data Analysis Methods

Data Collection Method	Description of Analysis Method
Online Student and Professor Surveys	Qualitative analysis, descriptive statistics and a one-way analysis of variance (ANOVA), and a Pearson Product Moment Correlation were used to interpret the data. The quantitative data was summarized with descriptive statistics. A one-way ANOVA was used to test for differences in students' mean ratings of their perceived benefits by their year in school. A Pearson R correlation was computed for students' mean ratings for all instructional methods and how strongly they agreed with the cost being worth the benefit; and for students' mean ratings for all 5 areas and cost.
Student Focus Groups	Qualitative analysis (identified themes for each question) to interpret the data from the focus groups.
Interviews	Qualitative analysis (identified themes for each question) to interpret the data from the interviews.
Classroom Observations	Qualitative analysis (identified themes for each question) to interpret the data from the observations.

I had two focuses as I analyzed the data. The first was to look for themes in technical problems or features of iClicker that were limiting professors or students. This data was very important because it aided administrators of iClicker at the CTL in determining if iClicker was meeting the users' needs and it enabled them to resolve problems encountered with the manufacturer or correct the problems themselves. The

second was to examine themes or trends in the data regarding what students said about the helpfulness of the instructional methods and if they felt using a SRS had increased their comprehension of course material, attendance at lecture, attentiveness/engagement during lecture, participation in lecture, and achievement in the course. Then I could determine if trends in students' ratings of the helpfulness of the instructional methods and those five areas corresponded with trends in how the professors were using the SRS. Determining themes or trends in this data will help fulfill stakeholders' needs by allowing administrators of iClicker at the CTL to develop support for professors on instructional methods to use with a student response system.

Reporting Strategies

An interim report was given to administrators at the Center for Teaching and Learning near the end of February, 2007. It detailed the status of the evaluation and information that had been collected to that point in time (see Appendix F). A final report of the evaluation has also been given to the Center for Teaching and Learning. This evaluation report was given to my committee members, IP&T department, the McKay School of Education, and the Brigham Young University library to fulfill the requirements of my Master of Science degree.

The final report is organized around the evaluation questions. Given that this project fulfills the requirements of an evaluation project for my Master of Science degree in Instructional Psychology and Technology (IP&T), the results were distributed in a format suitable for the requirements of the department and college (APA format). The report was also distributed in another form suitable to administrators at the CTL.

Schedule and Budget

A schedule and budget were created for the evaluation. It was planned that the evaluation take place during Winter semester 2007 and the report be written following Winter semester 2007, during the Spring and Summer terms of 2007. A complete table of the schedule and budget for the evaluation can be found in Appendix G.

Resources

I created the online surveys using the program Qualtrix, an online survey program for creating, collecting, and analyzing the data. This tool is licensed by the Center for Teaching and Learning. Microsoft Excel and Statistical Package for the Social Sciences (SPSS) were used to analyze the quantitative data. NVivo was used to analyze the qualitative data. Voice recorders were used for the interviews and focus groups. Microsoft Word and Excel were used to transcribe the interviews and focus groups. Other general office supplies were used to conduct the classroom observations and analyze the data. Financial resources were needed to purchase the lunch for the focus groups and for the gift cards to the BYU Bookstore, which were given to participants in the student focus groups. The Center for Teaching and Learning provided the financial resources for the evaluation.

Chapter 4: Findings and Discussion

Organization of Findings

The results of this evaluation have been organized by the evaluation questions. EQ 1, 2, and 3 have been combined into one section addressing technical problems experienced by professors and how that limited their use. EQ 4 and 5 have been combined into the technical problems experienced by students and any limitations they experienced as a result. The remaining questions, EQ 6, 7, 8, and 9, are each in their own section. Recommendations are given throughout the findings in order to make the connection more clear between the recommendation and the findings. The recommendations have also been summarized in Chapter 5. Table 4 gives a summary of the number of respondents for each of the data collection methods.

Table 4

Summary of the Number of Respondents for Each Data Collection Method

Data Collection Method	Date of Collection	Number Sampled	Number of Respondents
Professor Interviews	1 st -January 2007 2 nd -March 2007	10 professors	10 professors
Classroom Observations	January to March 2007	10 courses	10 courses
Student Focus Groups	March 2007		
Professor and Student Surveys	March 2007	33 professors 3,000 students	20 professors 558 students

Evaluation Questions 1, 2, & 3: Limitations for Professors

EQ1. Did professors experience technical problems in the hardware or software of iClicker and how well did iClicker function for them?

EQ2. What features of iClicker do professors like and dislike?

EQ3. Have any technical problems limited professors' usage of the system?

In order to address the three evaluation questions above, I examined professors' responses to 10 of the survey questions. During the interviews with the professors, I also asked them one question about technical problems. In addition, I examined the notes from the classroom observations for any technical problems observed while the system was in use.

The survey asked professors to rate how well the software, receiver, student transmitters (clickers), and instructor remote of iClicker had functioned for them. Overall, results show a very positive response to how well these elements of iClicker functioned for professors. In each of the four areas, at least 70% of professors' responded saying they had functioned or met their needs very well (see Table 5).

Table 5

How well iClicker has Functioned or Met Professors' Needs

Questions from professor survey about how well the iClicker system functioned for them. Items ranked from VERY well to NOT well (4 represents Very well, 3 represents Moderately well, 2 represents Somewhat well, and 1 represents Not well. The numbers in parenthesis are the raw number of responses for each ranking with the percentage beneath.

How well has the software met your needs for accomplishing what you wanted to? $n=20$				
4 (14)	3 (3)	2 (3)	1 (0)	$M = 3.55$
70%	15%	15%	0%	$SD = 0.76$
How well has the receiver functioned? $n=20$				
4 (18)	3 (2)	2 (0)	1 (0)	$M = 3.90$
90%	10%	0%	0%	$SD = 0.31$
How well have the transmitters functioned for your students? $n=19$				
4 (14)	3 (4)	2 (1)	1 (0)	$M = 3.68$
74%	21%	5%	0%	$SD = 0.58$
How well has your instructor remote functioned? $n=15$				
4 (12)	3 (1)	2 (1)	1 (1)	$M = 3.60$
80%	6.67%	6.67%	6.67%	$SD = 0.91$

Software. Under the question *How well has the software met your needs for accomplishing what you wanted to?*, 10% of professors rated it as *somewhat well*. In the open-ended responses of the interview about technical problems, difficulty with iGrader (the part of the iClicker software used for grading and tracking scores) was the most frequently stated problem (see Table 6). Another response from the survey reported the problem with iGrader being an “inability to manually manipulate students’ scores.” Many of the problems reported were an inability to do certain tasks in iGrader (such as manually manipulate students’ grades or designate graded and non-graded questions) and not necessarily the program malfunctioning. Three of the ten professors interviewed did not use the iGrader system at all. The department they taught in developed its own software for grade management. In this case, four of the seven professors interviewed that used iGrader reported a problem or difficulty using it. Despite issues with iGrader, the majority (90%) of the professors on the survey reported the software as functioning *very well* or *moderately well* for them. However, it should be noted that some professors did not use iGrader and the survey did not specify if they used it or not. So they may have rated the software as functioning well and not had experience using iGrader or vice versa.

The software, minus the problems with iGrader, appears to be working well for professors. The problems professors have encountered with iGrader may be resolved with more training; however, some of the problems identified were limitations of the software. The software is not completely meeting the criteria of the stakeholders because the trouble with iGrader is preventing some professors from performing the functions they want to with it.

Table 6

Professor Stated Technical Problems with iClicker

<i>Have you encountered problems as you used the iClicker software or hardware? If yes, what are the problems you have encountered?</i>			
	Interviews <i>n</i> =10		Survey <i>n</i> =20
	1 st	2 nd	
None	4	9	12
Trouble or difficulty using iGrader	4	---	1
Computer had trouble recognizing jump drive	2	---	---
Instructor remote not working for one day	2	---	
Transmitter turns off easily when tapped on the top	2	---	---
Clickers reset to default frequency every time they are turned off	1	---	1
Problem with using Keynote on a Mac and iClicker (thinks problem is with Keynote not iClicker)	1	---	---
Message that comes up to tell students to set their frequency would come up and block questions on the screen capture	1	---	---
iClicker recorded multiple sessions from single day	1	---	---
When students lose their clickers having to call the company to find out clicker ID number	1	---	---
Teach with a colleague who takes some of the lectures. There is not an easy way for her to gather data and import it into my file for the class.	---	---	1
A few times I have had clickers appear on my report that aren't registered to anyone in the class.	---	---	1
Periodically the base station has trouble drawing too much power	---	---	1
No preset countdown value less than 30 sec.	---	---	1
No Response	---	1	2

Note. Some professors cited multiple problems in the interviews, so the total number of responses is greater than 10.

Receiver. The receiver appears to be functioning well for professors, per the survey results. Every professor who responded to the survey said it functioned *very well* (90%) to *moderately well* (10%). In the qualitative responses there was only one response mentioning a problem with what is assumed to be the receiver, “Occasionally the base station has trouble drawing too much power” (see Table 6). Based on these results, the

receiver seems to be functioning well for professors and is meeting the criteria of the stakeholders.

Student clicker. Ninety-five percent of the professors on the survey said their students' clickers functioned *very well* or *moderately well*. In addition, during the classroom observations, I only noticed one student experiencing problems with their clicker. A button getting jammed appeared to be the problem and the student was able to un-jam it during class. From the responses on the professor survey and interviews, the students' clickers are functioning well for them. However, there is still the data from student responses of technical problems that must be examined before a conclusion can be made about the student clickers meeting the stakeholders' criteria (see *Questions 4 & 5: Limitations for Students*).

Instructor remote. The majority of professors felt their instructor remote had functioned *very well* (80%) for them. Thirteen percent responded that the instructor remote functioned *somewhat well* or *not well* on the survey. In addition, two of the ten professors from the interviews indicated problems with the instructor remote. Specifically, one professor from the interview said they could not get it to work one day, but that it had worked fine since. An open-ended response from the survey explained one of the difficulties encountered with the instructor remote:

I have had the problem occur several times where I meant to hide a display but accidentally hit the run button again. Then what happens is there is another screen shot taken, I end the polling, and then the students have a question that was asked for which they don't get participation points. I just feel awkward when I am trying to lecture to fumble through all the buttons.

This highlights a dislike of the functionality of the buttons on the instructor remote. It was not that the instructor remote did not work, but the design of its functionality that was the problem in this instance. This professor did not like the remote because the errors he committed while using it threw off his questions. Additional training and practice with the instructor remote could help resolve some of these user errors by giving professors more experience navigating the system. A job aid could also be developed that has a quick reference for the button functionality on the instructor remote. The instructor clicker is functioning well for professors and meeting stakeholders' criteria.

Ease of use. Professors were asked in the survey to rate how easy it was to begin using iClicker. Ninety percent said it was *very easy* to *easy* to begin using iClicker (see Table 7). This strong majority supports the conclusion that iClicker is a user-friendly program and it meets stakeholders' criteria.

Table 7

How Easy Was it to Begin Using iClicker

Question from professor survey about how easy professors felt it was to use iClicker. Item ranked from VERY easy to NOT easy at all (5 represents Very easy, 4 represents Easy, 3 represents Somewhat easy, 2 represents Not very easy, 1 represents Not easy at all).

How easy was it to begin using iClicker in your class? $n=20$

5 (13)	4 (5)	3 (1)	2 (0)	1 (1)	$M = 4.45$
65%	25%	5%	0%	5%	$SD = 1.00$

When I examined the overall technical problems with iClicker in the first interview, four of ten professors said they had not experienced any technical problems. In the second interview, nine of ten (one professor did not respond to the second interview) said they did not have any problems, and 12 of the 20 professors that responded to the survey reported no technical problems (see Table 6). The results of the interview and survey show an interesting trend. I conducted the first interviews during the first few weeks of the semester when the professors were just learning and getting used to iClicker. The second interviews and survey were conducted near the end of the semester after professors had used it for a couple of months. In the first interview it can be seen that professors reported more technical problems they had with the system compared to the second interview, in which all but one (one professor did not respond to being interviewed again) said they had not encountered any new problems with iClicker. In addition, in the survey, which was conducted about the same time as the second interview, the majority of professors responded that they had not experienced any technical problems with iClicker.

It appears that professors were able to resolve most of their problems with iClicker through becoming more familiar with the system during the period between the first interview and the second interview. Also, several of the problems reported in the survey results under technical problems are actually professors' dislikes of the system, such as the remote defaulting to the preset frequency when turned off, rather than actual technical problems. Overall, the system appears to be functioning well for professors and they are not experiencing major technical problems. Most of the problems that were encountered could be resolved with more training in the use of iClicker. The majority of

professors were satisfied with the iClicker system and did not experience major technical problems. The iClicker system is mostly meeting stakeholders' criteria in its hardware and software. Areas where it is deficient include (a) performing the functions professors want to use the system for (iGrader) and (b) a few reported malfunctions of the hardware or software.

Likes and dislikes of iClicker. In the interviews, professors were asked what features of iClicker they liked and disliked. Many of what professors' liked about iClicker dealt with features of iClicker that TurningPoint did not have. The TurningPoint system required professors to link their PowerPoint slides to the TurningPoint software, which is unnecessary with iClicker. Six of ten professors stated that they liked this feature, and two other responses said they felt the system was easier to use than TurningPoint. Professors also liked the ability to create questions during class. Since the TurningPoint software was linked to PowerPoint, professors could not easily change or add questions during class using TurningPoint, but were able to do so with iClicker. Multiple (5 of 10) professors said they liked the ability to use their instructor clicker to start and stop questions and advance the slides. Per the professors' responses from the interview, it is apparent that they seem satisfied with the differences between the iClicker versus the TurningPoint student response system (see Table 8).

When asked during the interview what features of iClicker the professors disliked, most responded with a concern, but then emphasized that they felt it was minor and stated they were generally satisfied with the system. Three of the ten professors interviewed said there was nothing they did not like about iClicker.

Table 8

Features of iClicker Professors Like

<i>What features of the iClicker do you like?</i>	Interviews <i>n</i> =10	
	1 st	2 nd
Do not have to link slides to the iClicker software	6	---
The ability to start and stop questions and advance slides remotely	5	---
Simplicity of the system	4	---
Ability to create questions during class	2	---
Easier to use than TurningPoint	2	---
Snap-shot of the page it takes	2	---
Automatic registration	1	---
Can get list of students from Bb and correlate it with the serial numbers	1	---
Display graphs	1	---
Extremely easy to start	1	---
iClicker is a little cheaper	1	---
Indicator on transmitter that response has been received	1	---
No problems with it locking or freezing up	1	---
All the software is contained on a USB drive	1	---
Transmitters are a little more durable than TP ones	1	---
Transmitters use triple A batteries	1	---
Nothing new		9

Note. Some professors cited multiple features they liked so number of responses does not equal *n*. One professor did not respond to the second interview so the total number of responses does not equal *n*.

The software's ability to be independent of PowerPoint had results that some professors did not like. For example, because iClicker is independent of the program used for displaying the question, the iClicker window floats above every program and there is no way to minimize the window without closing it. A couple professors said they did not like the inability to hide the iClicker window without exiting the program. There was also an additional screen that would pop-up and sometimes obscure the professor's question, which was mentioned a couple of times. Three of the ten professors said that there were not enough options on the clickers. Several reasons were given for disliking the number

of options. One professor stated he disliked the number of options because he had to rewrite questions from the previous semester in which he used the TurningPoint system, which had more options. Another said it limited him from asking very complicated questions (see Table 9).

In general, professors disliked minor nuances of the system. However, several larger issues were mentioned, such as only having five options, which could have an effect on the professors' instructional methods.

Table 9

Features of iClicker Professors Dislike

<i>What features of the iClicker do you dislike?</i>		
	Interviews <i>n</i> =10	
	1 st	2 nd
Nothing	3	---
Not enough options on the clicker	3	---
Cannot hide iClicker window without exiting the program	2	---
Screen that pops up when you start iClicker and blocks the question	2	---
Do not like scrolling through all the choices to get to the correct answer-takes a second for each one	2	---
Do not like the size of the receiver or transmitter	2	---
Frequency on transmitters always defaults to AA when turned off	2	---
Limited in the timing system or features	1	---
Can not rearrange the button assignment functionality on instructor remote	1	---
Display graphics are anemic	1	---
No way for professor to determine if a student transmitter wasn't transmitting	1	---
Keys on transmitter are too sensitive	1	
No website to enter transmitter codes to see who it belongs to, have to call the company	1	---
Nothing new		9

Note. Some professors cited multiple features they liked so number of responses does not equal *n*. One professor did not respond to the second interview so the total number of responses does not equal 10.

Technical problems that limited uses of iClicker. Several professors reported technical problems that limited the way they wanted to use the student response system. Two of twenty professors who participated in the survey stated the repetition of the steps of using iClicker has slowed down class, so they have reduced how much they use it:

I may decrease the number of lectures that incorporate audience participation because iClicker is not easy to use. The greatest difficulty is in flow. When I am thinking about my presentation material it is not natural to hit the run and stop and display and hide buttons.

There were two responses from the first interview and one from the survey that said the number of options on the transmitters was limiting their use of the system (which was a feature of iClicker a few professors reported they disliked). Another professor indicated experiencing trouble with the iGrader system, which had discouraged the professor from keeping students' scores up-to-date in Blackboard (see Table 10).

Three of ten professors from the first interview and 18 of 20 from the survey reported that the problems they encountered had not limited them. One professor even reported using iClicker more than other systems because of its ease of use:

The system is certainly easy to use and much less of a bother than the other systems that we previously used. I find that I have increased the number of times I use the clickers in each class period because they are so easy to use.

The system does appear to present some limitations to professors. However, limitations may be found in any student response system and overall, iClicker is meeting the majority of professors' needs. Once again, more training for professors may help resolve some of the limitations they have encountered. Also, creating a job aid to show

professors how to write different types of multiple-choice questions in a concise way could reduce the number of professors feeling limited by the number of options available on the clicker.

Table 10

Have Technical Problems Limited the Use of iClicker for Professors?

<i>Have any of these problems or features of the system limited or changed your use of the system or prevented you from accomplishing your instructional goals?</i>	Interviews <i>n</i> =10		Survey <i>n</i> =20
	1 st	2 nd	
	Not limited	3	---
Only 5 options limits the types of questions can do, have to be specific in your distracters	2	---	1
The scoring system is limited. Cannot specify in a session how many questions will be graded	1	---	---
Learning all of the details of using the software and hardware	1	---	---
There have been complaints from the students, but mostly because of their ignorance of how the system works.	1	---	---
Repetition of simple steps slows down class so I've limited my use of them	---	---	2
Have not kept grades update in Blackboard because the process of manually making changes is so cumbersome.	---	---	1
Yes, but minimally	---	---	1
May decrease the number of lectures use iClicker in because it is not easy to use-difficulty is in the flow	---	---	1
Easier to click on right answer with the mouse than with the instructor remote	---	---	1
When opening polling the bar at the bottom of the screen comes up over PP and sometimes blocks part of the question	1	---	---
Put clicker questions throughout lecture after teaching material, instead of just at the beginning of class	---	---	1
No response	---	9	---

Note. Professors sometimes gave multiple limitations or did not respond on the interview and survey so the total number of responses does not equal *n*.

Other features professors would like in iClicker. On the survey, we asked professors what other features would be necessary in order for them to use iClicker how

they wanted, without any limitations. The most frequently cited item was improving the tracking/grading system (iGrader). Professors said they wanted a system that would allow them to easily sort and edit grades. The other features mentioned also dealt with improving either features of the system professors did not like or resolving technical problems they experienced (see Table 11). One professor indicated on the survey that she would like more options on the clickers. Over half (13 of 20) of the professors who participated in the survey said there was nothing to be changed, or did not respond.

Table 11

Other Features of SRS that are Necessary for Professors

<i>Are there any other software or hardware features that are necessary for you in order to use the student response system as you want in your course?</i>	
	Survey <i>n</i> =20
No	9
No Response	4
Tracking/grading system that makes grades easily sortable and editable.	3
Have more than 5 possible responses	1
A few times the clickers are left in the classroom. It would be nice to be able to find out who it belongs to by entering the registration numbers.	1
I want something that flows as nice as TurningPoint did and prettier.	1
A clicker that maintains its frequency	1

Overall, it appears that iClicker is meeting the majority of professors' needs. There are several recurring themes throughout professors' responses to each of these questions regarding improvements that may need to be made to the system. The first theme relates to the problems with or the inability of the iGrader system to accommodate professors' needs, the second theme covers the problems with instructor clickers (not working or button functionality), and the third is not having enough options on the

clickers. These three items appear to be the main technical issues with iClicker, from the professors' standpoint.

Evaluation Questions 4 & 5: Limitations for Students

EQ4. Have students experienced any technical problems with iClicker?

EQ5. Have these technical problems limited students' usage of the system?

In order to address the two evaluation questions above, I examined students' responses to the two survey questions and also examined two questions from the student focus groups.

The majority of students from the survey did not report any technical problems with iClicker. The most frequently stated problem in the survey (78 of 558 students), and also mentioned in the focus groups, was that the clicker turns off easily (see Table 12). I also noticed in the classroom observations that when students would drop their clicker it would turn off. Students also noted that the clicker did not maintain its frequency when turned off, which was also viewed as a problem. However, this is how the system was built and is not considered a technical problem even though it is a feature that both students and professors reported they do not like (see Table 9 and 12). The ease of accidentally turning off the clickers could contribute to the annoyance felt by students of having to reset the frequency as they must reset the frequency each time they turn it back on during class. The clickers should therefore be made to not turn off so easily. Students also reported that the clicker has sensitive buttons and, as a result, turns on easily. Thus, while it is in their backpack it can be bumped and turned on, wasting the battery life (see Table 12). A protective case for the transmitter may address that problem.

Table 12

Student Reported Technical Problems

<i>What problems have you experienced with the clickers?</i>		
	Focus Groups <i>n</i> =47	Survey <i>n</i> =558
No Problems	7	275
Turns off easily	2	78
Turns on in backpack and drains batteries	1	21
Doesn't keep the frequency when it's turned off and have to reset every time it is turned on	2	20
One time the professor had trouble getting the equipment to work properly	2	16
Had trouble registering them online	---	8
User errors	---	7
Not knowing if my answer has been received	---	5
Box that pops up each time iClicker is started-gets in the way of the question	1	4
Had trouble with answer being received	1	2
Did not work on the first day	---	2
Having to adjust the battery to get it to turn on	---	2
One of the buttons got jammed	---	2
Had times when it's taken 10-15 minutes to get iClicker running in class	2	1
Clickers are wearing out/buttons not working sometimes	---	1
No way to check what answer I sent in	---	1
Battery cover will fall off	---	1
Don't know how much battery life I have left	---	1
Clicker ran out of battery life fairly quickly	---	1
Took a lot of extra time to get clickers registered to students	2	---
One day had trouble getting it to move to the next question	1	---
Had trouble with students being able to register to the right frequency and the program recognizing it	1	---
Professor used a Mac which had problems with the system	1	---

Note. Not all students responded to this question or cited multiple problems so the total number of responses does not equal *n*.

In the students' responses of technical problems limiting the use of iClicker, a majority (383 of 558 students) from the survey said there were no limitations from the technical problems (see Table 13).

Several students who had used the previous system reported not experiencing any limitations since the last system. The problem with the clicker turning off easily would sometimes cause problems during the clicker questions. Students reported that it would turn off during a question and there would be instances when they did not have enough time to turn it back on, set the frequency, and answer before the timer on the question ran out, which resulted in missed points or just not being able to participate. Wasted class time was also listed as a limitation by some students (see Table 13).

One student gave an interesting insight into the technical problems experienced in his class,

Technical problems have only enhanced the clicker experience because then we are not graded on that quiz and I can actually relax and listen to what the professor is saying instead of being worried about whether the next slide to pop up is going to be a quiz question.

The technical problems actually eliminated a portion of the way the professor was using the system (graded questions) that the student did not like and so he viewed it as a positive benefit; however, this was a rare incident.

The technical problems that have been experienced do not appear to be severely limiting. However, even these small limitations may influence students' perceptions of the helpfulness of the SRS. If students are missing points because their clicker does not work or turns off, which prevents students from answering the question, the use of the

SRS could be viewed negatively. Steps should be taken to eliminate problems that could adversely affect a student's grades. For example, when the clicker turns off and the student is not able to answer in time. The clicker is functioning fairly well for students; however, it is not fully meeting the criteria of stakeholders because problems are being experienced that are limiting some students.

Table 13

Student Perceived Limitations Caused by the Technical Problems

<i>Have the technical problems limited the use of iClicker?</i>		
	Focus Groups <i>n</i> =47	Survey <i>n</i> =558
No limitations	4	383
It turns off easily and when it turns off not having enough time to turn it back on and answer the question	4	24
Program did not work one day so could not use them/had to do the quizzes at another time	---	19
Just limited it for the one day there were problems	1	15
Wasted class time when there are problems	7	11
People that had trouble registering their clicker missed points	---	7
When the professor forgets the receiver or his clicker so you can't use the system that day	---	7
If your battery runs out or system doesn't work you miss points	---	5
Not enough buttons so number or choices is limited	---	4
Miss points when there are technical problems	---	2
Had to use a raise of hands instead, students would see what others were answering and base response on that	---	2
Some students clickers don't work so they don't benefit from using them	---	2
It takes more time to administer quizzes	---	2
One of the buttons got jammed once and could not participate	---	1
Only used the clickers once because of technical problems	---	1
The box that comes up about the frequency every time the professor starts a quiz questions, really bugs students	---	1
No way of knowing if there is something wrong with your clicker- so you can miss points.	---	1
Professor has to push the "start" button in order to initiate a quiz, harder to make quizzes 'on the fly.'	---	1
If we have to miss class have to take the quiz online and don't get the feedback	---	1

Evaluation Question 6: Helpfulness of Instructional Methods

EQ6. What instructional methods used with the SRS do students find helpful?

In order to address the evaluation question above, I examined students' responses to 11 quantitative survey questions. I also examined responses to one open-ended question from the student focus groups.

The quantitative results from the survey are broken down into three categories: first, there is an overall summary from all student responses ($n=558$); second, the results are divided by professor ($n=10$); and finally, descriptive statistics are given for each group. The summary of the qualitative data from students' responses in the focus groups is broken down by themes from the question. The last section gives a summary of the one-way analysis of variance that was computed by students' year in school. Table 14 contains the 11 instructional methods that students were asked to rate their helpfulness on in the survey. This table has been included to give the full description of the instructional methods as contained in the survey and the abbreviation as contained in the figures and tables in this chapter.

Overall results of instructional methods. Overall, students' mean ratings of the helpfulness of the instructional methods were positive. Every mean rating for each instructional method was over 3.00, which was designated as *somewhat helpful* on the Likert scale that was used. The highest mean rating among the instructional methods was for *receiving immediate feedback*, $M = 4.63$, $SD = 0.73$. The lowest mean rating was for using the SRS to *start class discussion*, $M = 3.60$, $SD 1.14$.

Table 14

Instructional Methods from the Student Survey

<i>Full description of instructional method from survey</i>	<i>Abbreviation of instructional method for Table and Figures</i>
Asking questions that check if you did the reading	Check for reading
Using it to encourage attendance	Encourage attendance
Asking questions to test how well you understand the course material	Test understanding of course material
Receiving credit for trying to answer the questions even if you get them wrong	Receiving credit for trying
Asking questions to guide topics covered in class	Guide topics in class
Asking questions to get discussions started in class	Start discussions
When the professor tells you to work with your neighbor to answer the clicker questions	Work with your neighbor
Receiving feedback immediately (seeing if you got the answer right or wrong) about how well you understood the material	Immediate feedback
Using the clickers for in-class simulations (research experiments, polling, voting, etc).	In-class simulations
Using it to administer quizzes in class	In-class quizzes
Using it to ask questions during test reviews in class	Test reviews

The other instructional methods' mean ratings fell somewhere between these two means. Interestingly, immediate feedback was the focus of instructional methods when the use of student response systems was beginning in the 1960s (Judson & Sawada, 2002) and received the highest overall mean rating of students' perceptions of its helpfulness in this evaluation. Figure 1 shows graphically each instructional method's overall mean rating. The overall means and standard deviations for each of the instructional methods can be found in Table 15.

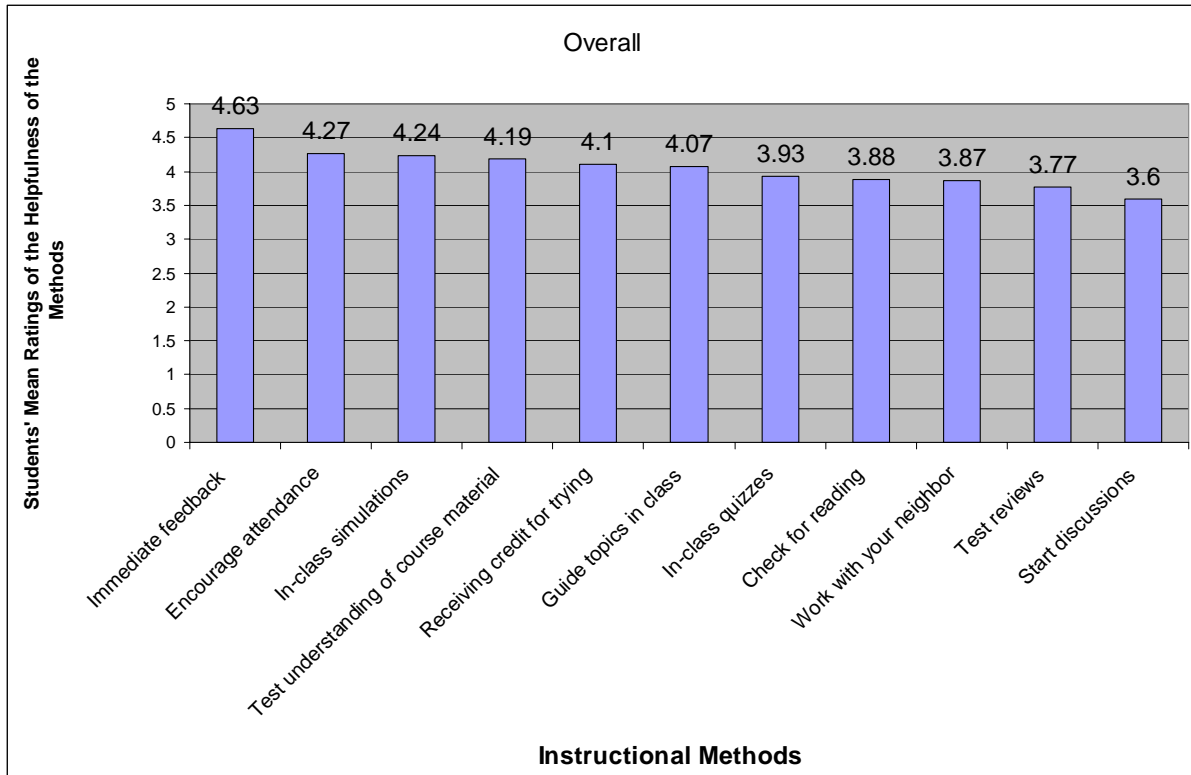


Figure 1. Overall mean ratings for each instructional method.

Table 15

Overall Descriptive Statistics for Each Instructional Method

How helpful were the following instructional methods in your class where the student response systems (clickers) were used? (5-Very helpful, 4-Helpful, 3-Somewhat helpful, 2-Not too helpful, 1-Not helpful at all)

Overall, n=558	<i>M</i>	<i>SD</i>
Check for reading	3.88	1.03
Encourage attendance	4.27	0.97
Test understanding of course material	4.19	0.87
Receiving credit for trying	4.10	1.07
Guide topics in class	4.07	0.93
Start discussions	3.60	1.14
Work with your neighbor	3.87	1.02
Immediate feedback	4.63	0.73
In-class simulations	4.24	1.11
In-class quizzes	3.93	0.94
Test reviews	3.77	1.17

Receiving immediate feedback was also one of the most helpful instructional methods most frequently stated by students in the focus groups (8 of 47 students, see Table 16). One student said, “I like being able to take quizzes with it in class. I like being able to see how well I did right then. Ask the question, see the answer.” Another student cited the system’s ability to provide feedback to the instructor, as well as the students:

I would say it's helped me a ton when he goes over a concept and then quizzes you on it to make sure you really understand it and if you see right then the results as well then you know you don't actually understand the concept then he can review right then seeing whether the students understand or not.

Table 16

Instructional Methods Students from Focus Groups Found Helpful

	Number of Responses <i>n</i> =47
Using it to ask questions about material taught during the lecture and/or from reading material throughout the lecture	14
Using the SRS to take quizzes or ask questions in class and seeing how you did right then	8
Using it to administer a quiz/assessment	4
Having students work in groups (collaboratively) to solve the clicker questions	3
Used application type questions	2
Using it for class administration items (asking the best day for a test review, to evaluate the class, etc.)	2
Professor re-explaining the material when students answered the question incorrectly	1
Used questions similar to exam questions	1
Did a pre-test clicker question (did not tell students the right answer) then taught the material and did a post-test question	1
Having questions at the end of class to see if students understood the material covered in class	1
Using it to get discussions going about topics leading to other topics	1
Using it to rank class presentations	1
Asking simple questions to check attendance	1

Note. Not all students responded to this question so the total number of responses does not equal 47.

Another student recognized the immediate feedback as valuable after only a couple of opportunities to use the system in class, “We've actually only used it twice, which is for in-class quizzes but I see lots of other opportunities that it would be nice if he were to use it because it's informative, in being able to have immediate feedback.”

The most frequently stated instructional methods students said they found helpful in the focus groups was using the SRS to ask questions about material covered during lecture or on the assigned reading throughout class (14 of 47 students, see Table 16). There were several reasons given for why they found this instructional method helpful. First, it keeps their attention throughout the lecture and makes them catch the material as they go along. Also, it helps increase their preparation for class (they do the reading because they know there will be questions on it). Students from the focus groups did not really mention much about specific types of questions professors would use to ask questions about the material. However, one student gave a description of the types of questions her professor used that she found helpful,

Ours did a lot of critical thinking, so he'll take the concept that we've just learned and then he'll have 6 or 7 different scenarios and you'll have to say if A does this then B does what? So its really helpful in getting you to think more than just A is the right answer you have to think why A is the right answer. Its really helpful.

The similar general instructional method of using the clicker system to test students' understanding of the course material from the survey received an overall mean rating of $M = 4.19$, $SD = 0.87$. It was the fourth-highest rated instructional method by students.

From the overall responses, receiving immediate feedback in class appears to be the instructional method students find most helpful. In the focus groups, asking questions throughout class was mentioned most frequently as being a helpful instructional method. However, on the survey, the instructional method that corresponded with this was worded a little differently, *Asking questions to test how well you understand the course material*, which includes the word *test* and does not say anything about asking the questions *throughout lecture*. The wording of this instructional method on the survey may have contributed to the lower rating because students may have interpreted the *asking questions* as a quiz or other type of formal assessment. It also did not include any mention of distributing the questions throughout class, which students identified in the focus groups as being helpful to them. Still, students do find asking questions on the course material and reading helpful. Additionally, as stated by students in the focus groups, dispersing the questions throughout the lecture is also helpful to them. A similar trend of students' perceptions of the helpfulness of the instructional methods continued when grouped by their professor.

Results by professor. When we asked students to rate the helpfulness of the instructional methods on the survey, we also asked them to tell us which class they were in so we could see how students' ratings varied over the different professors participating in the evaluation. We wanted to see if there would be variability in the ratings according to which professor the student had because the professors were using the SRS in different instructional ways. I took the response to what professor students listed and categorized them accordingly. I only used those professors who had been interviewed and had classroom observations done in their course ($n=10$). Only these ten professors' students'

responses were used in this section because we were able to collect information about the instructional methods the professor was using from the classroom observations and professor interviews.

Descriptive statistics (mean and standard deviation) were computed for each class. By examining the mean rating for each class, you can see a similar trend of *immediate feedback* as generally having the highest mean rating across professor in Figure 2 (the heavy blue line with squares). *Using the clicker to get discussions started in class* also generally has the lowest mean rating across professor (see Figure 2, heavy brown line with circles), as was the result from the overall mean ratings. Additional information about the instructional methods' mean ratings and standard deviations for each professor is found in Tables 17 and 18.

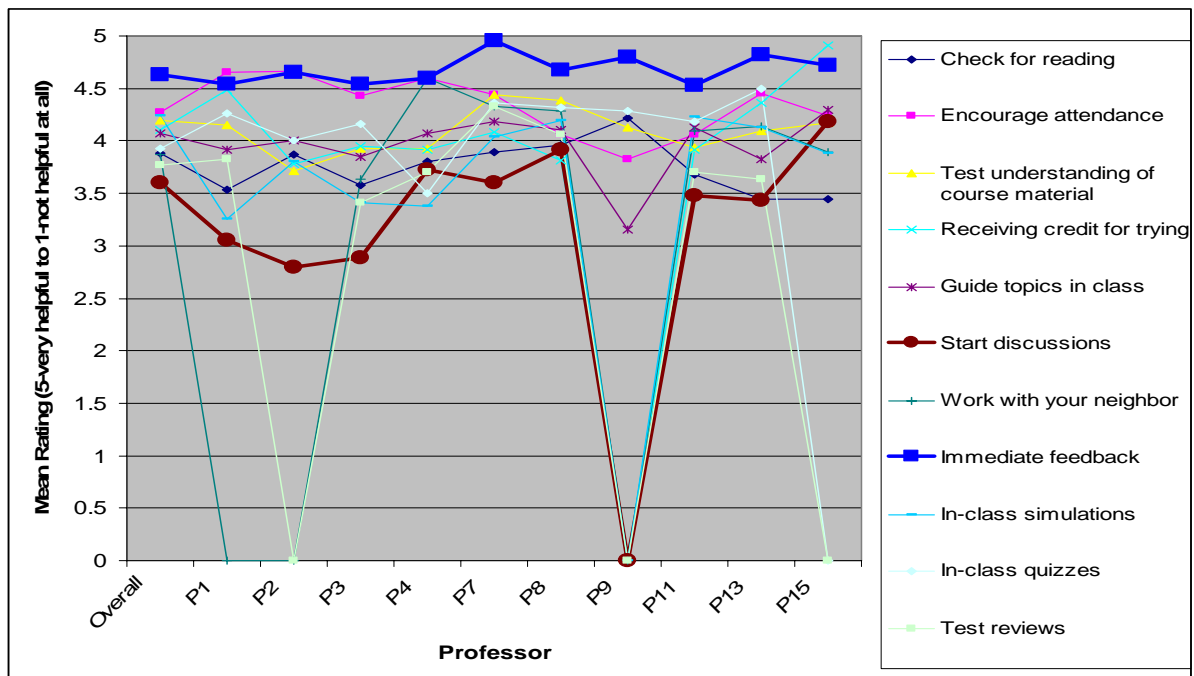


Figure 2. Line graph of mean ratings of instructional methods grouped by professor.

Table 17

Descriptive Statistics for Instructional Methods Grouped by Professor

How helpful were the following instructional methods in your class where the student response systems (clickers) were used? (5-Very helpful, 4-Helpful, 3-Somewhat helpful, 2-Not too helpful, 1-Not helpful at all)

		Check for reading	Encourage attendance	Test understanding of course material	Receiving credit for trying	Guide topics in class
P1,	<i>M</i>	3.53	4.65	4.15	4.48	3.91
<i>n</i> =26	<i>SD</i>	0.96	0.56	0.78	0.87	1.02
P2,	<i>M</i>	3.87	4.67	3.71	3.78	4.00
<i>n</i> =17	<i>SD</i>	0.92	0.49	0.92	0.97	0.82
P3,	<i>M</i>	3.58	4.43	3.93	3.95	3.85
<i>n</i> =41	<i>SD</i>	0.97	0.81	0.91	0.90	0.89
P4,	<i>M</i>	.80	4.60	3.93	3.92	4.07
<i>n</i> =15	<i>SD</i>	0.94	0.51	0.88	0.79	0.73
P7,	<i>M</i>	3.89	4.44	4.44	4.08	4.18
<i>n</i> =42	<i>SD</i>	0.97	0.81	0.74	0.97	0.75
P8,	<i>M</i>	3.96	4.06	4.39	3.81	4.11
<i>n</i> =87	<i>SD</i>	0.92	0.99	0.85	1.23	0.94
P9,	<i>M</i>	4.22	3.82	4.13	---	3.15
<i>n</i> =25	<i>SD</i>	0.74	1.19	0.63	---	0.99
P11,	<i>M</i>	3.68	4.06	3.94	3.91	4.13
<i>n</i> =35	<i>SD</i>	1.39	1.08	1.03	1.15	0.90
P13,	<i>M</i>	3.45	4.45	4.09	4.36	3.82
<i>n</i> =11	<i>SD</i>	1.29	0.82	0.70	0.67	1.08
P15,	<i>M</i>	3.44	4.24	4.17	4.94	4.29
<i>n</i> =18	<i>SD</i>	0.88	0.83	0.62	0.24	0.67

Table 18

Descriptive Statistics for Instructional Methods Grouped by Professor, Contd.

How helpful were the following instructional methods in your class where the student response systems (clickers) were used? (5-Very helpful, 4-Helpful, 3-Somewhat helpful, 2-Not too helpful, 1-Not helpful at all)

		Start discussions	Work with your neighbor	Immediate feedback	In-class simulations	In-class quizzes	Test review
P1,	<i>M</i>	3.05	---	4.54	3.25	4.26	3.82
<i>n</i> =26	<i>SD</i>	1.03	---	0.86	1.61	0.45	1.07
P2,	<i>M</i>	2.80	---	4.65	3.80	4.00	---
<i>n</i> =17	<i>SD</i>	1.62	---	0.49	0.63	1.06	---
P3,	<i>M</i>	2.89	3.63	4.54	3.41	4.16	3.41
<i>n</i> =41	<i>SD</i>	1.16	1.22	0.55	1.26	0.81	1.35
P4,	<i>M</i>	3.73	4.60	4.60	3.38	3.50	3.70
<i>n</i> =15	<i>SD</i>	0.47	0.63	0.51	0.52	0.97	0.95
P7,	<i>M</i>	3.60	4.33	4.95	4.04	4.36	4.33
<i>n</i> =42	<i>SD</i>	1.10	.075	0.22	0.79	0.66	0.86
P8,	<i>M</i>	3.92	4.28	4.68	4.20	4.32	4.06
<i>n</i> =87	<i>SD</i>	1.01	0.90	0.84	0.91	0.86	1.03
P9,	<i>M</i>	---	--	4.80	---	4.28	---
<i>n</i> =25	<i>SD</i>	---	---	0.50	---	0.68	---
P11,	<i>M</i>	3.48	4.09	4.53	4.23	4.18	3.70
<i>n</i> =35	<i>SD</i>	1.30	1.10	0.71	0.92	0.94	1.06
P13,	<i>M</i>	3.43	4.14	4.82	4.13	4.50	3.63
<i>n</i> =11	<i>SD</i>	0.98	0.90	0.60	1.13	0.98	1.30
P15,	<i>M</i>	4.18	3.89	4.72	3.88	---	---
<i>n</i> =18	<i>SD</i>	0.64	1.28	0.46	0.81	---	---

In addition to the trends from the overall results that continue into each individual professor's students' responses, there is more information from the survey that provides insights into how the SRS was used and how that seemed to affect students' perceptions of the helpfulness of those instructional methods. There are no doubt numerous factors that may have influenced students' ratings of their perceived helpfulness of the instructional methods and we are not trying to ignore the influence of these things. We are, however, trying to find patterns or trends in the data based on what is known about

the instructional methods professors were using. Table 19 shows a summary of how the professors I interviewed and observed were using the SRS. The first three rows tell how the professor awarded points when using the SRS. The fourth row indicated how many times the professor used the SRS during the semester and the rows below are the 11 general instructional methods we asked students about. An “X” indicates the professor used that instructional method. Some professors just have lines through certain instructional methods, which indicates the professor did not use that method. This data was collected from the actual student survey. There was a choice under the Likert scale for *my professor did not use the clicker this way*. If more than half of the students under that professor chose the option of *my professor did not use the clicker this way* I concluded that the professor was not using the SRS in that way and did not include data from those instructional methods for that specific professor. This was confirmed by classroom observations and self-reports from the professor during their interviews. The last row in the table indicates if the professor would re-explain material after a clicker question; this data was collected from the classroom observations.

Column P9 shows that this professor used the SRS strictly for assessment, meaning students had to get the answer right in order to get any points. There were also fewer instructional methods employed by this professor and the SRS was only used four times during the semester. Also, in the classroom observations, I noticed that there was no explanation following a clicker question. The question would be displayed, students would answer, and then the graph of the distribution of responses would be revealed with the correct answer highlighted. The instructor would then immediately move on to the next question.

Table 19

How Professors Were Using iClicker

	P1	P2	P3	P4	P7	P8	P9	P11	P13	P15
Award partial credit even when student gets question wrong	X	X	X		X			X	X	
Questions not graded, students only given participation points			X	X		X				X
Questions are graded-no points for wrong answers		X		X		X	X	X		
Frequency of use	EC	7-8 times a smstr.	EC	EC	EC	EC	4 times a smstr.	EC	EC	EC
Immediate feedback	X	X	X	X	X	X	X	X	X	X
Encourage attendance	X	X	X	X	X	X	X	X	X	X
In-class simulations	X	X	X	X	X	X		X	X	X
Test understanding of course material	X	X	X	X	X	X	X	X	X	X
Receiving credit for trying	X	X	X	X	X	X		X	X	X
Guide topics in class	X	X	X	X	X	X	X	X	X	X
In-class quizzes	X	X	X	X	X	X	X	X	X	
Check for reading	X	X	X	X	X	X	X	X	X	X
Work with your neighbor			X	X	X	X		X	X	X
Test reviews	X		X	X	X	X		X	X	
Start discussions	X	X	X	X	X	X		X	X	X
Re-explain material when students got a question wrong (observed)	X	X	X	X	X	X		X	X	X

Note. EC = every class. Smstr = semester.

The students' mean ratings of the helpfulness of the instructional methods that were used in professor P9's class are generally lower (Figure 3, orange line with circles represents P9) than the other professors' students' mean ratings that used the system more often, in more ways, and not strictly for assessment, but also awarded points for participation. This suggests that using the SRS more frequently, in a greater variety of ways, and not strictly for assessment increased students' perceptions of the helpfulness of the instructional methods used with the SRS.

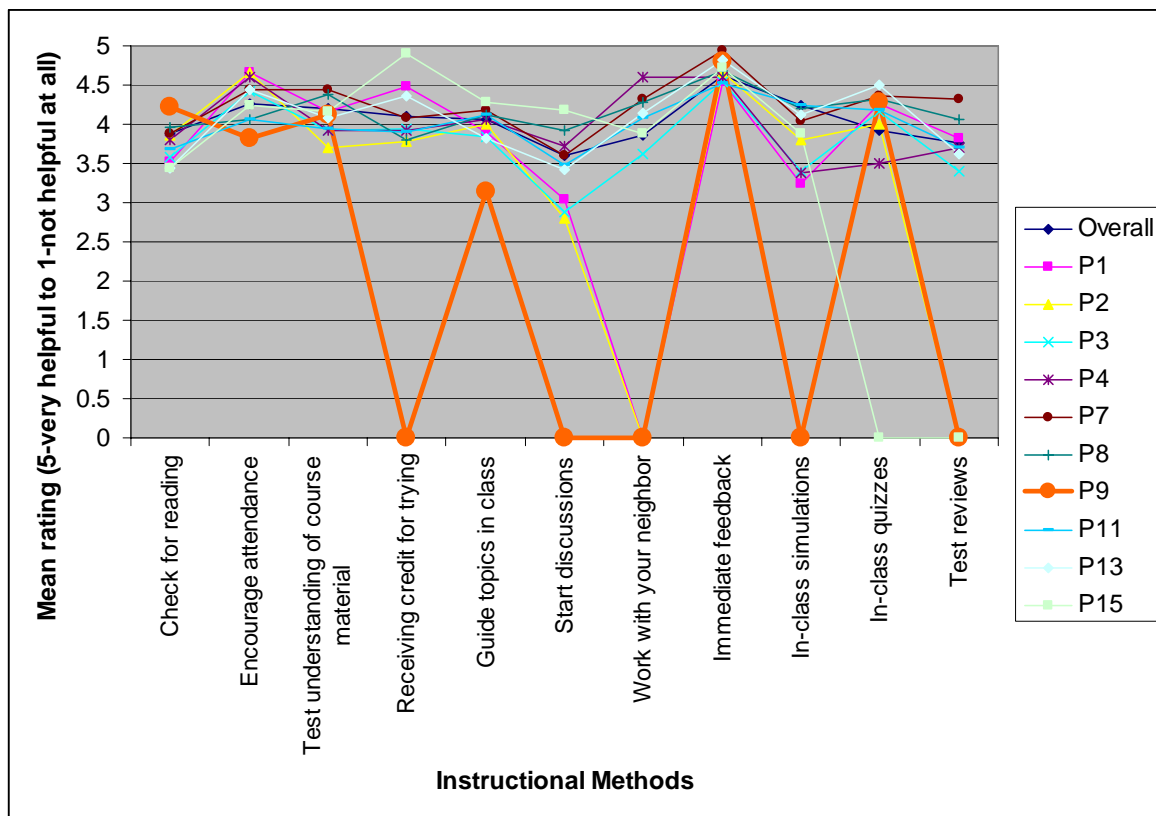


Figure 3. Mean ratings of the instructional methods for each professor.

Professor P9 represents an outlier among the ten professors in this group. Many of the professors (P3, P4, P7, P8, P11, and P13) used the SRS in very similar ways. Most, in some way, used all of the 11 general instructional methods we asked students about on the survey. They also used a combination of grading methods, awarding points for

participating and for selecting the correct answers, re-explaining material following a clicker question (see Table 19). These professors' students' mean ratings across instructional methods follow a very similar path (see Figure 4). All of the professors in this group taught a subject in the natural sciences and all had a larger class size, so there were similarities in addition to the instructional methods they used.

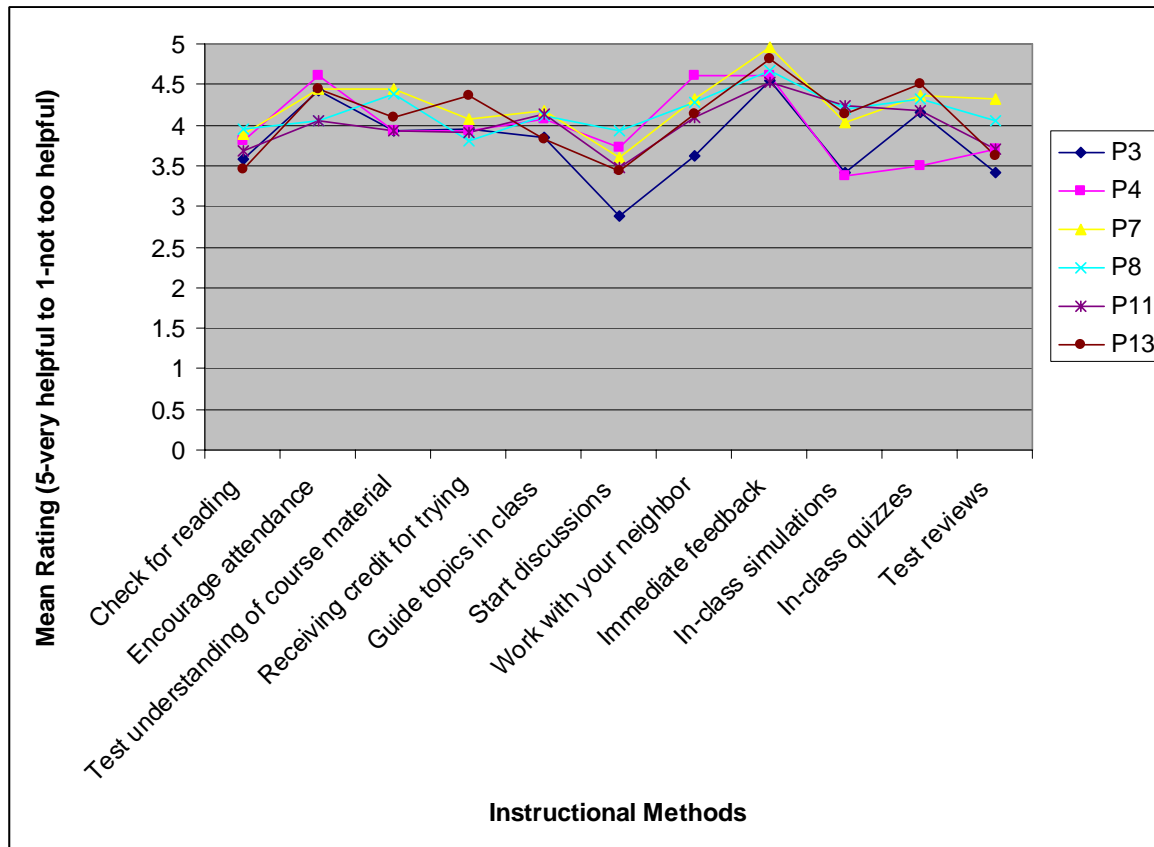


Figure 4. The professors who used the SRS in very similar ways students' mean ratings of the helpfulness of the instructional methods from the survey.

The similar mean ratings simply show that even across class and professor, when the SRS was used in similar ways, students generally perceived about the same helpfulness.

Overall, students were generally positive about the helpfulness of the instructional methods. Most of the mean ratings were in a range of *somewhat helpful* to *helpful*,

signifying students did perceive a degree of helpfulness in the instructional methods used even across each professor (see Table 17 and 18). It seems that students perceived using iClicker as more helpful and were more positive about the helpfulness of the instructional methods when professors used it often and in a variety of ways (not strictly for assessment).

Results by year in school. As discussed earlier, there were many factors that may have influenced students' perceptions of the helpfulness of the instructional methods. One of the factors I considered in this evaluation and collected data for were students' year in school (freshman, sophomore, junior, senior, and graduate student). I grouped students by their year in school (freshman, sophomore, junior, senior, and graduate students) and then computed a one-way analysis of variance for this factor. Only one graduate student responded to the survey so his responses were not included in the test. In Figure 5, it can be seen that freshmen (dark blue line with circles) generally have a higher mean rating of the helpfulness of each instructional method.

The one-way analysis of variance yielded statistically significant differences among the groups for several of the instructional methods: encouraging attendance $F(3, 532) = 4.34, p = .00$, testing understanding of course material $F(3, 549) = 7.42, p = .00$, immediate feedback $F(3, 552) = 9.37, p = .00$, and in-class quizzes $F(3, 483) = 4.98, p = .00$. Post hoc tests revealed the differences in ratings of the previous instructional methods to be between freshmen and the upper classmen, with freshmen having a statistically significant ($p < .05$) higher mean rating of the helpfulness of *encouraging attendance* than juniors and seniors, freshmen and sophomores having a statistically significant ($p < .05$) higher mean rating of *testing understanding of course material* than

seniors, freshmen having a statistically significant ($p < .05$) higher mean rating of *immediate feedback* than sophomores, juniors, and seniors, and freshmen having a statistically significant ($p < .05$) higher mean rating of *in-class quizzes* than seniors.

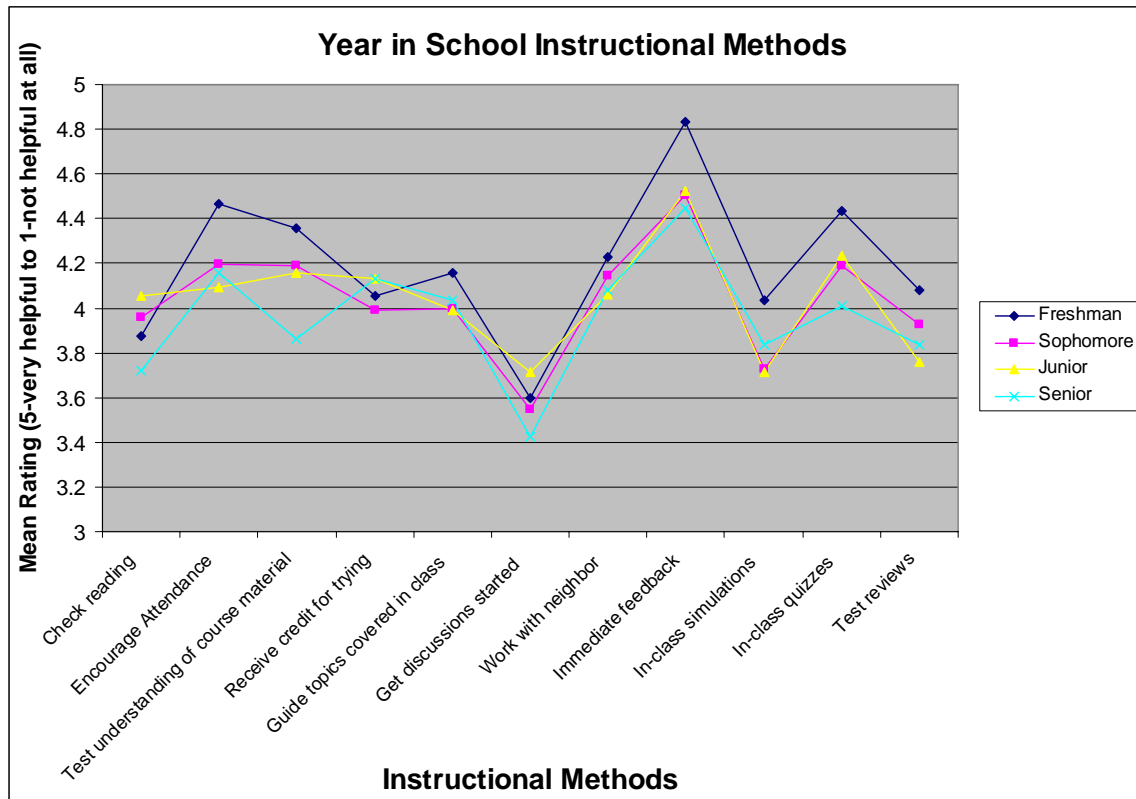


Figure 5. Mean ratings of instructional methods by year in school.

The statistical significance of these results may suggest several interpretations. One interpretation is that statistically significant differences that do appear in students' mean ratings of the helpfulness of the instructional methods follow the same trend with the lower classmen (freshman and sophomore) having statistically significant higher mean ratings of the instructional methods than the upper classmen (junior and senior). This could be due to freshmen's lack of experience at a university setting and so when they are introduced to the clicker system they do not know much else as far as experience in a lecture and so find it more helpful than more seasoned students who may have

experienced effective instruction without the SRS. Another interpretation could be that this technology is new to freshmen and sophomores so there is more of a novelty effect with using the SRS.

Evaluation Question 7: Areas Students Feel Using SRS has Increased

EQ7. Do students feel using a SRS has increased their comprehension of course material, attendance at lecture, attentiveness/engagement during lecture, participation in lecture, and achievement in the course?

In order to address the evaluation question above, I examined student responses to the five questions on the survey and five questions from the focus groups.

Overall results. When all student responses were examined, *Attendance at lecture* was the area with the highest mean rating, $M = 3.96$, $SD = 0.80$. *Achievement in the course* had the lowest mean rating of $M = 3.59$, $SD = 0.69$ (see Table 20). The lower mean rating in *achievement in the course* could also be due to the difficulty in measuring achievement or determining if this one factor (using a SRS) contributed to their achievement. As one student stated from the focus group, “I wouldn’t know if it has contributed to my achievement because I don’t have a similar class that is not using them to compare it with.” Attendance seems to be an easier construct to measure and determine what factors can motivate it. Despite the lower mean rating of *achievement in the course*, it still has a mean rating above 3.00, which the Likert scale states as *has remained the same*, so it appears that overall, students do perceive the use of the SRS as having somewhat of a positive effect on their achievement in the course.

In the focus groups, students were positive about the effects of the SRS on the five areas. Students' responses (n=47) in each of these areas generally had twice as many students say using the SRS increased the area than those that said it did not (Figure 6).

Table 20

Descriptive Statistics of 5 Areas from Survey

Question: How do you feel using the student response system in your class has increased the following? (5-Greatly increased, 4-Increased, 3-Has remained the same, 2-Slightly decreased, 1-Greatly decreased)

		Comprehension of course material	Attendance at lecture	Attentiveness or engagement in lecture	Participation in lecture	Achievement in the course
Overall	<i>M</i>	3.77	3.96	3.87	3.79	3.59
<i>n</i> =558	<i>SD</i>	0.64	0.80	0.76	0.79	0.69

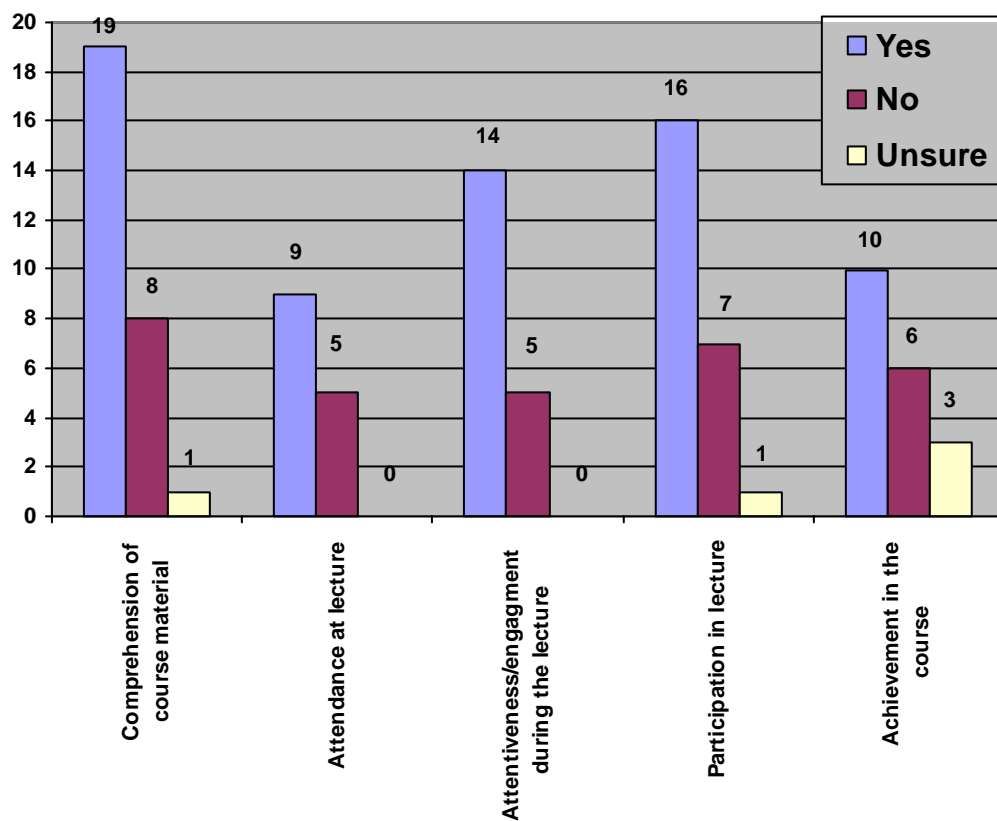


Figure 6. Student responses from the focus groups about whether they felt the 5 areas increased as a result of using the SRS.

Several students reported that it helped increase their comprehension because the immediate feedback let them know what they needed to study more. One student said, “When we do our quizzes I usually find out I don't know what I'm doing and so I know that I'm doing it wrong.” Another student expressed that the discussion that follows the questions and feedback is also helpful in understanding their own knowledge, “I was going to say because the professor has a period where you have to discuss it and kind of discussing it you either learn to understand or you understand what you don't understand.” The majority of students did say that they felt using the SRS had helped increase their attendance. Major motivators were the points from quizzes or participating. Some students reported they would go to class regardless of the SRS use or points. Even though this area had the highest mean rating across students on the survey, it was the area that was the least responded to and talked about in the focus group. Attendance is easier to measure but may not be seen as important an issue to students as the SRS helping increase their comprehension of the material or achievement in the course and therefore discussed it less in the focus groups.

When students were asked about increasing their attentiveness or engagement, they reported working together in groups was helpful. One student said, “Sometimes it's good because you can work in these groups and understand stuff but other times if you're just doing an individual quiz it might not be as engaging.” Many students said that they did not fall asleep in class because they knew that there were going to be questions/quizzes. They also said that it helped increase their participation because when they would get an answer wrong they would want to know why and so would ask more questions. They said they felt more confident asking questions when they could see other

students' responses and see that others were thinking the way they were. Many of the students that felt using the SRS in class helped increase their achievement in the course said it did so because the clicker questions were similar to ones on the tests and so helped them in their test preparation or knowing what types of questions would be on the test.

One student said,

On like the test it always helps because my teacher uses a lot of clicker questions on the exams of that unit so that helps a lot. And he will put them on Blackboard before as a review so it helps.

Overall, students are positive about the use of the SRS in helping increase the five areas.

Results by professor. The results from this section follow a similar trend as in the overall results. Generally, *attendance at lecture* (see Figure 7, pink line with circles) had the highest mean rating across professor and *achievement in the course* (see Figure 7, purple line with squares) had the lowest mean rating across professor.

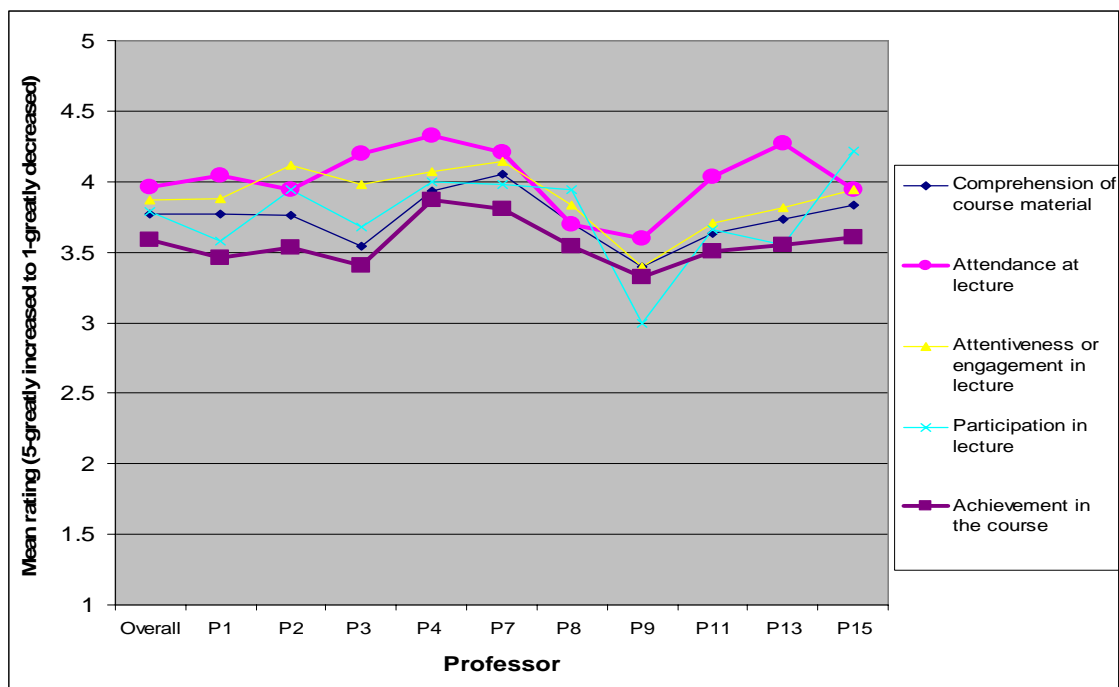


Figure 7. Students mean ratings divided by professor of how they felt the 5 areas increased as a result of using the SRS.

Professors P3, P4, P7, P8, P11, and P13, who used the SRS with about the same frequency and used very similar instructional methods (see Table 13), had mean ratings on the student survey in these 5 areas that were very similar (see Table 21). A similar result for these professors was found in the mean ratings of the helpfulness of the instructional methods on the student survey.

Table 21

Descriptive Statistics of 5 Areas from Survey Grouped by Professor

Question: How do you feel using the student response system in your class has increased the following?

(5-Greatly increased, 4-Increased, 3-Has remained the same, 2-Slightly decreased, 1-Greatly decreased)

		Comprehension of course material	Attendance at lecture	Attentiveness or engagement in lecture	Participation in lecture	Achievement in the course
P1,	<i>M</i>	3.77	4.04	3.88	3.58	3.46
<i>n</i> =26	<i>SD</i>	0.51	0.72	0.71	0.64	0.65
P2,	<i>M</i>	3.76	3.94	4.12	3.94	3.53
<i>n</i> =17	<i>SD</i>	0.75	0.90	0.86	0.83	0.62
P3,	<i>M</i>	3.54	4.20	3.98	3.68	3.41
<i>n</i> =41	<i>SD</i>	0.51	0.72	0.65	0.72	0.50
P4,	<i>M</i>	3.93	4.33	4.07	4.00	3.87
<i>n</i> =15	<i>SD</i>	0.70	0.82	0.70	0.76	0.74
P7,	<i>M</i>	4.05	4.21	4.14	3.98	3.81
<i>n</i> =42	<i>SD</i>	0.58	0.84	0.68	0.72	0.67
P8,	<i>M</i>	3.71	3.70	3.83	3.94	3.54
<i>n</i> =87	<i>SD</i>	0.63	0.82	0.77	0.78	0.71
P9,	<i>M</i>	3.40	3.60	3.40	3.00	3.32
<i>n</i> =25	<i>SD</i>	0.58	0.82	0.71	0.29	0.63
P11,	<i>M</i>	3.63	4.03	3.71	3.66	3.51
<i>n</i> =35	<i>SD</i>	0.73	0.66	0.71	0.80	0.74
P13,	<i>M</i>	3.73	4.27	3.82	3.55	3.55
<i>n</i> =11	<i>SD</i>	0.47	0.65	0.98	0.69	0.52
P15,	<i>M</i>	3.83	3.94	3.94	4.22	3.61
<i>n</i> =18	<i>SD</i>	0.51	0.73	0.42	0.65	0.50

Under P9 (see Figure 8) there is a dip in the mean ratings from the survey across these five areas. This professor's students generally rated these five areas as not increasing as much as other professors who used the SRS more frequently and employed more instructional methods. This is the same professor whose students generally rated the helpfulness of the instructional methods used in this class as less helpful than in other classes that were using the SRS more often and in more ways (see Figure 3).

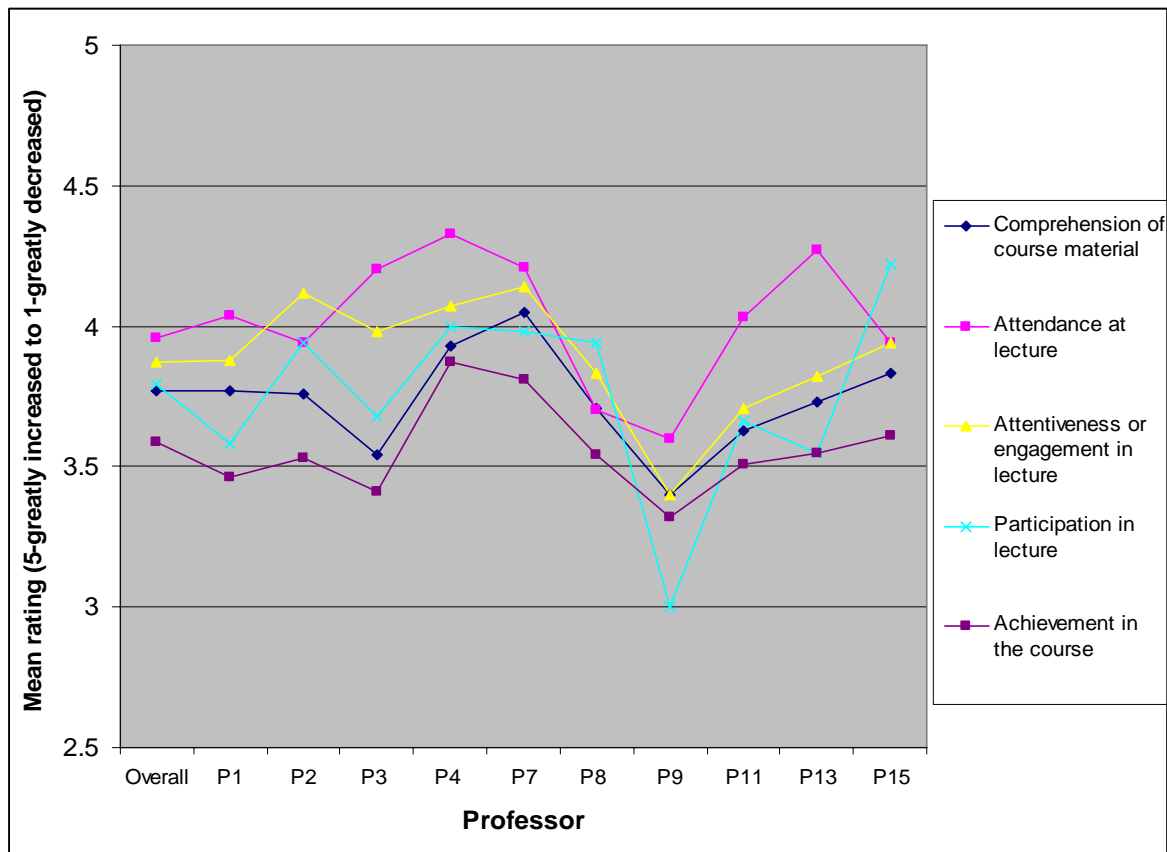


Figure 8. Mean ratings of how much the five areas increased across professor.

Students' mean rating of how much they felt their participation in class had increased under P15 is higher than any other of the professors, $M = 4.22$, $SD = 0.65$. This professor used the SRS to only award participation points. Students were not graded on if their answer was correct or not; if they answered they, received the points. Hence, the emphasis was on coming to class and participating, so it is logical that this class rated

their participation increasing more than any other area. Professor 15 was the only one of the ten that never graded the correctness of students' answers.

From the survey results grouped by individual professor it appears that students felt these five areas increased more when the SRS was used more frequently, with more instructional methods, and points were administered for participation and the correctness of the response.

Results by year in school. Students' year in school did not seem as significant of a factor as it was in students' ratings of the helpfulness of the instructional methods. The one-way analysis of variance yielded only statistically significant differences in students mean ratings for *attentiveness/engagement during lecture* $F(3, 553) = 3.39, p = .02$. The post-hoc tests revealed the significant difference was between freshmen and sophomores. Practically, the statistical results of this test do not appear to be significant. The results are not telling anything in particular and provide no insight into differences in the groups. Overall, year in school did not seem to influence students' perceptions of how using the SRS increased the five areas.

Evaluation Question 8: Cost of Purchasing the Clicker

EQ8. Do students feel the cost of purchasing the clicker is worth the benefit they receive from using it?

In order to address the evaluation question above, I examined students' responses to one survey question.

In all but one class involved in the evaluation, students had to purchase the clicker with their own money in the bookstore. The clicker cost students approximately thirty-five dollars. Some students traded in their old clicker from last semester to the CTL and

received a coupon for about eighteen dollars off the new clicker. The overall mean rating was $M = 3.61$, $SD = 1.43$. The overall mean rating falls between the *somewhat agree* and *somewhat disagree* rankings, which is not particularly positive toward the cost being worth the benefit students felt they received from using the SRS.

A statistically significant positive correlation was found when students' mean rating across instructional methods were correlated (Pearson r Correlation) with how strongly they agreed with the cost being worth the benefit, $n = 558$, $r = .487$, $p = .000$. As students agreed more strongly with the cost of the clicker being worth the benefit they received, their mean rating of the helpfulness of the instructional methods also increased. As they disagreed more with the cost being worth the benefit, their mean rating of the helpfulness of the instructional methods also decreased (see Figure 9).

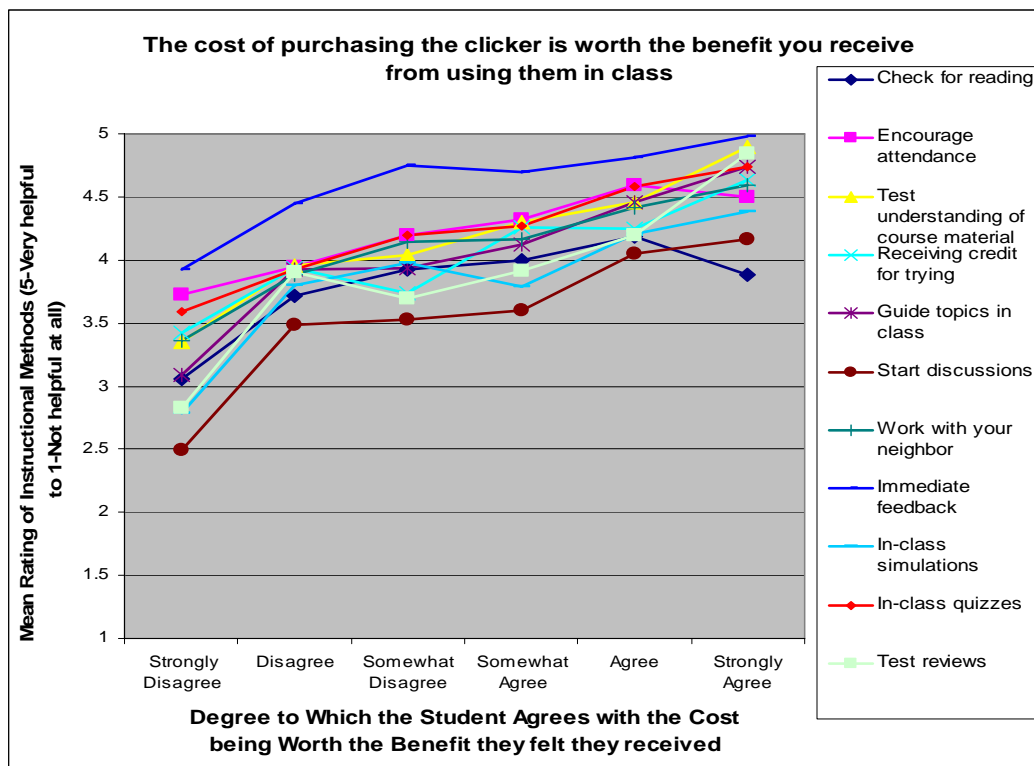


Figure 9. Students mean ratings of the helpfulness of the instructional methods grouped by how strongly they agreed with the cost being worth the benefit they felt they received from using the SRS.

This same trend continues for each of the five areas (comprehension of course material, attendance at lecture, attentiveness/engagement during lecture, participation in lecture, and achievement in the course). The Pearson Correlation also yielded a statistically significant correlation between students' mean rating of the five areas and how strongly they agreed with the cost being worth the benefit, $n = 558$, $r = .538$, $p = .000$. The more strongly students agreed with the cost being worth the benefits, the more they rated the five areas as increasing as a result of using the SRS. The more strongly students disagreed with the cost being worth the benefits they received from using the SRS, the less they rated these areas as increasing as a result of using the SRS in class (see Figure 10).

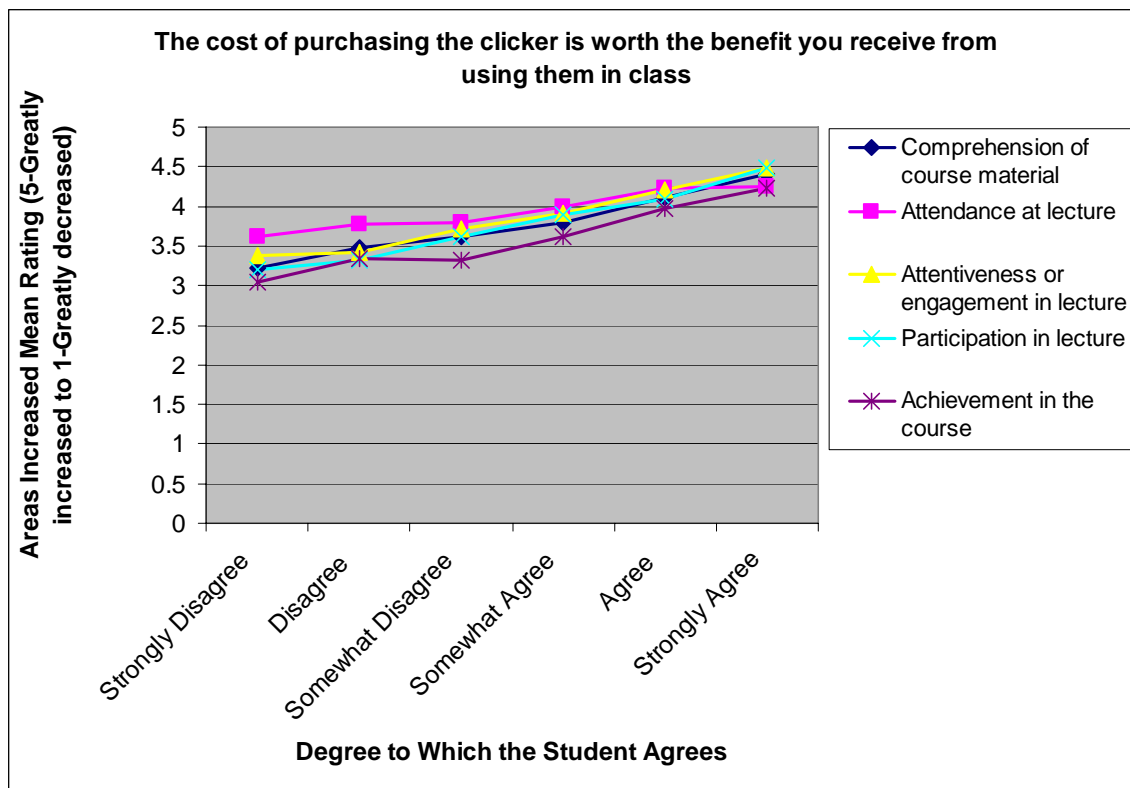


Figure 10. Students mean ratings of how much they felt the 5 areas increased as a result of using the SRS in class grouped by how strongly they agreed with the cost being worth the benefit they felt they received from using the SRS.

When students were grouped by professor, P9 had the lowest mean rating from students of the cost of purchasing the clicker being worth the benefits they received. Other professors (P3, P4, P7, P8, and P13) who used the SRS more frequently and in more ways had higher mean ratings from students (see Figure 11).

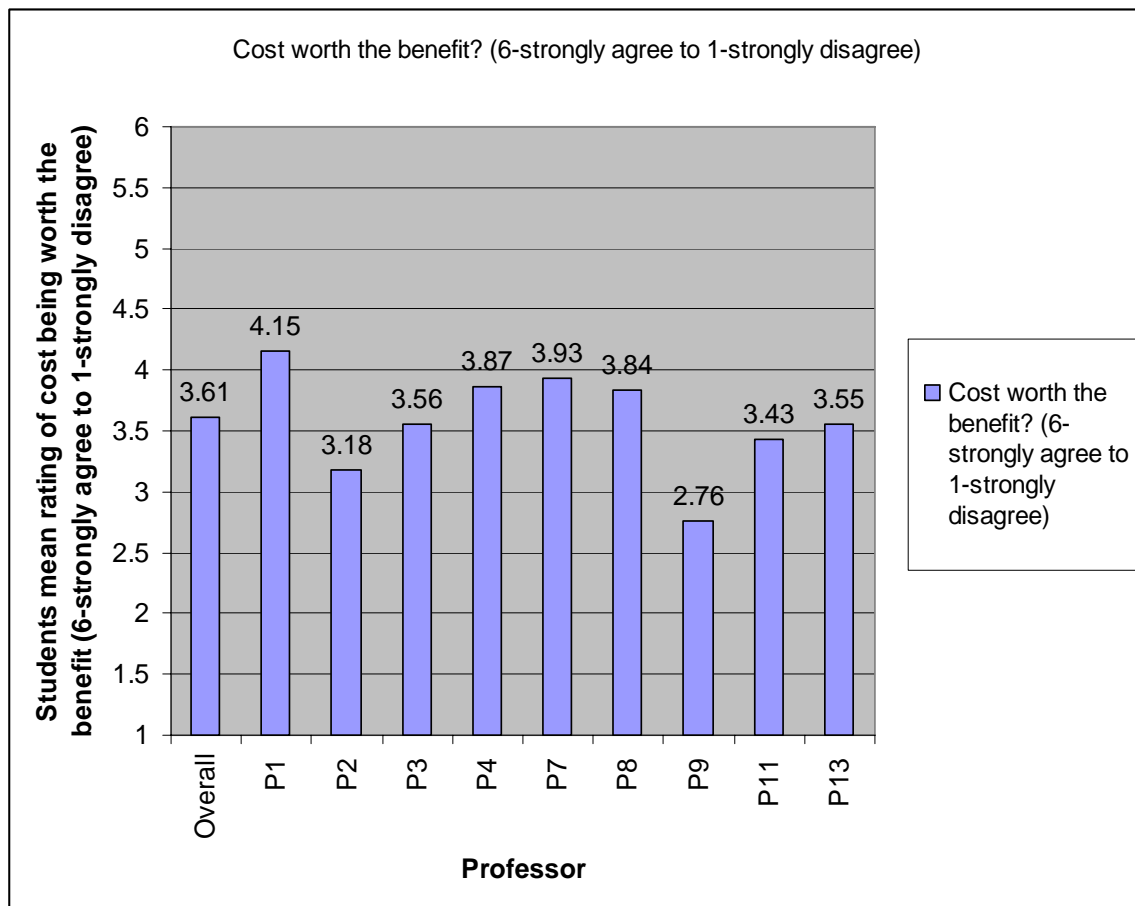


Figure 11. Students mean rating of the cost of purchasing the clicker being worth the benefit they felt they received from using the SRS by professor.

The cost of purchasing a clicker appears to be a significant factor in students' ratings of the helpfulness of using a student response system practically and statistically. When students are required to spend thirty-five dollars for something they have no idea

of what its purpose will be could also predispose students to have a more negative perception of the SRS before it is ever used. In one of the classroom observations, I was there on the first day of the clickers' use and there were numerous statements from students to the professor that he needed to use it enough for it to be worth the money they paid for it. This is an important factor for professors to consider as they decide to incorporate the use of a SRS in their class. Professors should carefully plan how they will use the SRS and if that use is worth the cost it will pose to students. Simply using the SRS more frequently, in more ways, and not strictly for assessment appears to influence in a positive way how students feel about the cost of purchasing the clicker.

Evaluation Question 9: Advantages and Disadvantages of Using a SRS

EQ9. What are the advantages and disadvantages of using a SRS for professors and students?

In order to address the evaluation question above, I examined students' responses to two survey questions and two focus groups questions. I also examined professors' responses to two survey questions and two interview questions.

Advantages. The most frequently stated advantage by students was receiving immediate feedback during class that helped them know what material they did not understand (see Table 22). This was also the most frequently stated advantage for professors (see Table 23), but they saw it as feedback to themselves about what students did and did not understand.

Table 22

Advantages of Using a SRS for Students

	<i>Focus Groups n=47</i>	<i>Survey n=558</i>
Immediate Feedback following the questions/helps students know what they need to work on or don't understand	14	176
Motivates students to attend lecture	1	83
Students are more involved in the lecture	1	70
Students pay more attention during lecture	1	62
Helps teacher understand how well students understand the material	---	57
Shows whole classes understanding of material and show how well you understand compared to the rest of the class	1	49
Save times/Quicker than quizzes on paper	6	33
No Advantages	---	26
Easier grading/scoring for the professor and students	---	25
Helps students get a better understanding of the material being taught	2	20
Breaks up the monotony of lecture	1	17
Anonymity of responses	1	16
Saves paper	---	15
Able to discuss the problem to make sure we understand the concept being covered/increased discussion	---	15
Have to keep up on the material/be prepared for class	---	14
Tests knowledge and understanding of concepts/practice problems	---	14
Receiving credit for doing the reading and coming to class/easy points	---	14
Helps with test preparation	---	10
Interaction of using the system makes a better learning environment/makes class more personal	---	7
Receiving points for trying, even if you're wrong	---	4
Makes it harder to cheat	---	3
Can poll about the class in general	---	3
Misconceptions are clarified with the clicker quizzes	---	2
There are more points given out	---	2
Class is more organized	---	2
Help me learn visual concepts in physics	---	1
Gets students to class on time	---	1
Helps you meet new people/find study groups	1	1
Being able to change your answer	---	1
Creates an atmosphere of constantly being asked what you know instead of just on a test.	---	1
Generates discussion	---	1
Easy to Cheat	---	1
Made class time more valuable	---	1
Good way to review important concepts	---	1
Easier than counting hands	---	1
Helps you understand what the teacher wants you to get out of class	1	---
Has helped me read questions more carefully and better	1	---

Table 23

Advantages of Using a SRS Stated by Professors

	Interviews <i>n</i> =10	Survey <i>n</i> =20
Helps me gauge where students need help/see what they don't understand	10	10
Ability to engage to some degree everyone in the class	7	7
Encourages students to pay attention	1	6
Encourages students to attend class	3	5
Helps students understand what they don't understand	---	3
Encourages student preparation	---	2
Helps prepare students for the exams	---	2
Facilitates group activities	---	2
Makes class more interactive and interesting for students		
Ease of grading/recording scores	2	1
Breaks up the lecture; Is a fun activity	1	1
Anonymous nature let's all speak out	1	1
Students being able to see where they stand in relation to their peers	---	1
Promotes class discussion	1	1
Allows teacher to give individual help	---	1
Helps make learning a two-way experience	---	1
Gives you the ability to connect with a large group of people	3	---
Gives me a chance to walk around the class	1	---
Good way to track attendance and see if students who are struggling are attending class	1	---

Immediate feedback being stated as the most frequent advantage of using a SRS follows what was found in students' ratings of the helpfulness of the instructional methods from the survey. The *immediate feedback* received the overall highest mean rating. Students also felt that instructors' receiving this feedback about how well they

understood the material was an advantage for them because instead of just moving on, the professor would many times re-explain the material to help eliminate any confusion on the subject. One student said, “The professor gets immediate feedback on how much of the class really understands the material and if additional explanations are needed.” Other frequently stated advantages by students and professors were that it encourages attendance, helps keep students’ attention, and helps students get involved in the lecture. Students also felt that being able to see where they stood in relation to their peers was an advantage and felt that the SRS saved time over traditional methods of taking quizzes. Students also stated a variety of other advantages of using the SRS (see Table 23).

Disadvantages. A large number of students from the survey and focus groups felt that there were not any disadvantages to using the SRS (see Table 24). There were four responses from professors from the survey and interviews that also reported having only positive experiences using iClicker (see Table 25). The most frequently stated disadvantage among students was the cost (127 responses survey and focus groups). This response helps support what was found earlier about how strongly students agreed with the cost being worth the benefit (see section *Question 8: Cost of Purchasing the Clicker*).

Other disadvantages stated by students were feeling discouraged when they missed a question and were docked points or forgetting their clicker/having it malfunction and losing points because they could not participate. Many of the disadvantages they stated dealt with missing points or being penalized for circumstances that were sometimes out of their control (see Table 24).

Table 24

Disadvantages of using a SRS Stated by Students

	Focus Groups <i>n</i> =47	Survey <i>n</i> =558
None	1	134
Cost-too expensive	24	103
Discouraging to get deducted points when you forget your clicker or don't understand the concept	---	47
No way to make up the points if you have to miss class/or late to class	4	39
Distracts the class-lose time from lecture	3	36
Having to remember to bring it to class/forgetting it	---	27
Clickers don't always work	---	19
Not given enough time to work the problem out and have to guess	---	17
Student Cheat/Easy to Cheat	1	15
Can be stressful answering the questions	---	12
One more thing to keep track of and carry	4	9
Daily Quizzes/ Counts toward your grade	---	9
If clicker breaks or lose it have to buy a new one/can miss points	1	8
Forget what I answered/not knowing for sure if your answer was received	---	5
Tempting to just listen to your peers instead of thinking for yourself	---	5
Turns off easily--when dropped or otherwise	---	5
Questions not worded well/ Clicker questions don't pertain to the exams	---	5
Teacher relies on it too much	---	4
Reduces communication between student and teacher	---	4
They are a waste/Can do quizzes on paper	1	3
Reduce amount of material covered	---	3
Not as personal when answering questions	---	3
Would just try to guess better rather than trying to understand the material	---	3
Having to register the clicker	---	3
Limited to multiple choice questions/distracters could be better	2	3
Batteries dying	2	3
Have to do the reading before class	---	2
When you haven't covered the material for the question and don't know the answer	---	2
When you get it wrong but the concept is not re-explained by the professor or right answer is not explained	---	2
Have to set frequency each time you turn them on	2	1
Questions don't measure complete comprehension of the material	---	2
Not being used enough/not enough classes use it	5	1
Don't know what classes will use them again so don't know if you should sell them back or not	1	1
When the professor doesn't really know how to work the system	1	1
If you don't understand you get left behind	1	1
No case or protection for the clicker	1	---
Makes the University think it is okay to have large classes	---	1
Hard to change your answer	---	1
Class is too small for their use to be worth it	---	1
Size/Shape is too large	---	1

The most frequently stated disadvantage for professors dealt with the extra time involved in using a SRS. The extra time for set-up and take-down before and after class, the time it takes to generate good multiple-choice questions because they are limited to those types of questions, and the time involved in the grade administration (see Table 25).

When professors were asked if they felt the advantages outweighed the disadvantages on the survey, 16 of the 20 professors said yes, 2 said maybe, and 2 professors did not respond. Also, of the disadvantages stated, only one response had to do with the features of iClicker (which is found in many other systems as well), which had to do with it being limited to multiple-choice questions.

Table 25

Disadvantages of Using a SRS Stated by Professors

	Interviews <i>n</i> =10	Survey <i>n</i> =20
Limited to MC questions. Generating good Multiple Choice Questions-takes time	3	7
Can interrupt the flow of class	4	4
Worry about technology malfunctions	1	4
Students losing or forgetting their transmitter	1	2
Don't cover as much material during lecture	2	2
Only had positive experiences using it	2	2
Getting students to register their clicker numbers	---	2
Can be used too much	1	1
Works better in smaller classes	---	1
Students can be slow to respond and I have to move on without all of the responses in	---	1
Student cheating/Students bringing their friends clickers to take the quiz for them	---	1
Some students get tired of waiting	---	1
Quieting the class down after a clicker question when they are allowed to work together.	---	1
Extra time it takes to use-before and after class time-management of scores and set-up in class	8	1
Cost to the students	4	---
Assigning points after class	1	---

Chapter 5: Conclusions and Recommendations

Conclusions

The results of this evaluation provide helpful insights into the use of iClicker and students' perceptions of the helpfulness of using such a system. However, care must be given to not misinterpret the data by placing absolute qualifications on it. The data on students' perceptions of the helpfulness of the instructional methods is not meant to give the final word, but to provide general guidance, and it should be noted that the information is based on students' perceptions. More investigation is needed if stakeholders wish to gain more specific results of effective instructional methods and the affect on students. It must also be remembered that the data from professors about technical problems encountered and other issues with the system are from the first semester of use of the new system, iClicker, and should not be misinterpreted as summative conclusions about the system.

In general, the iClicker system appears to be functioning quite well for professors and students. The technical problems that have been encountered have been minor and professors reported being able to resolve most of them on their own. There are several improvements that could be made to the system to better address the criteria of the stakeholders (listed in section *Program Improvements/Recommendations*). The extra time involved in the set-up, grade administration, and writing questions for SRS use was a significant disadvantage for professors. However, despite these and other disadvantages, professors still felt that the advantages of using a SRS outweighed the disadvantages.

Students were generally positive about the helpfulness of the instructional methods used by their professors. The two instructional methods students perceived as

most helpful were the immediate feedback they received and asking questions about lecture and reading material throughout the lecture. Students also felt that using the SRS had helped increase, to at least some degree, their comprehension of course material, attendance at lecture, attention/engagement during lecture, participation in lecture, and achievement in the course. It appeared that students felt iClicker was more helpful and perceived the previously mentioned five areas as increasing more when it was used frequently with more instructional methods, and not only for assessment. The cost of purchasing a clicker was a large disadvantage for students and appears to influence their perceptions of the helpfulness of using a SRS. Still, many students did perceive using a SRS to be helpful to them.

Program Improvements/Recommendations

I believe that improvements could be made to the program in several areas. In the context of the specific system that the CTL is supporting, I believe that this system (iClicker) is, overall, meeting the needs of professors, with a few exceptions of specific professors.

Technical problems. The issues with the iGrader system should be resolved because it is limiting some professors from using the system how they would like to in their grading and keeping students' grades up-to-date. It would be desirable to have a system where students' grades could be manually edited and manipulated. Other technical problems that professors experienced early on in the semester may have been prevented had they received more training in how to use the system or had a job aid available when the problem arose. I would suggest that the Center for Teaching and Learning develop more in-depth training for professors wishing to use iClicker (i.e.,

provide them with the opportunity to practice navigating and learning the instructor remote buttons before their first class). Also, creating a quick job aid that professors can have on-hand while using iClicker in class that includes a “how to” list and descriptions for things like operating the instructor remote, downloading grades, etc. would be helpful. Another technical problem with the system that should be resolved is the problem with the transmitters turning off so frequently. Changes should be made to the transmitter to prevent this from happening. This would help eliminate the burden of resetting the frequency so often. A case could be provided with the transmitter to protect it while in students’ backpacks and prevent transmitters from breaking, which forces students to replace them. The final need that should be addressed is to make the transmitter accessibility friendly. For example, there is no brail on the transmitter buttons. The transmitter should be able to function for students no matter their circumstance. These are problems that must be addressed with the manufacturer of iClicker and would be the responsibility of administrators at the CTL to address.

Instructional methods. Additional materials should be developed for professors on instructional methods students have found helpful with the SRS. The CTL could create many good resources to help professors write multiple-choice questions that test at the level of knowledge (Blooms Taxonomy) they wish to assess (Bloom, Krathwohl, & Masia, B.B., 1956). Taking the time to write good multiple-choice questions was seen as a disadvantage of using a SRS to professors, so there is a need in this area. Examples could be given of different types of multiple-choice questions that can be asked and a general format of these questions with a vocabulary guide for creating them.

Another area of support CTL could develop is for students. Cost was a significant factor in students' feelings about the helpfulness of using a SRS and was the most frequently stated disadvantage among students. Many students at the end of the semester sell back their transmitter to help alleviate the cost, but find out when they return for the next semester they have another class that is using the SRS and consequently have to purchase another one. Creating a list of courses and section numbers that will be using the system the following semester that students can check before they sell back their transmitter would help reduce the number of students re-purchasing transmitters. Also, by the CTL providing more technical and instructional support for the SRS, more professors may be encouraged to use the system, which would in turn enable students to use them in more classes, helping them feel they have "gotten their money's worth" out of their clicker. Addressing this area of weakness in the program (cost to students) would help improve the strength of the program by hopefully creating a more positive feeling in students about purchasing the clicker. The strengths of using instructional methods that students perceive as helpful could also help overcome this weakness. If students felt strongly about the benefit they received from using the SRS because it was really helping them, it would help eliminate the negative perception that the cost adds to using a SRS.

Successes of the Evaluation

The technical support that was provided to professors using iClicker was done in a timely manner and professors reported that they were able to resolve their problems for the most part. The iClicker does appear to meet the majority of professors' needs when it comes to using a SRS. The transmitters functioned well by reports from professors and students, with the main problem being the clicker turning off very easily. The other

hardware also functioned well for professors with only a few reports of problems with the software or receiver. The instructional methods used by professors were also perceived as helpful and overall, students did feel it helped increase their comprehension of course material, attendance at lecture, attentiveness/engagement during lecture, participation in lecture, and achievement in the course to some degree.

Challenges Encountered During the Evaluation

Despite the plans in the evaluation proposal to help minimize the data burden, there was still a large amount of data to be collected, organized, and analyzed. There was also a limited amount of time to collect the data (one semester). There was a challenge in ensuring a representative sample of professors and subject matters participating in the evaluation. The majority of professors willing to participate in the evaluation, taught courses in one of the natural sciences departments and instructional methods across these professors did not vary as much. There were also many factors that could contribute to students' perceptions of the helpfulness of the instructional methods and it was impossible to control or measure all of them.

Limitations of the Evaluation

One limitation of the evaluation was in the student survey. The evaluators acknowledged several factors that may influence students' ratings of the instructional methods. However, there are many other factors that could influence students' ratings that were not tested, such as students liking the subject matter or professor, personal circumstances in students' lives that could affect this performance in the class, or students' natural ability in the subject matter. Another limitation was the need to condense the survey by generalizing the instructional methods asked about in order to

ensure an adequate response rate from students. The instructional methods that were included in the student survey were generalized and not as specific as originally planned. These two limitations reserved evaluators' judgments about the helpfulness of the instructional methods, meaning more general recommendations and conclusions were given about the results pertaining to what instructional methods students found helpful. This also limited the report by providing generalized recommendations about the instructional methods, instead of more specific recommendations for administrators at the CTL to use to develop instructional support for professors.

Another limitation of the study was that not every professor using iClicker was involved in the evaluation and so information about all technical problems experienced was not collected from every professor. This creates a limitation because there may be other problems that were not reported. Therefore, the CTL may not be aware of them and are thereby unable to resolve or address all of the problems.

Meta-evaluation

A meta-evaluation was conducted on this evaluation based on Stufflebeam's 30 standard program evaluation checklist (Stufflebeam, 1999). The lead evaluator conducted the meta-evaluation by documenting and assessing the evaluation process using the 30 standards. The meta-evaluation was based on Stufflebeam's 30 standards due to the familiarity of the lead evaluator with the 30 standard checklist from previous evaluation courses and a recommendation from a faculty member in the Instructional Psychology and Technology department, whose expertise is in evaluation.

The meta-evaluation for the final report is the summative meta-evaluation for this project, meaning it is the final meta-evaluation for this project (see Appendix H).

Additional meta-evaluations were conducted on the proposal for this evaluation, as well as during the interim reporting period of the evaluation (see Appendix F).

Chapter 6

Article to be Submitted for Publication

Introduction

The Center for Teaching and Learning (CTL) at Brigham Young University (BYU) began supporting the use of a student response system (SRS) several years ago. A student response system is a combination of hardware and software that allows students to respond to questions posed by the instructor using a response pad (that resembles a remote control) in-class. Student responses are collected by a receiver that is attached to the computer and then compiled by the software on the computer. The instructor can then choose to display the results using the program software. Problems with the student response system the CTL was supporting prompted them to begin looking for a new system to support. After a new system was selected, which appeared would better meet the needs of professors and students, administrators at the CTL requested an evaluation of the new system. The evaluation was to take place Winter semester 2007 (January to April 2007).

The purpose of the evaluation of the new student response system (iClicker) at Brigham Young University was to evaluate how well the technology (hardware and software) of the new system was functioning and how well the system met the needs of professors and students. The CTL also identified the need to provide instructional support to professors about ways of using a SRS in their course. The reason for this was because professors would call the CTL asking if they should start using a SRS in their course and ask for information about how other professors have used it or advantages of using one. The CTL did not have information about this to provide to professors and so requested

the evaluation also address how professors are using the SRS and what instructional methods being used by professors students perceived as helpful. This article focuses on the results from the evaluation of students' perceptions of the helpfulness of the instructional methods being used with the SRS and if students felt there were benefits to using a SRS in class. There were several evaluation questions (EQ) that guided the evaluation of the instructional methods, which including the following:

EQ1. What instructional methods used with the SRS do students find helpful?

EQ2. Do students feel using a SRS has increased their comprehension of course material, attendance at lecture, attentiveness/engagement during lecture, participation in lecture, and achievement in the course?

EQ3. Do students feel the cost of purchasing the clicker is worth the benefit they receive from using it?

The stakeholders' evaluation criteria for the instructional methods used with the SRS included that (1) students should perceive the instructional methods being used with the SRS as helpful. Students should also (2) feel using the SRS has helped increase their attendance to lecture, comprehension of course material, achievement in the course, participation in lecture, and attentiveness/engagement during the lecture. Students should also (3) perceive benefits of using the SRS no matter their demographics (i.e., year in school). The students should (4) perceive the benefits of using a SRS as worth the cost they pay for the transmitter (see Table 26).

Table 26

Criteria and Evaluation Questions Answered

<i>Criteria</i>	<i>Evaluation questions that will answer the criteria</i>
(1) Students perceive the instructional methods being used with the SRS as helpful.	EQ 1
Students (2) feel using the SRS has helped increase their: attendance to lecture, comprehension of course material, achievement in the course, participation in lecture, and attentiveness/engagement during the lecture.	EQ 2
Students (3) perceived benefits of using the SRS no matter their year in school.	EQ 1
Students (4) perceive the benefits of using a SRS as worth the cost they pay for the clicker.	EQ 3

Many studies have been conducted on student response system use in higher education; however, most do not discuss specific instructional methods students found helpful. The studies described the instructional methods that were used, but would generally ask students about areas such as if they felt their interaction in class or class preparation had increased or tried to measure a change in students' achievement or other areas (Draper & Brown, 2004), but did not specifically ask students about the helpfulness of the instructional methods used.

The use of the student response system in higher education dates back to the 1960s, although the popularity of using such systems on university campuses has increased since the mid-1990's (Judson & Sawada, 2002). When student response systems were initially introduced at universities, learning theory and behavioral objectives were primarily focused on a behaviorist approach to learning. Educators were

mostly concerned with the systems ability to provide instant feedback to students and professors. Even today much of the use of these systems focuses around the immediate feedback these systems can provide. Back then, as is still common now, instructors would use the feedback to aid in the flow of instruction, adapting their lectures according to responses from students (Judson & Sawada, 2002). These approaches are still used today in university lecture halls. However, much of the research from the 1960s and 1970s did not show any significant differences in mean achievement between students in control sections and students in treatment sections using the SRS that employed these methods. Data from exams and other assessments did not provide support for increased academic achievement from the use of the SRS; although, students provided strong support for the SRS in many studies. Other benefits emerged from students' reports such as positive attitudes toward the class, feeling the system was useful, feelings of increased understanding, and increased attendance even though there was no evidence of increased achievement in the course (Judson & Sawada, 2002).

Recent research on the use of student response systems has shifted its focus from a behavioral stimulus-response approach to creating interactive learning environments in the classroom employing more constructivist oriented approaches. Current trends in learning theory and research have no doubt contributed to this shift, but the reasons for adopting student response systems still vary. Common reasons for current adoption of a SRS include increasing student engagement in large lectures, improving student performance, increasing teacher-student and peer interaction, providing immediate feedback from students to teacher, guiding learners through the material, monitoring of individual students from responses, improving retention and demographic comparisons,

enhancing group discussion, facilitating group discussion in large lectures, assessing teaching and learning methods in real time allowing professors and students to gauge student understanding, increasing student engagement, and using it for classroom administration techniques (Barrett, Bornsen, Erickson, Markey, & Spiering, 2005; Beatty, Gerace, Lenoard, & Dufresne, 2006; Blackman, Dooley, Kuchinski, & Chapman, 2002; Draper, Cargill, & Cutts, 2002; Greer & Heaney, 2004; Liu, Liang, Wang, & Chan, 2003; Silliman & McWilliams, 2004; Williams, 2003; Wit, 2003; Woods & Chiu, 2003).

Despite the varied reasons for adopting a SRS for in-class use, many researchers have recognized the need to focus on the effective underlying pedagogy of using the system. (Judson & Sawada, 2002; Draper & Brown, 2004). Judson & Sawada (2002) state the purpose of their review of the research on student response systems is not to show incorporating technology as the key, but to point to the instructional practices of educators using such a system. Wit (2003) stated, “Introducing technology in the classroom just for the sake of it does not necessarily help the learner and can be sheer folly” (p. 14). With the current shift in focus to the underlying pedagogy of using student response systems and many different reasons for using the systems, there are many instructional methods that may be used. As discussed earlier, the behaviorist approach in the early years of its use has been replaced with a more constructivist oriented approach to the instructional methods (Judson & Sawada, 2002). Much of the focus of the instructional methods is on creating an interactive learning environment for students and moving away from the traditional large lecture format of talking at students for the entire period with students passively listening, which is seen as a weak method because of the lack of interactivity (Draper & Brown, 2004). With the variety of instructional methods

to be employed with a SRS, instructors should realize that there are many factors along with the instructional methods they use that may contribute to the success of their learning outcomes from using a SRS (Draper & Brown, 2004). However, the instructional methods used are still a significant contributor and so must be carefully selected.

Participants

Participants in the evaluation consisted of professors using the student response system iClicker and students in these professors' classes at Brigham Young University. There were approximately 600 students (freshmen, sophomores, juniors, and seniors) and 16 professors in this group.

Data Collection Methods

Data was collected from students via an online survey and through six focus groups held during Winter semester 2007. The survey asked students to rate their perceived degree of helpfulness of 11 instructional methods and asked them if they felt their comprehension, attendance, engagement, participation, and achievement in the course had increased as a result of using the SRS. Students were then asked to rate how much they agreed with the following statement, *the cost of purchasing the clicker is worth the benefit I received from using one in-class*. The focus groups asked students open-ended questions about what instructional methods they found helpful and if they felt the previously mentioned five areas increased from using the SRS. Table 27 shows each data collection method, data collected, and what evaluation question it was designed to answer.

Table 27

Criteria, Evaluation Questions Answered, and Data Collection Method

<i>Criteria</i>	<i>Evaluation questions that will answer the criteria</i>	<i>Data Collection Method</i>	<i>Data to be collected</i>
(1) Students perceive the instructional methods being used with the SRS as helpful.	EQ 1	Student focus groups and online survey.	Student's ratings (quantitative) on the helpfulness of specific instructional methods being used with student response systems. Qualitative data on instructional methods students perceived as helpful.
Students (2) feel using the SRS has helped increase their: attendance to lecture, comprehension of course material, achievement in the course, participation in lecture, and attentiveness/engagement during the lecture.	EQ 2	Online survey and student focus groups	Student's ratings (quantitative) on how much they felt 5 areas increased because of using a SRS. Qualitative responses on if students felt 5 areas increased because of using a SRS.
Students (3) perceived benefits of using the SRS no matter their year in school.	EQ 1	Online survey	Demographics of the students (year in school)
Students (4) perceive the benefits of using a SRS as worth the cost they pay for the clicker.	EQ 3	Online survey	Student's ratings (quantitative) of if they felt the benefit they received was worth the cost of purchasing the clicker.

Data Analysis

The focus in analyzing the data was to examine themes or trends regarding what students said about the helpfulness of specific instructional methods and if they felt using a SRS had increased their comprehension of course material, attendance at lecture,

attentiveness/engagement during lecture, participation in lecture, and achievement in the course and then determine if trends in students' ratings of helpfulness of the instructional methods and those five areas corresponded with trends in how the professors were using the SRS.

Results

The results have been organized around the three evaluation questions. The first section describes the results from data collected about students' perceptions of the helpfulness of the instructional methods used with the SRS. The second section describes the results of areas students' felt had increased as a result of using the SRS (comprehension, attendance, engagement, participation, and achievement). The last section describes the results of data collected about students' perceptions of the cost of purchasing the clicker being worth the benefit they received.

Evaluation Question 1: Helpfulness of Instructional Methods

EQ1. What instructional methods used with the SRS do students find helpful?

In order to address the evaluation question above, students' responses to 11 survey questions and responses from the focus groups from one open-ended question were examined. Table 28 contains the 11 instructional methods that students were asked to rate the helpfulness of on the survey. This table has been included to give the full description as contained in the survey and the abbreviation as contained in the figures and tables in this chapter.

Table 28

Instructional Methods from the Student Survey

<i>Full description of instructional method from survey</i>	<i>Abbreviation of instructional method for Table and Figures</i>
Asking questions that check if you did the reading	Check for reading
Using it to encourage attendance	Encourage attendance
Asking questions to test how well you understand the course material	Test understanding of course material
Receiving credit for trying to answer the questions even if you get them wrong	Receiving credit for trying
Asking questions to guide topics covered in class	Guide topics in class
Asking questions to get discussions started in class	Start discussions
When the professor tells you to work with your neighbor to answer the clicker questions	Work with your neighbor
Receiving feedback immediately (seeing if you got the answer right or wrong) about how well you understood the material	Immediate feedback
Using the clickers for in-class simulations (research experiments, polling, voting, etc).	In-class simulations
Using it to administer quizzes in class	In-class quizzes
Using it to ask questions during test reviews in class	Test reviews

Overall results of instructional methods. Overall students' mean ratings of the helpfulness of the instructional methods were positive. Every mean rating for each instructional method was over 3.00, which was designated as *somewhat helpful* on the Likert scale. The highest mean rating among the instructional methods was for *receiving immediate feedback*, $M = 4.63$, $SD = 0.73$. The lowest mean rating was for using the SRS to *start class discussion*, $M = 3.60$, $SD = 1.14$. The other instructional methods' mean ratings fell somewhere between these two means. Interestingly, immediate feedback was the focus of instructional methods when the use of student response systems was beginning in the 1960s (Judson & Sawada, 2002) and received the highest overall mean rating of students' perceptions of its helpfulness in this evaluation. Receiving immediate

feedback was also one of the most frequently stated helpful instructional methods by students in the focus groups. One student said, "I like being able to take quizzes with it in class. I like being able to see how well I did right then, ask the question see the answer." Another student cited the systems ability to provide feedback to the instructor as well as the students,

I would say its helped me a ton when he goes over a concept and then quizzes you on it to make sure you really understand it and if you see right then the results as well then you know you don't actually understand the concept then he can review right then seeing whether the students understand or not.

The most frequently stated instructional method students in the focus groups said they found helpful was using the SRS to ask questions about material covered during lecture or on the assigned reading throughout class. There were several reasons given for why they found this instructional method helpful, such as it keeps their attention throughout the lecture, which makes them catch the material as they go along and helps increase their preparation for class (they do the reading because they know there will be questions on it). Students from the focus groups did not really mention much about specific types of questions professors would use to ask questions about the material; however, one student gave a description of types of questions their professor used that they found helpful,

Ours did a lot of critical thinking so he will take the concept that we've just learned and then he'll have 6 or 7 different scenarios and you'll have to say if A does this then B does what? So its really helpful in getting you to

think more than just A is the right answer you have to think why A is the right answer. It's really helpful.

The similar instructional method of using the clicker system to test students' understanding of the course material from the survey received an overall mean rating of $M = 4.19$, $SD = 0.87$. It was the fourth highest rated instructional method by students.

From the overall responses from the survey and focus groups, receiving immediate feedback in class appears to be the instructional method students find most helpful. Although, in the focus groups asking questions throughout class was also frequently cited as being a helpful instructional method. Students find asking questions on the course material and reading helpful; additionally, as stated by students in the focus groups, dispersing the questions throughout the lecture is also helpful to them.

Results by professor. When we asked students to rate the helpfulness of the instructional methods on the survey, we also asked them to tell us which class they were in so we could see how students' ratings varied over professors participating in the evaluation. Descriptive statistics (mean and standard deviation) were computed for each group of student responses by what professors' class they were in. By examining the mean rating for each professor there is a similar trend of *immediate feedback* as generally having the highest mean rating across professor (Figure 12 the heavy blue line with squares). *Using the clicker to get discussions started in class* generally has the lowest mean rating across professor (see Figure 12, heavy brown line with circles) as was the result from the overall mean ratings.

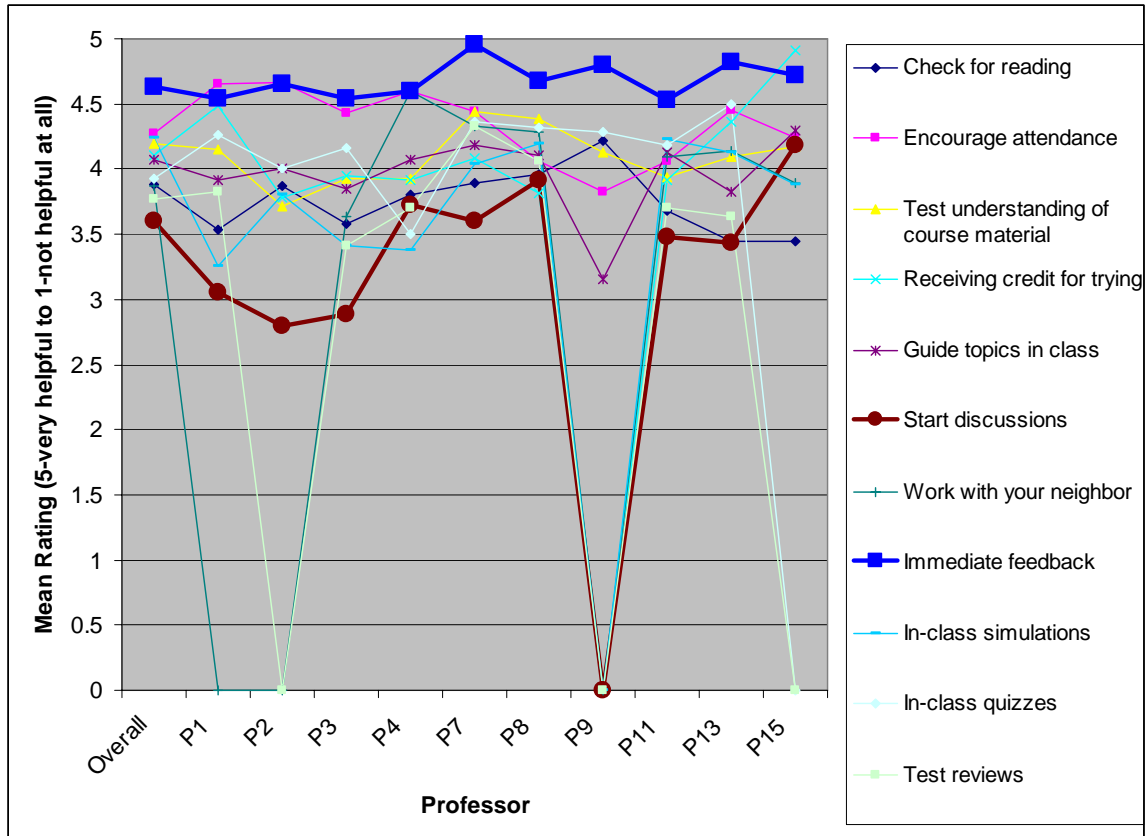


Figure 12. Line graph of mean ratings of instructional methods grouped by professor.

In addition to the trends from the overall results that continue into each individual professor, there is more information from the survey that provides insights into how the SRS was used and how that seemed to affect students' perceptions of the helpfulness of those instructional methods. Under professor P9 in Figure 13 it shows that students' mean ratings of the helpfulness of the instructional methods that were used in this professor's class are generally lower (Figure 13, orange line with circles represents P9) than the other professors' mean ratings. Professor P9 used the SRS strictly for assessment, meaning students had to get the answer right in order to get any points. There were also fewer instructional methods employed by this professor and the SRS was only used four times during the semester. The other professors used the system more often, in more ways, and not strictly for assessment, but also awarded points for participation. This suggests that

using the SRS more frequently, in a greater variety of ways, and not strictly for assessment increased students' perceptions of the helpfulness of the instructional methods used with the SRS.

Professor P9 represents an outlier among the ten professors in this group. Many of the professors (P3, P4, P7, P8, P11, and P13) used the SRS in very similar ways. Most, in some way, used all of the 11 general instructional methods we asked students about. They also used a combination of grading methods, awarding points for participating and for selecting the correct answers at times, and would re-explain material following a clicker question.

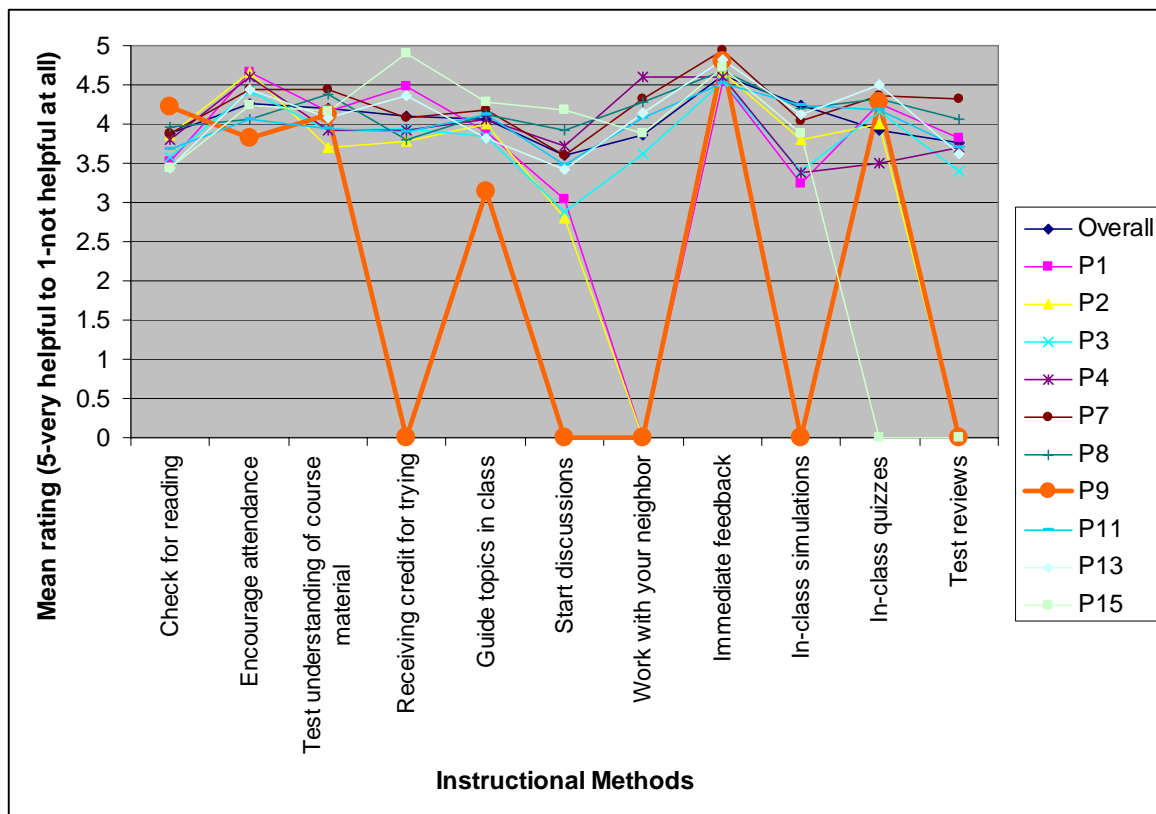


Figure 13. Mean ratings of the instructional methods for each professor.

Professors' who used the SRS in similar ways students mean ratings across instructional methods follow a very similar path (see Figure 14). All of the professors in this group taught a subject in the natural sciences and all had a large class size, so there were similarities in addition to the instructional methods they used. The similar mean ratings simply show that even across class and professor, when the SRS was used in similar ways, students generally perceived about the same helpfulness.

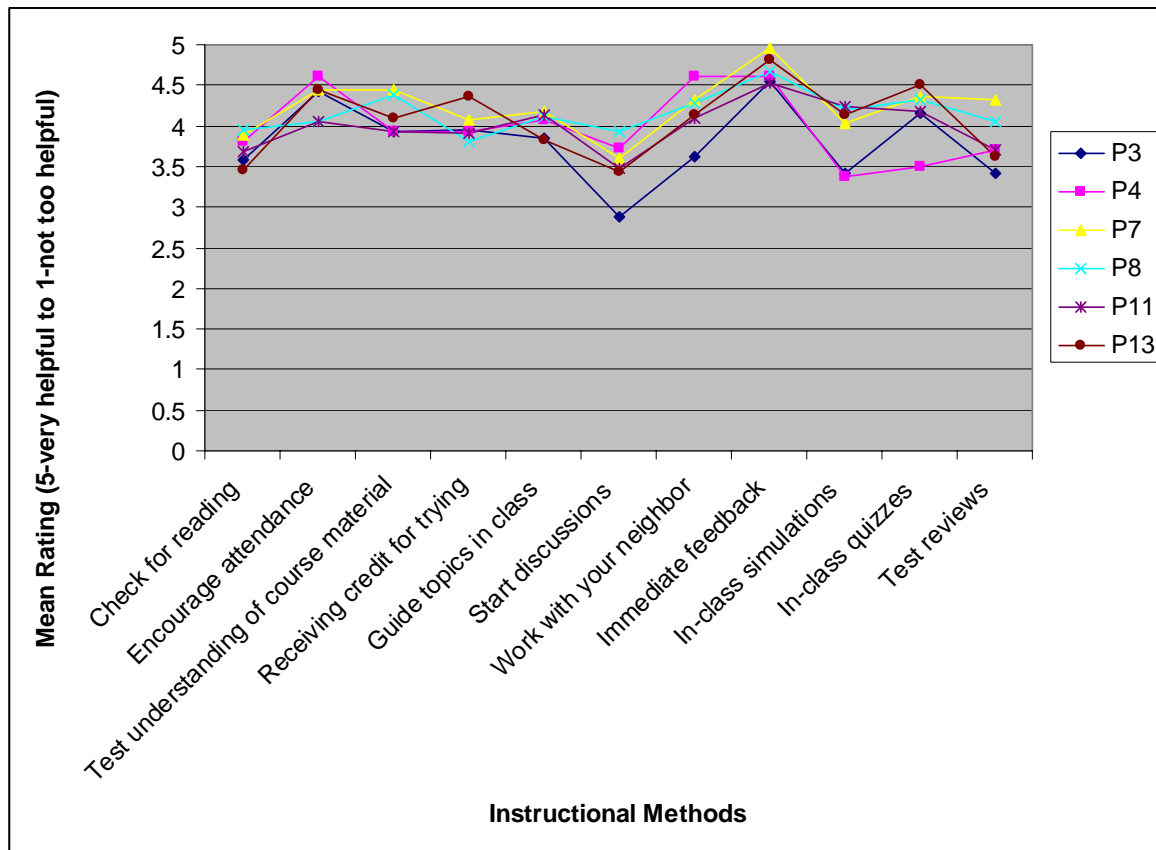


Figure 14. The professors who used the SRS in very similar ways students' mean ratings of the helpfulness of the instructional methods from the survey.

Evaluation Question 2: Areas Students Feel Using SRS has Increased

EQ2. Do students feel using a SRS has increased their comprehension of course material, attendance at lecture, attentiveness/engagement during lecture, participation in lecture, and achievement in the course?

In order to address the evaluation question above, student responses to five questions on the survey and five questions from the focus groups were examined.

Overall results. When all student responses were examined, *attendance at lecture* was the area with the highest mean rating, $M = 3.96$, $SD = 0.80$. *Achievement in the course* had the lowest mean rating of $M = 3.59$, $SD = 0.69$. The lower mean rating in *achievement in the course* could also be due to the difficulty in measuring achievement or determining if this one factor (using a SRS) contributed to the students' achievement. As one student stated from the focus group, "I wouldn't know if it has contributed to my achievement because I don't have a similar class that is not using them to compare it with." Attendance seems to be an easier construct to measure and determine what factors can motivate it. Despite the lower mean rating of *achievement in the course* its mean rating is still above 3.00, which on the Likert scale was *has remained the same*. It appears that, overall, students do perceive the use of the SRS as having somewhat of a positive effect on their achievement in the course.

In the focus groups, students were also positive about the effects of the SRS on their comprehension, attendance, engagement, participation, and achievement in the course. Students' responses ($n=47$) in each of these areas generally had twice as many students responding that using the SRS increased the area than those who said it did not (Figure 15). Several students reported that it helped increase their comprehension because

the immediate feedback let them know what they needed to study more. One student said, “When we do our quizzes I usually find out I don't know what I'm doing and so I know that I'm doing it wrong.” Another student cited the discussion that follows the questions and feedback is also helpful in understanding their own knowledge, “I was going to say because the professor has a period where you have to discuss it and kind of discussing it you either learn to understand or you understand what you don't understand.”

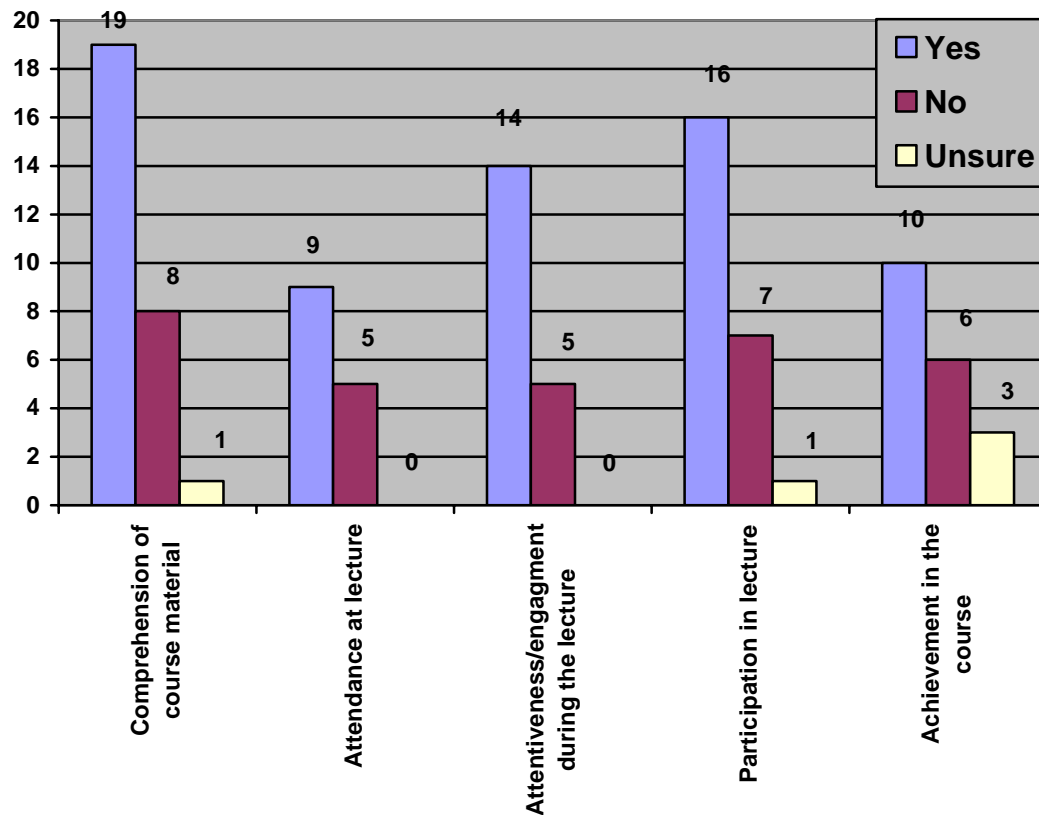


Figure 15. Student responses from the focus groups about if they felt the 5 areas increased as a result of using the SRS.

The majority of students did say that they felt using the SRS had helped increase their attendance. Major motivators were the points from quizzes or participating. Some students reported they would go anyways regardless of the SRS use or points. Even

though this area had the highest mean rating, it was the area that was the least responded to and talked about in the focus group. Attendance is easier to measure but may not be seen as important an issue to students as the SRS helping increase their comprehension of the material or achievement in the course and so discussed it less in the focus groups.

When students were asked about increasing their attentiveness or engagement they reported working together in groups was helpful. One student said, “Sometimes it's good because you can work in these groups and understand stuff but other times if you're just doing an individual quiz it might not be as engaging.” Many students said that they do not fall asleep in class because they know that there are going to be questions/quizzes. They also said that it helped increase their participation because when they would get an answer wrong they would want to know why and so would ask more questions. Students said they felt more confident asking questions when they could see other students’ responses and see that others were thinking the way they were. Many of the students that felt using the SRS in class helped increase their achievement in the course said it did because the clicker questions were similar to ones on the tests and so helped them in their test preparation or knowing what types of questions the professor would ask on the test. One student said,

On like the test it always helps because my teacher uses a lot of clicker questions on the exams of that unit so that helps a lot. And he will put them on his website before as a review so it helps.

Overall students are positive about the use of the SRS helping increase those five areas.

Results by professor. The results from this section follow a similar trend as in the overall results. Generally, *attendance at lecture* (Figure 16, pink line with circles) had the

highest mean rating across professor and *achievement in the course* (Figure 16, purple line with squares) the lowest mean rating across professor.

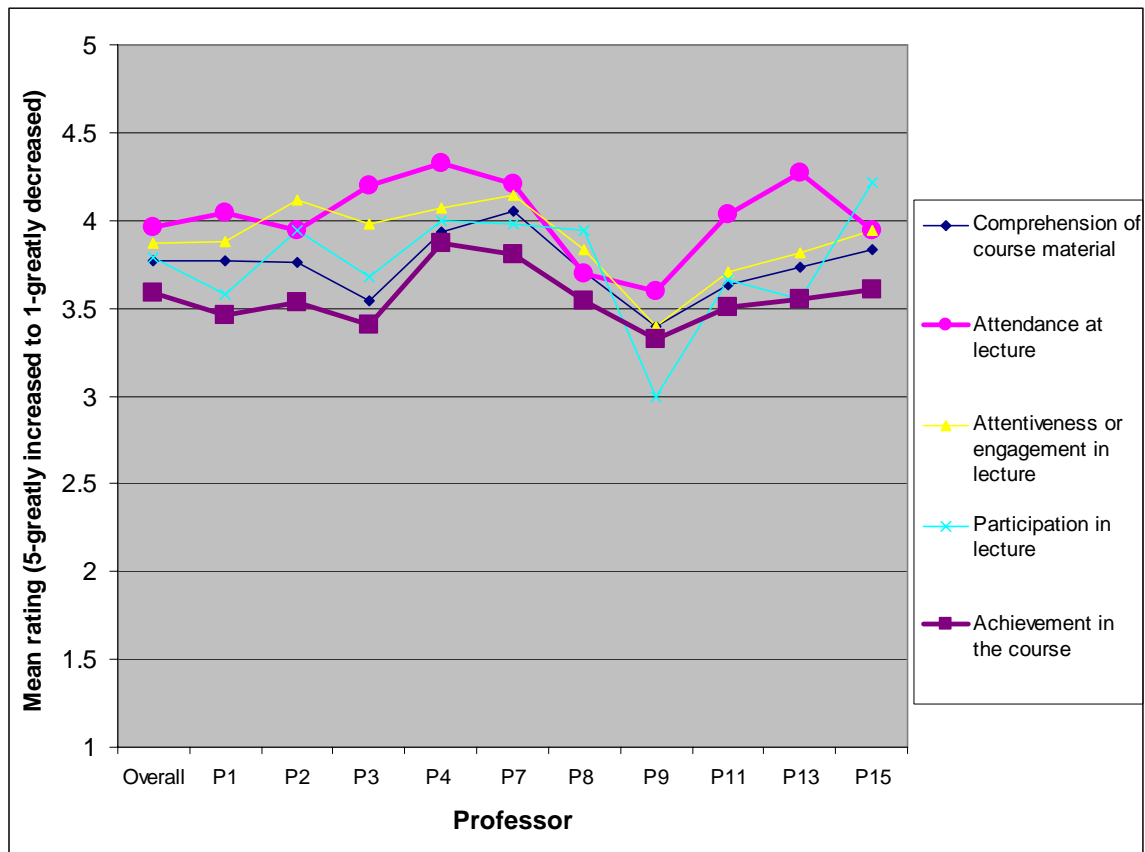


Figure 16. Students mean ratings divided by professor of how they felt the 5 areas increased as a result of using the SRS.

Under professor P9 (see Figure 17) there is a dip in the mean ratings from the survey across these five areas. This professor's students generally rated these five areas not increasing as much as other professors who used the SRS more frequently and employed more instructional methods. This is the same professor whose students generally rated the helpfulness of the instructional methods used in this class as less helpful than students' in other classes that were using the SRS more and in more ways (see Figure 15).

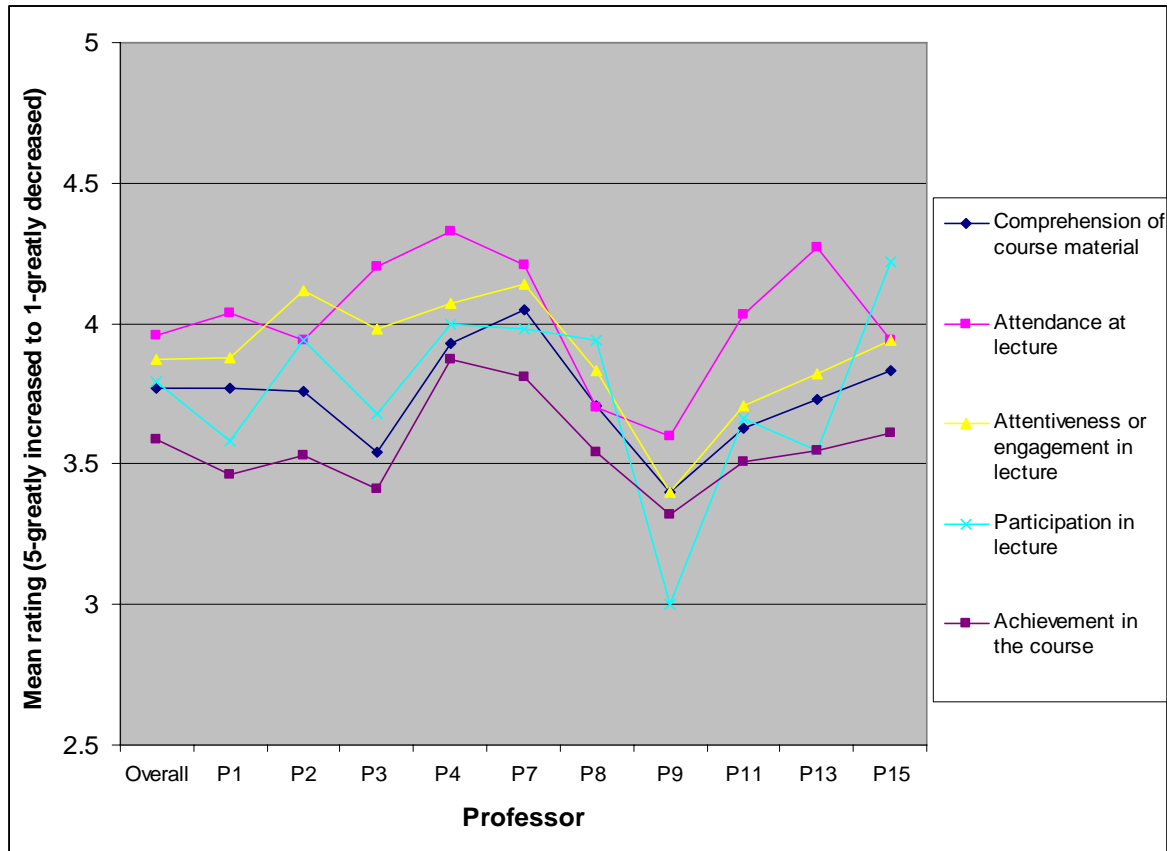


Figure 17. Mean ratings of how much the five areas increased across professor.

From the survey results grouped by individual professor it appears that students felt these five areas increased more when the SRS was used more frequently, more instructional methods were used, and points were not solely administered based on the correctness of the response.

Evaluation Question 3: Cost of Purchasing the Clicker

1. Do students feel the cost of purchasing the clicker is worth the benefit they receive from using it?

In order to address the evaluation question above, students' responses to one survey question were examined. In all but one class involved in the evaluation, students had to purchase the clicker with their own money in the bookstore. The clicker cost

students approximately thirty-five dollars. On the survey students were asked how strongly they agreed with *the cost of purchasing the clicker being worth the benefit they received from using the SRS in class*. The overall mean rating was $M = 3.61$, $SD = 1.43$. The overall mean ratings fall between *somewhat agree* and *somewhat disagree* rankings, which is not particularly positive towards the cost being worth the benefit students felt they received from using the SRS.

A statistically significant positive correlation was found when students' mean rating across instructional methods were correlated (Pearson r Correlation) with how strongly they agreed with the cost being worth the benefit, $n = 558$, $r = .487$, $p = .000$. As students agreed more strongly with the cost of the clicker being worth the benefit they received their mean rating of the helpfulness of the instructional methods also increased. As they disagreed more with the cost being worth the benefit, their mean ratings of the helpfulness of the instructional methods also decreased. This same trend continues for each of the five areas (comprehension of course material, attendance at lecture, attentiveness/engagement during lecture, participation in lecture, and achievement in the course). The Pearson Correlation also yielded a statistically significant correlation between students' mean rating of the five areas and how strongly they agreed with the cost being worth the benefit, $n = 558$, $r = .538$, $p = .000$. The more strongly students agreed with the cost being worth the benefits they felt they received, the more they rated the five areas as increasing as a result of using the SRS. The more strongly they disagreed with the cost being worth the benefits they received from using the SRS, the less they rated these areas as increasing as a result of using the SRS in class.

When students' responses were grouped by what professor they had, professor P9 had the lowest mean rating from students of the cost of purchasing the clicker being worth the benefit they received. Other professors (P3, P4, P7, P8, and P13) who used the SRS more frequently and in more ways had higher mean ratings from students (see Figure 18).

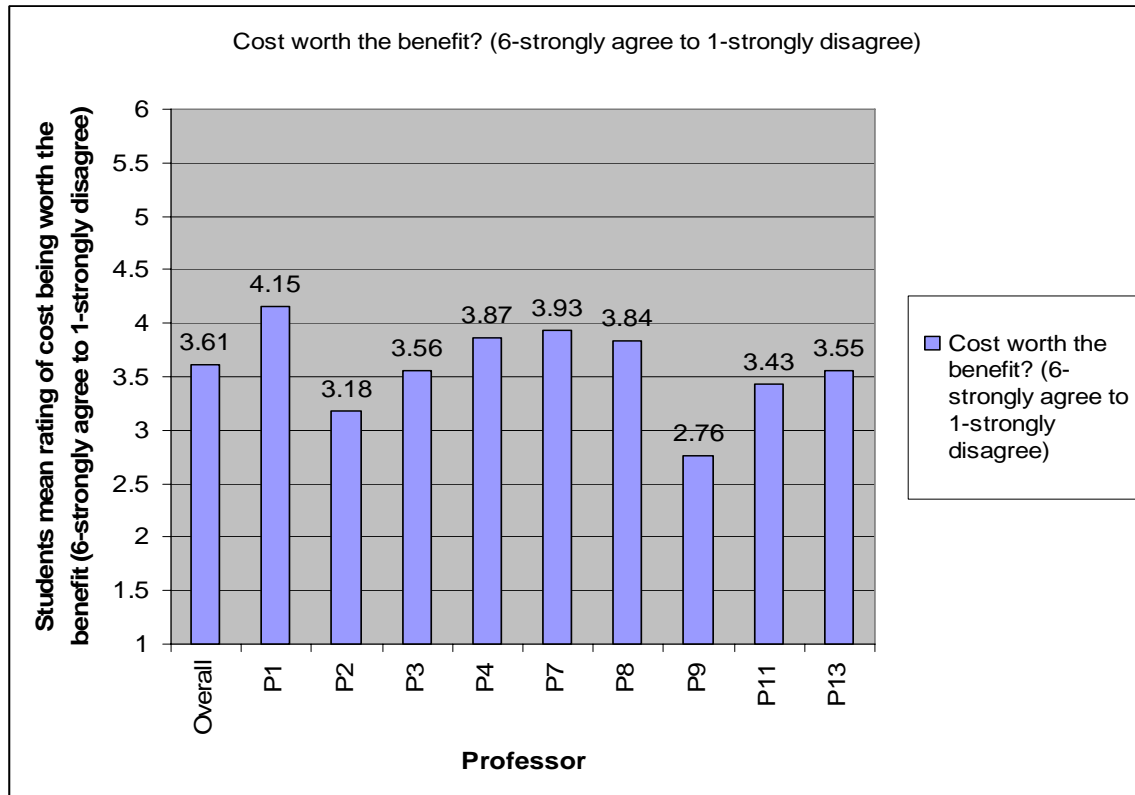


Figure 18. Students mean rating of the cost of purchasing the clicker being worth the benefit they felt they received from using the SRS by professor.

The cost of purchasing a clicker appears to be a significant factor in students' ratings of the helpfulness of using a student response system practically and statistically. When students are required to spend thirty-five dollars for something that they have no idea of what its purpose will be could predispose students to have a more negative perception of the SRS before it is ever used. Deciding if the students will be responsible

for the cost of the clicker or if the department/course will be responsible for the cost is an important factor to consider when implementing one of these systems. However, simply using the SRS more frequently, in more ways, and not strictly for assessment appears to influence in a positive way how students feel about the cost of purchasing the clicker.

Conclusions

Students were generally positive about the helpfulness of the instructional methods used by their professors. The two instructional methods students perceived as most helpful were the immediate feedback they received and asking questions about lecture and reading material throughout the lecture. Students also felt that using the SRS had helped increase, to at least some degree, their comprehension of course material, attendance at lecture, attention/engagement during lecture, participation in lecture, and achievement in the course. It appeared that students felt using a SRS was more helpful when there was frequent use, multiple instructional methods, and not used strictly for assessment. The cost of purchasing a clicker was a large disadvantage for students and appears to influence their perceptions of the helpfulness of using a SRS. Still, many students did perceive using a SRS to be helpful to them.

The results of this evaluation do provide helpful insights into the use of a SRS and students' perceptions of the helpfulness of using such a system; however, care must be given to not misinterpret the data by placing absolute qualifications on it. The data on students' perceptions of the helpfulness of the instructional methods is not meant to give the final word, but to provide general guidance, and it should be noted that the information is based on students' perceptions. More investigation is needed to if

stakeholders wish to gain more specific results of effective instructional methods and the affect on students.

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APPENDIX A: Classroom Observation Form

Classroom Observations

Observations will be done in a natural setting. The evaluators will be non-participants in the class and will be obtrusive, meaning their presence will not be disguised, although they may blend in because the evaluators are students themselves. The checklist is semi-structured. The checklist does not ask for extremely specific details but gives general questions about behavior to assess. Observation will be direct, meaning the behavior will be observed as it occurs. Please arrive at the class 10 minutes before it is scheduled to begin.

Checklist for Classroom Observations

1. Which class are you observing (class title, time, and date)?
2. How long did it take for the professor to get the software up and running (record the number of minutes from when they start setting up to when it is complete)?
3. Did the professor experience any technical difficulties setting up the SRS at the beginning of class (this would include: problems loading the software or problems getting the receiver to work)?
4. Did the professor or students experience any technical difficulties throughout the lecture with the student response system (this would include problems with the software—freezing, not responding to the remote control, timer malfunction, receive malfunction, or clicker malfunction)?
5. How did the professor use the student response system?
6. How did students respond to the use of the SRS?
7. What was the general feel of the class while the SRS was being used?
8. Was there discussion following an SRS question?
9. Did students seem alert during class?
10. How were students behaving in class?

APPENDIX B: Student Survey

1. What year in school are you?

Freshman Sophomore Junior Senior Graduate Student

2. What requirements does this class fill?

General Ed Major or Minor requirement Elective None

3. What class are you in that you are taking this survey for?

How helpful were the following instructional methods in your class where the student response systems (clickers) were used? (5-Very helpful, 4-helpful, 3-somewhat helpful, 2-not too helpful, 1-not helpful at all)

4. Asking questions that check if you did the reading
5. Using it to encourage attendance
6. Asking questions to test how well you understand the course material
7. Receiving credit for trying to answer the questions even if you get them wrong
8. Asking questions to guide topics covered in class
9. Asking questions to get discussions started in class
10. When the professor tells you to work with your neighbor to answer the clicker questions
11. Receiving feedback (seeing if you got the answer right or wrong) about how well you understood the material
12. Using the clickers for in-class simulations (research experiments, polling, voting, etc).
13. Using it to administer quizzes in class
14. Using it to ask questions during test reviews in class

How do you feel using the student response system in your class has increased the following?

(5-Greatly increased, 4-Increased, 3-Has remained the same, 2-Slightly decreased, 1-Greatly decreased)

15. Comprehension of course material
16. Attendance at lecture
17. Attentiveness/engagement in lecture
18. Participation in lecture
19. Achievement in the course

Open-ended questions for the survey

20. What problems have you experienced with the clickers?
21. How have technical problems with the clickers limited their use in the classroom?
22. What are the advantages of using a student response system in class?
23. What are the disadvantages of using a student response system in class?
24. Are there any other uses of the clickers that your professors is using that you have found beneficial to you?

APPENDIX C: Focus Group Questions

Protocol for Student Focus Groups

- Moderators introduce themselves (basic background information.)
- CID would like to understand what benefits you have experienced from using the student response systems.
- You have been asked to participate in this focus group to help us understand which instructional methods professors are using are most beneficial to you as students. We also want you to help us understand technical problems you have had with the system and how that has affected the benefits of using the system and any features of the systems that are important for you to benefit from using the system.
- We will be providing lunch and a 5 dollar gift certificate to the BYU Bookstore as a thank you for participating.
- We want you to feel comfortable sharing your thoughts and experiences.
- Participation is completely voluntary and you may chose to leave at any time. Everything that is said whether it be tape recorded or written down will remain confidential. No individual or group names will be using in summary reports. We are tape recording the session so evaluators can transcribe and analyze the results. Please don't use specific names of professors or classmates.
- The Moderator will be taking notes so they can summarize the results.
- Ground Rules/Suggestions:
 - Active participation by everyone is encouraged. Please remember that everyone has something to contribute.
 - Basic courtesies need to be observed. Please do not interrupt each other.
 - Share any thoughts or ideas you may have.
 - Personal respect is important: all ideas and input are helpful and will be treated as such.
 - If you speak first on one question, let someone else speak first on the next.

I would like to start our discussion by asking about instructional methods, these are ways the professor uses the SRS, for example, to administer in-class quizzes or to ask questions to generate class discussion. The first question I have is:

Questions:

1. What instructional methods of using the student response system did you find helpful?
2. Has using a student response system in class increased your comprehension of course material?
3. Has using a student response system in class increased your engagement/attention to the lecture?
4. Has using a student response system in class increased your achievement in the course?
5. Has using a student response system in class increased your participation in the lecture?

6. Has using a student response system in class increased your attendance to the lecture?
7. How have technical problems with the clickers limited their use in the classroom?
8. What problems have you experienced with the clickers?
9. What are the advantages of using a student response system in class?
10. What are the disadvantages of using a student response system in class?
11. What other features would you like to have to make their use more beneficial to you?

APPENDIX D: Professor Interview Questions

Interview questions for faculty members on their instructional methods and the implementation of the technology

1. What technical problems have you encountered as you started using the SRS?
2. How have the problems you've encountered limited your pedagogical methods or reasons for using the Student Response System?
3. What features of the Student Response System do you like and what are the advantages of using such a system in class?
4. What features of the Student Response System do you dislike and what are the disadvantages of using such a system in class?

Follow-up interview questions for faculty members on their instructional methods and the implementation of the technology

1. What technical problems have you encountered as you started using the Student Response System?
2. How have the problems you've encountered limited your pedagogical methods or goals?
3. What features of the Student Response System do you like and what are the advantages of using such a system in class?
4. What features of Student Response System do you dislike and what are the disadvantages of using such a system in class?

APPENDIX E: Professor Survey

Professor Survey

1. What are the advantages for using this student response system?
2. What are the disadvantages for using this student response system?
3. Do you feel the advantages of using a Student Response System outweigh the disadvantages?
4. Did the features or problems of the system change how you used the student response system in class from how you originally intended to use it? How?
5. Have you encountered problems as you used the student response system software or hardware? If yes, what are the problems you have encountered?
6. How have these problems limited your use of the system or prevented you from accomplishing your pedagogical goals? (open-ended)
7. How easy was it to begin using this student response system in your class (4-very easy, 3-easy, 2-somewhat easy, 1-not easy)?
8. Do students ever complain about their responses not being received?
9. Are there any other software or hardware features that are necessary for you in order to use the student response system as you want in your course lectures?
10. How well has the software met your needs for accomplishing what you wanted to by using a Student Response System? (very well, moderately well, somewhat well, not well)
11. How well has the receiver met your needs for accomplishing what you wanted to by using a Student Response System? (very well, moderately well, somewhat well, not well)
12. How well have the transmitters functioned for your students? (very well, moderately well, somewhat well, not well)
13. How well has your instructor remote functioned? (very well, moderately well, somewhat well, not well)

APPENDIX F: Interim Report

Interim Report for iClicker Evaluation

Prepared by Coral Hanson

Background

The purpose of this evaluation being undertaken on student response systems (SRS) at Brigham Young University (BYU) is to evaluate the pedagogical methods of student response systems being used by professors because there should be a perceived benefit of using the systems and what the degree of there being a perceived benefit of certain pedagogical methods will enable the CID to develop instructional support on pedagogical methods to use with the SRS for professors. It is also being done to evaluate how well the technology (hardware and software) of both the current and new systems are functioning and how well the systems are meeting the needs of professors.

The evaluation began at the start of January 2007, the beginning of winter semester for BYU. The evaluation of the student response systems being used at Brigham Young University is now well underway.

Status of the Evaluation

Near the end of December the evaluator piloted the student survey to be administered near the end of March or beginning of April. After piloting the survey the evaluator found that changes needed to be made to reduce the length of the survey, thereby producing more valid results. The length of the survey appeared to discourage students from taking it or reading it thoroughly and taking the time to answer the questions according to how they felt instead of just clicking the first alternative available. The survey consisted of five Likert scales each which asked the student to rate the

helpfulness of specific instructional ways of using the student response system in relation to increasing their comprehension of material, attendance, participation in class, achievement in the course, and engagement in the lecture. Each of these categories was a separate Likert scale with 20-25 instructional methods listed for the student to rate. The evaluator is currently condensing the survey to address this problem. The 20-25 descriptions of instructional methods professors are using with the clickers will be condensed to 7 or 8 and students will not be asked to rate their helpfulness according to the categories but will be asked about how helpful the clickers were in general according to those categories separately.

Two focus groups were held near the beginning of January to pilot the questions for the focus groups. Students recruited for these focus groups were enrolled in classes the previous semester that had used the student response system TurningPoint. After conducting the focus group the evaluator determined the need to change a couple of the focus group questions. The results of the focus group also informed the changes that would need to be made to the survey. The questions that needed to be changed were the similar ones that needed to be changed on the survey. In the trial focus groups students were asked what instructional methods were helpful in terms of increasing their comprehension of material, attendance, participation in class, achievement in the course, and engagement in the lecture; the same categories used in the Likert scales on the survey. In response to these questions students did not distinguish in any way between the categories, but provided the same response for each question. As a result the evaluator determined to change the questions for the focus group in a similar way to the changes being made to the survey. Instead of asking what instructional methods were helpful in

terms of each of those categories, they will just be asked what instructional methods they found to be helpful. They will then be asked if using a student response system helped them increase their comprehension of material, attendance, participation in class, achievement in the course, and engagement in the lecture.

The changes in the survey and focus group questions will eliminate the tie between a specific instructional method and how the student found it helpful but determining that kind of one-to-one relationship in a course when there are so many other methods used is impossible and piloting the instruments did not reveal those relationships anyways. The new survey and focus group questions will show which instructional methods students feel are helpful and in what general ways they find the use of a SRS to be helpful.

At the beginning of January the evaluator contacted all of the professors known to CID that have used a student response system in the past to see if they were using one Winter semester 2007, what kind they were using and if they would be willing to participate in the evaluation. Approximately 68 professors were contacted. Of the 68, 18 responded that they were using a student response system winter semester 2007 and they would be willing to participate in the evaluation. One of the 18 never responded to further inquiries by the evaluator and so was dropped from the list. All 17 professors are using the current system CID supports called iClicker. No professors were using the old system TurningPoint making it impossible to include the old system in the evaluation; therefore, evaluation of student response systems at BYU only includes iClicker. Of the 17 professors that agreed to participate, ten were selected using stratified random sampling methods to be included in the evaluation. Professors were categorized according to their

department and then the ten were randomly selected. Many departments had only one representative and so the one was selected from that department. After the professors were selected the evaluator made arrangements with them to sit in on their class when the system was being used throughout the semester. The next step was to pilot the professor interview questions. One of the seventeen professors who was not selected was used to pilot the questions. An interview was scheduled and conducted as the others would be. All of the questions worked well; there was no confusion about what the evaluator was asking from the professor. After the evaluator had attended at least one class session in the professor's class, she interviewed each professor regarding their experience with iClicker and how they were using it in their class. All of the professors were very helpful and interested in the evaluation. The technical problems that were reported with the software or hardware of the new system were minimal and professors had been able to resolve most of them on their own or with the assistance of technical support from the company or administrators at CID responsible for the support of the system. Professors have experienced a few features of the system that they have not liked, but have not limited the way they would like to use the SRS instructionally. For example, professors do not like the fact that every time a student turns their clicker off or the clicker turns off on its own, when the student turns it back on they have to reset the frequency of their clicker to the classroom frequency of the receiver.

The classroom observations have revealed very few (2-3) problems with iClicker while in use. The only instances of problems were with the instructor remote, the remote seemed to stop working for a few seconds but then resumed working. The iClicker software occasionally covers up part of the instructors question on the display and the

student clickers turn off easily if dropped or tapped on the top, which creates the problem of students having to reset their clickers to the right frequency during class.

The ten professors are using iClicker in similar ways. Some put less emphasis on getting the right answer versus understanding the concept behind the question and material that the question covers. Some put more emphasis on using it to track attendance and to encourage students to come prepared to class. How much each professor uses it in class varies from lecture to lecture. The evaluator has recorded both negative and positive responses from students while using the clickers in class.

Future of the Evaluation

Currently, the evaluator is still sitting in on the lectures of the 10 professors and will continue to do so through March. In the third week of March the evaluator will recruit students from these classes to participate in focus groups. There will be 4 to 6 focus groups held near the end of March or beginning of April. The evaluator will also conduct follow-up interviews with the professors involved in the evaluation near the end of March. At the end of March or beginning of April two surveys will be administered. One survey will be for students and the other for all faculty members using iClicker winter semester 2007. The results of each of these methods of data collection will then be analyzed in April and the final report will be written by the end of April (this is my goal since I will be getting married May 3rd).

Meta-Evaluation

This part of the report is the formative metaevaluation for this project.

U1 Stakeholder Identification

- Clearly identify the evaluation client—Yes
- Engage leadership figures to identify other stakeholders—Yes
- Consult potential stakeholders to identify their information needs—Yes

- Use stakeholders to identify other stakeholders—Yes
- With the client, rank stakeholders for relative importance—Yes
- Arrange to involve stakeholders throughout the evaluation—Yes
- Keep the evaluation open to serve newly identified stakeholders—No
- Address stakeholders' evaluation needs—Yes
- Serve an appropriate range of individual stakeholders—Yes
- Serve an appropriate range of stakeholder organizations—No

The evaluation client was identified as administrators at the Center for Instructional Design (CID). The client (administrators at CID) identified professors that would be using the student response system (SRS) iClicker winter semester 2007 as stakeholders in the evaluation and the students in their classes as other stakeholders in the evaluation. Since the evaluation has only addressed the needs of the Center for Instructional Design the administrators were consulted about what information they would like from the evaluation. No other stakeholders were identified beyond professors and students. Stakeholders at the CID will be involved throughout the evaluation. The interim report has been prepared and given to administrators at CID. Because the evaluation is only addressing the needs of CID and the evaluation is already a very large project additional information has not been collected for new stakeholders outside of CID. The evaluation does address the needs of CID which will also indirectly address some of the needs of professors and students. The evaluation serves a range of stakeholders at the CID, those interested in how the technology is functioning and those interested in the perceived benefits of incorporating the technology into specific pedagogical methods or the benefit to students. The evaluation only serves the CID.

U2 Evaluator Credibility

- Engage competent evaluators—Yes
- Engage evaluators whom the stakeholders trust—Yes
- Engage evaluators who can address stakeholders' concerns—Yes
- Engage evaluators who are appropriately responsive to issues of gender, socioeconomic status, race, and language and cultural differences—Yes
- Assure that the evaluation plan responds to key stakeholders' concerns
- Help stakeholders understand the evaluation plan—Yes
- Give stakeholders information on the evaluation plan's technical quality and practicality—Yes
- Attend appropriately to stakeholders' criticisms and suggestions—Yes
- Stay abreast of social and political forces—Yes
- Keep interested parties informed about the evaluation's progress—Yes

The lead evaluator has not employed the help of other student evaluators at the Center for Instructional Design because of their work load is too great to assist in other projects that are not their own. The lead evaluator in this evaluation works more than most of the other evaluators and so is able to accommodate more work. The team does include the head

evaluator at the Center for Instructional Design and three faculty members from the Instructional Psychology and Technology department. Stakeholders trust evaluators as competent to conduct the evaluation and trust them to release information to them. Evaluators have received training in evaluation and have talked with stakeholders to appropriately address stakeholders' concerns. Evaluators are sensitive to issues of gender, socioeconomic status, race, and language and cultural differences. The lead evaluator has met with the supervisor (head stakeholder) of the evaluation to explain the plan. The evaluation plan has been written up and given to the CID. Changes have been made to attend to stakeholders' suggestions. The evaluator attends meetings at the CID where the use and administration of student response systems is discussed by administrators at the CID. The lead evaluator has made changes in a couple of the instruments used in the evaluation based on feedback from piloting the instruments and from other evaluators on the team. An interim report has been prepared and given to the client.

U3 Information Scope and Selection

- Understand the client's most important evaluation requirements—Yes
- Interview stakeholders to determine their different perspectives—Yes
- Assure that evaluator and client negotiate pertinent audiences, questions, and required information—Yes
- Assign priority to the most important stakeholders—Yes
- Assign priority to the most important questions—Yes
- Allow flexibility for adding questions during the evaluation—Yes
- Obtain sufficient information to address the stakeholders' most important evaluation questions—Yes
- Obtain sufficient information to assess the program's merit—Yes
- Obtain sufficient information to assess the program's worth—Yes
- Allocate the evaluation effort in accordance with the priorities assigned to the needed information—Yes

The evaluation supervisor at CID and the team responsible for the implementation of the student response systems were both consulted to determine their perspectives. Stakeholders at CID approved the questions and populations that the data will be collected from for the evaluation. Priority has been assigned to administrators at CID as the most important stakeholders. After piloting the student survey and focus group questions it was determined that changes needed to be made to the questions. The length of the survey discouraged students from taking it and accurately responding (most seemed to just rush through clicking the first answer available). Changes have been made to condense the survey. The focus group questions have also been changed to reflect how the questions are being asked on the survey. Information will be collected from two populations and there will be three data collection methods from each population to obtain sufficient information to address stakeholders' questions, assess the program's merit, and assess the program's worth.

U4 Values Identification

- Consider alternative sources of values for interpreting evaluation findings—Yes
- Provide a clear, defensible basis for value judgments—Yes
- Determine the appropriate party(s) to make the valuational interpretations—Yes
- Identify pertinent societal needs—No
- Identify pertinent customer needs—Yes
- Reference pertinent laws—No
- Reference, as appropriate, the relevant institutional mission—Yes
- Reference the program's goals—Yes
- Take into account the stakeholders' values—Yes
- As appropriate, present alternative interpretations based on conflicting but credible value bases—Yes

All value judgments will be based on the information collected. Value judgments will be supported by an objective interpretation of the information. No value judgments have yet been made because the data collection is not complete. Evaluators will make valuational interpretations. Stakeholders at the CID will also make valuation interpretations. Societal needs have not been identified. Customer needs have been identified by stakeholders at CID as part of CID's needs. There are no pertinent laws that pertain to the evaluation. CIDs institutional mission and goals will be referenced as value judgments are made about the student response systems. Stakeholders' values at the CID will be taken into account. If values of stakeholders outside of CID (professors and students) conflict with stakeholders at CID and are credible they will be reported.

U5 Report Clarity

- Clearly report the essential information—Yes
- Issue brief, simple, and direct reports—Yes
- Focus reports on contracted questions—Yes
- Describe the program and its context—Yes
- Describe the evaluation's purposes, procedures, and findings—Yes
- Support conclusions and recommendations—Yes
- Avoid reporting technical jargon—Yes
- Report in the language(s) of stakeholders—Yes
- Provide an executive summary—Yes
- Provide a technical report—Yes

The evaluation report will be clear and concise. The report will focus on the questions stakeholders at CID have requested. The report will include descriptions of the program, evaluation purposes, procedures and findings. Conclusions and recommendations will be supported by information collected from the evaluation. No conclusions or recommendations will be made without support from information collected from the evaluation. The report will include an executive summary and a technical report of the

data collected. All of the data has not yet been collected so the report has not been written so there is nothing new to report.

U6 Report Timeliness and Dissemination

- Make timely interim reports to intended users—Yes
- Deliver the final report when it is needed—Yes
- Have timely exchanges with the program's policy board—No
- Have timely exchanges with the program's staff—No
- Have timely exchanges with the program's customers—Yes
- Have timely exchanges with the public media—No
- Have timely exchanges with the full range of right-to-know audiences—Yes
- Employ effective media for reaching and informing the different audiences—No
- Keep the presentations appropriately brief--Yes
- Use examples to help audiences relate the findings to practical situations—Yes

An interim report has been provided to users. More interim reports will be written if requested by stakeholders at CID. The final report will be delivered at the end of April 2007; however, there may be changes that need to be made after this date to the final report. If it is requested earlier it will be delivered by the date requested. All entities involved in the evaluation will be kept up to date on the status of the evaluation with the interim report. There have not been a couple of exchanges with one of the administrators of the program several times since the evaluation has started. The lead evaluator could provide more status reports to key stakeholders at CID. All participants involved in the evaluation will have access to the interim and final report. The presentation to stakeholders at the CID will not last longer than an hour if there is one. The evaluation will be assessing practical applications and so examples from the evaluation will be reported.

U7 Evaluation Impact

- Maintain contact with audience—Yes
- Involve stakeholders throughout the evaluation—Yes
- Encourage and support stakeholders' use of the findings—Yes
- Show stakeholders how they might use the findings in their work—Yes
- Forecast and address potential uses of findings—Yes
- Provide interim reports—Yes
- Make sure that reports are open, frank, and concrete—Yes
- Supplement written reports with ongoing oral communication—Yes
- Conduct feedback workshops to go over and apply findings—Yes
- Make arrangements to provide follow-up assistance in interpreting and applying the findings—Yes

Better contact needs to be maintained with audiences and stakeholders at CID. There has been some contact but more would be appropriate. The final report will encourage

stakeholders at CID to use the information to provide better technical and instructional support to professors. An interim report has been provided to users. More interim reports will be written if requested by stakeholders at CID. Reports will be concise and report all information collected from the evaluation even if it is contradictory to what stakeholders would like. Oral communication will continue throughout the evaluation with meetings with stakeholders at CID. A meeting will be scheduled with administrators at CID to go over the final report and how to apply the findings.

Feasibility

F1 Practical Procedures

- Tailor methods and instruments to information requirements—Yes
- Minimize disruption—Yes
- Minimize the data burden—No
- Appoint competent staff—Yes
- Train staff—Yes
- Choose procedures that the staff are qualified to carry out—Yes
- Choose procedures in light of known constraints—No
- Make a realistic schedule—Yes
- Engage locals to help conduct the evaluation—No
- As appropriate, make evaluation procedures a part of routine events—No

Methods and instruments have been developed to collect the information requested by stakeholders at CID. Changes have been made in the student survey and focus group questions to better collect the information required. Disruptions for collecting the data are as minimal as possible. Evaluators appointed to the evaluation have been trained in evaluation and research. All staff has had experience conducting the procedures to collect the information. The schedule to collect the information includes a realistic timeline (4 months). The only procedure that will be part of routine events will be the classroom observations.

F2 Political Viability

- Anticipate different positions of different interest groups-No
- Avert or counteract attempts to bias or misapply the findings-Yes
- Foster cooperation-Yes
- Involve stakeholders throughout the evaluation-Yes
- Agree on editorial and dissemination authority-Yes
- Issue interim reports-Yes
- Report divergent views-No
- Report to right-to-know audiences-Yes
- Employ a firm public contract-No
- Terminate any corrupted evaluation-Yes

Findings will be reported objectively. Stakeholders at CID have been involved, but could be kept up-to-date more on the evaluation. The CID will have the authority to disseminate the final report to all right-to-know audiences. A proposal has been written for the evaluation but there is no formal contract. The evaluation has not become corrupted but if it does it will be terminated.

F3 Cost Effectiveness

- Be efficient—Yes
- Make use of in-kind services—No
- Produce information worth the investment—Yes
- Inform decisions—Yes
- Foster program improvement—Yes
- Provide accountability information—No
- Generate new insights—Yes
- Help spread effective practices—Yes
- Minimize disruptions—Yes
- Minimize time demands on program personnel—Yes

Evaluators will be as efficient as possible while collecting the data. Classroom observations are not as efficient because each one has taken approximately an hour. The interviews with professors have lasted anywhere from 10-25 minutes, which has not gone over the allotted time the evaluator scheduled with them. The data collected will be valuable to stakeholders. Stakeholders should be able to use the information to develop the program to better support its users (professors and students).

Propriety

P1 Service Orientation

- Assess needs of the program's customers—Yes
- Assess program outcomes against targeted customers' assessed needs—Yes
- Help assure that the full range of rightful program beneficiaries are served—Yes
- Promote excellent service—Yes
- Make the evaluation's service orientation clear to stakeholders—Yes
- Identify program strengths to build on—Yes
- Identify program weaknesses to correct—Yes
- Give interim feedback for program improvement—Yes
- Expose harmful practices—Yes
- Inform all right-to-know audiences of the program's positive and negative outcomes—Yes

Negative and positive information from the evaluation will be reported. Needs of users will be assessed and they will report how well they feel the system is meeting their needs. Interim feedback has been given so far in the evaluation, consisting of a written report

and verbal communication with stakeholders at CID; however, more verbal interim communication about the evaluation should take place with stakeholders.

P2 Formal Agreements

Reach advance written agreements on:

- Evaluation purpose and questions—Yes
- Audiences—Yes
- Evaluation reports—Yes
- Editing—No
- Release of reports—Yes
- Evaluation procedures and schedule—Yes
- Confidentiality/anonymity of data—Yes
- Evaluation staff—Yes
- Metaevaluation—Yes
- Evaluation resources—Yes

All of the information listed above has been included in the evaluation proposal, except the editing.

P3 Rights of Human Subjects

- Make clear to stakeholders that the evaluation will respect and protect the rights of human subjects—Yes
- Clarify intended uses of the evaluation—Yes
- Keep stakeholders informed—Yes
- Follow due process—Yes
- Uphold civil rights—Yes
- Understand participant values—Yes
- Respect diversity—Yes
- Follow protocol—Yes
- Honor confidentiality/anonymity agreements—Yes
- Do no harm—Yes

All data that will be collected will have informed consent for participants. IRB approval has been obtained for the evaluation, which helps ensure the proper treatment of all participants.

P4 Human Interactions

- Consistently relate to all stakeholders in a professional manner—Yes
- Maintain effective communication with stakeholders—Yes
- Follow the institution's protocol—Yes
- Minimize disruption—Yes
- Honor participants' privacy rights—Yes

- Honor time commitments—Yes
- Be alert to and address participants' concerns about the evaluation—Yes
- Be sensitive to participants' diversity of values and cultural differences—Yes
- Be even-handed in addressing different stakeholders—No
- Do not ignore or help cover up any participants incompetence, unethical behavior, fraud, waste, or abuse—Yes

Evaluators are employed by the CID and will maintain professional behavior in all interactions with stakeholders and participants. Protocol established for the evaluation has been followed so far. Data collection methods have not overstepped the time allotted for each procedure (only interviews have been conducted so far and none have gone over the allotted time). The evaluation is specifically addressing the needs of CID and not the other stakeholders. Ethical behavior will be upheld during the evaluation. IRB approval has been obtained to ensure this.

P5 Complete and Fair Assessment

- Assess and report the program's strengths _-Yes
- Assess and report the program's weaknesses -Yes
- Report on intended outcomes -Yes
- Report on unintended outcomes -Yes
- Give a thorough account of the evaluation's process -Yes
- As appropriate, show how the program's strengths could be used to overcome its weaknesses -No
- Have the draft report reviewed-Yes
- Appropriately address criticisms of the draft report -Yes
- Acknowledge the final report's limitations –Yes
- Estimate and report the effects of the evaluation's limitations on the overall judgment of the program-Yes

The final report will be fair and complete. Challenges encountered during the evaluation will be reported. Limitations of the evaluation will be reported and how that affected judgments made by the evaluators. Other evaluators at CID as well as several faculty members at Brigham Young University will review drafts of the final report.

P6 Disclosure of Findings

- Define the right-to-know audiences-No
- Establish a contractual basis for complying with right-to-know requirements -No
- Inform the audiences of the evaluation's purposes and projected reports -Yes
- Report all findings in writing -Yes
- Report relevant points of view of both supporters and critics of the program -Yes
- Report balanced, informed conclusions and recommendations -Yes
- Show the basis for the conclusions and recommendations -Yes
- Disclose the evaluation's limitations -Yes

- In reporting, adhere strictly to a code of directness, openness, and completeness - Yes
- Assure that reports reach their audiences-Yes

The final report will give both the negative and positive information from participants. The right-to-know audiences have not been defined and no contract has been established with complying with their right to know. All conclusions and recommendations will be supported by the information in the report.

P7 Conflict of Interest

- Identify potential conflicts of interest early in the evaluation -Yes
- Provide written, contractual safeguards against identified conflicts of interest -No
- Engage multiple evaluators -No
- Maintain evaluation records for independent review -Yes
- As appropriate, engage independent parties to assess the evaluation for its susceptibility or corruption by conflicts of interest -No
- When appropriate, release evaluation procedures, data, and reports for public review -Yes
- Contract with the funding authority rather than the funded program -No
- Have internal evaluators report directly to the chief executive officer -Yes
- Report equitably to all right-to-know audiences -No
- Engage uniquely qualified persons to participate in the evaluation, even if they have a potential conflict of interest; but take steps to counteract the conflict-No

Conflicts of interest have been identified and addressed in the proposal. There are no formal contracts for resolving conflicts of interest besides the proposal. So far in the evaluation multiple evaluators have not been engaged to collect data. Other evaluators have been involved in constructing the instruments to collect the data and making revisions to them but not in the data collecting. Other evaluators will be engaged in the data collection for the student focus groups. One conflict of interest that was addressed is the fact that several administrators at the CID that are responsible for choosing which student response system to support are not evaluators in the evaluator. A person independent of those decisions was chosen to evaluate this program.

P8 Fiscal Responsibility

- Specify and budget for expense items in advance -Yes
- Keep the budget sufficiently flexible to permit appropriate reallocations to strengthen the evaluation -Yes
- Obtain appropriate approval for needed budgetary modifications -Yes
- Assign responsibility for managing the evaluation finances -Yes
- Maintain accurate records of sources of funding and expenditures -Yes
- Maintain adequate personnel records concerning job allocations and time spent on the job -Yes

- Employ comparison shopping for evaluation materials -No
- Employ comparison contract bidding -No
- Be frugal in expending evaluation resources -Yes
- As appropriate, include an expenditure summary as part of the public evaluation report-Yes

The schedule and budget have been specified in advance. The budget is flexible and can be adjusted based on the needs of the evaluation. Project managers at the CID will manage the evaluation budget. Personnel are required to record how many hours are spent on the project. The main expenditures will be man-hours for conducting the evaluation. The other expense will be five-dollar gift certificates and lunch to be provided for the focus groups.

Accuracy

A1 Program Documentation

- Collect descriptions of the intended program from various written sources -No
- Collect descriptions of the intended program from the client and various stakeholders -Yes
- Describe how the program was intended to function -Yes
- Maintain records from various sources of how the program operated -Yes
- As feasible, engage independent observers to describe the program's actual operations -No
- Describe how the program actually functioned -Yes
- Analyze discrepancies between the various descriptions of how the program was intended to function -No
- Analyze discrepancies between how the program was intended to operate and how it actually operated -Yes
- Ask the client and various stakeholders to assess the accuracy of recorded descriptions of both the intended and the actual program -Yes
- Produce a technical report that documents the program's operations -Yes

There were no written descriptions of how the program was intended to function. Descriptions were collected from the client. A description of how the program should function is included in the client's criteria. Data is being collected using multiple methods about how the program is actually functioning and will be described in the final report.

A2 Context Analysis

- Use multiple sources of information to describe the program's context -Yes
- Describe the context's technical, social, political, organizational, and economic features -Yes
- Maintain a log of unusual circumstances -Yes

- Record instances in which individuals or groups intentionally or otherwise interfered with the program -Yes
- Record instances in which individuals or groups intentionally or otherwise gave special assistance to the program -Yes
- Analyze how the program's context is similar to or different from contexts where the program might be adopted -No
- Report those contextual influences that appeared to significantly influence the program and that might be of interest to potential adopters -Yes
- Estimate effects of context on program outcomes -No
- Identify and describe any critical competitors to this program that functioned at the same time and in the program's environment -No
- Describe how people in the program's general area perceived the program's existence, importance, and quality –Yes

Data will be collected using multiple methods about how the program is actually functioning and will be described in the final report. The context of the program at CID has been described. Contextual influences that appear to significantly influence the program are being recorded (for example, the fact that at BYU students are required to purchase their own clicker). A log of unusual circumstances has not been specifically kept but should come out in the data collected. There may be interference or special assistance given to the program by administrators at CID, which will be recorded.

A3 Described Purposes and Procedures

- At the evaluation's outset, record the client's purposes for the evaluation -Yes
- Monitor and describe stakeholders' intended uses of evaluation findings -Yes
- Monitor and describe how the evaluation's purposes stay the same or change over time -Yes
- Identify and assess points of agreement and disagreement among stakeholders regarding the evaluation's purposes -No
- As appropriate, update evaluation procedures to accommodate changes in the evaluation's purposes -Yes
- Record the actual evaluation procedures, as implemented -Yes
- When interpreting findings, take into account the different stakeholders' intended uses of the evaluation -Yes
- When interpreting findings, take into account the extent to which the intended procedures were effectively executed -Yes
- Describe the evaluation's purposes and procedures in the summary and full-length evaluation reports -Yes
- As feasible, engage independent evaluators to monitor and evaluate the evaluation's purposes and procedures –No

The client's purposes for the evaluation and their intended uses of it have been recorded. Evaluation procedures have remained the same at this point in the evaluation. The only thing that has slightly changed is condensing the student survey and student focus group

questions. All procedures will be reported in the final report. The interpretation of the findings and organization will take into account the intended uses of the evaluation. The evaluation procedures and purposes will be described fully in the final report.

A4 Defensible Information Sources

- Obtain information from a variety of sources -Yes
- Use pertinent, previously collected information once validated -No
- As appropriate, employ a variety of data collection methods -Yes
- Document and report information sources -Yes
- Document, justify, and report the criteria and methods used to select information sources -Yes
- For each source, define the population -Yes
- For each population, as appropriate, define any employed sample -Yes
- Document, justify, and report the means used to obtain information from each source -Yes
- Include data collection instruments in a technical appendix to the evaluation report -Yes
- Document and report any biasing features in the obtained information –Yes

All data collection methods and instruments have been reported and provided in the proposal. The changes made to the student survey and student focus groups questions will be reported and the current survey and focus group questions will be included in the appendix. Multiple methods are being used to collect the data. The populations data is being collected from have been described as well as how samples have been selected. All data collection instruments will be provided in the final report. Any biases will be recorded.

A5 Valid Information

- Focus the evaluation on key questions -Yes
- As appropriate, employ multiple measures to address each question -Yes
- Provide a detailed description of the constructs and behaviors about which information will be acquired -No
- Assess and report what type of information each employed procedure acquires -Yes
- Train and calibrate the data collectors -Yes
- Document and report the data collection conditions and process-Yes
- Document how information from each procedure was scored, analyzed, and interpreted -Yes
- Report and justify inferences singly and in combination -Yes
- Assess and report the comprehensiveness of the information provided by the procedures as a set in relation to the information needed to answer the set of evaluation questions -No

- Establish meaningful categories of information by identifying regular and recurrent themes in information collected using qualitative assessment procedures-Yes

The evaluation will focus on the questions clients wish to have answered. Multiple methods will be employed to answer each question. A description of what information each method or question will collect is included. Other evaluators will be trained by the lead evaluator on how to collect the information. Information on how the results will be scored and analyzed is included. The report will justify judgments and inferences from the combination of data collected. Qualitative analysis will identify regular and recurrent themes. Descriptions of the behaviors about which information is being collected need to be written as well as assessing the comprehensiveness of the information provided by the data collection procedures as a set in relation to the information needed to answer the set of evaluation questions. A table has been provided in the proposal with the questions and the data collection procedures, but a more detailed descriptions should be written.

A6 Reliable Information

- Identify and justify the type(s) and extent of reliability claimed -No
- For each employed data collection device, specify the unit of analysis-Yes
- As feasible, choose measuring devices that in the past have shown acceptable levels of reliability for their intended uses -No
- In reporting reliability of an instrument, assess and report the factors that influenced the reliability, including the characteristics of the examinees, the data collection conditions, and the evaluator's biases -No
- Check and report the consistency of scoring, categorization, and coding -No
- Train and calibrate scorers and analysts to produce consistent results -Yes
- Pilot test new instruments in order to identify and control sources of error-Yes
- As appropriate, engage and check the consistency between multiple observers-Yes
- Acknowledge reliability problems in the final report -Yes
- Estimate and report the effects of unreliability in the data on the overall judgment of the program-Yes

A description of how reliability will be maintained for each instrument is provided in the proposal. How each data set will be analyzed has also been included. Instruments have been piloted and if scorers are used outside the main evaluator they will be trained to ensure consistency in what they look for in classroom observations.

A7 Systematic Information

- Establish protocols for quality control of the evaluation information -Yes
- Train the evaluation staff to adhere to the data protocols -Yes
- Systematically check the accuracy of scoring and coding No

- When feasible, use multiple evaluators and check the consistency of their work - Yes
- Verify data entry-Yes
- Proofread and verify data tables generated from computer output or other means - Yes
- Systematize and control storage of the evaluation information -Yes
- Define who will have access to the evaluation information -Yes
- Strictly control access to the evaluation information according to established protocols -Yes
- Have data providers verify the data they submitted-No

Evaluators will be trained in the protocol for the interviews, focus groups, and classroom observations. So far only one evaluator has worked on the evaluation. This is due to the fact that the other evaluators have been busy with their own projects and the main evaluator has been working more and so had time to collect the data on her own. The student focus groups will require another evaluator to help conduct them. Other employees will be used to transcribe and code data. Their work will be checked for consistency. The lead evaluator will verify data entry and will verify computer output of the analyzed data. Who will have access to the data and how it will be stored is defined in the proposal.

A8 Analysis of Quantitative Information

- Begin by conducting preliminary exploratory analyses to assure the data's correctness and to gain a greater understanding of the data -No
- Choose procedures appropriate for the evaluation questions and nature of the data -Yes
- For each procedure specify how its key assumptions are being met -No
- Report limitations of each analytic procedure, including failure to meet assumptions -No
- Employ multiple analytic procedures to check on consistency and replicability of findings -Yes
- Examine variability as well as central tendencies -Yes
- Identify and examine outliers and verify their correctness -No
- Identify and analyze statistical interactions -Yes
- Assess statistical significance and practical significance -Yes
- Use visual displays to clarify the presentation and interpretation of statistical results-Yes

The analysis of quantitative information has been explained in the proposal. Questions and analysis procedures are appropriate for the data. How assumptions are being met has not been explained. Any limitations in the analytic procedures will be reported in the final report. Descriptive statistics and tests of significance will be used.

A9 Analysis of Qualitative Information

- Focus on key questions -Yes
- Define the boundaries of information to be used -No
- Obtain information keyed to the important evaluation questions -Yes
- Verify the accuracy of findings by obtaining confirmatory evidence from multiple sources, including stakeholders -Yes
- Choose analytic procedures and methods of summarization that are appropriate to the evaluation questions and employed qualitative information -Yes
- Derive a set of categories that is sufficient to document, illuminate, and respond to the evaluation questions -No
- Test the derived categories for reliability and validity -No
- Classify the obtained information into the validated analysis categories -No
- Derive conclusions and recommendations and demonstrate their meaningfulness -Yes
- Report limitations of the referenced information, analyses, and inferences-Yes

Qualitative data will focus on the questions stakeholders at CID wish to have answered. Multiple sources and methods will be used to collect the data. The analysis of qualitative data has been defined in the proposal and is appropriate for the type of data to be collected. Need to define a set of categories to respond to the evaluation questions.

A10 Justified Conclusions

- Focus conclusions directly on the evaluation questions -Yes
- Accurately reflect the evaluation procedures and findings -Yes
- Limit conclusions to the applicable time periods, contexts, purposes, and activities -Yes
- Cite the information that supports each conclusion -Yes
- Identify and report the program's side effects -No
- Report plausible alternative explanations of the findings -Yes
- Explain why rival explanations were rejected -Yes
- Warn against making common misinterpretations -Yes
- Obtain and address the results of a prerelease review of the draft evaluation report -No
- Report the evaluation's limitations-Yes

The report results and conclusions will focus on the evaluation report. Procedures and findings will be reported accurately. All conclusions will be directly supported by information collected in the evaluation. Any plausible alternative explanations of the findings will be reported in the final report. Warnings will be given in the final report against misinterpreting the data. The proposal does not specify a prerelease review of the draft of the final evaluation report; however, it will be reviewed by the evaluation supervisor before it is released to other administrators at the CID. The final report will contain a section detailing limitations of the evaluation.

A11 Impartial Reporting

- Engage the client to determine steps to ensure fair, impartial reports -Yes
- Establish appropriate editorial authority -No
- Determine right-to-know audiences -No
- Establish and follow appropriate plans for releasing findings to all right-to-know audiences -Yes
- Safeguard reports from deliberate or inadvertent distortions -Yes
- Report perspectives of all stakeholder groups -Yes
- Report alternative plausible conclusions -Yes
- Obtain outside audits of reports -No
- Describe steps taken to control bias -Yes
- Participate in public presentations of the findings to help guard against and correct distortions by other interested parties –Yes

Right-to-know audiences have not been established besides participants in the evaluation and the client. A plan has been established to release the information to the study participants and clients. All reports will be objective and will reflect the actual results obtained. A description of steps taken to control bias will be included in the final report. The evaluators are independent from the client and so will not write the report according to what the client wishes to hear. Alternative possible conclusions will be explored in the report and at least one public presentation will be given of the results.

A12 Metaevaluation

- Designate or define the standards to be used in judging the evaluation -Yes
- Assign someone responsibility for documenting and assessing the evaluation process and products -Yes
- Employ both formative and summative metaevaluation -Yes
- Budget appropriately and sufficiently for conducting the metaevaluation -Yes
- Record the full range of information needed to judge the evaluation against the stipulated standards -Yes
- As feasible, contract for an independent metaevaluation -No
- Determine and record which audiences will receive the metaevaluation report -Yes
- Evaluate the instrumentation, data collection, data handling, coding, and analysis against the relevant standards -Yes
- Evaluate the evaluation's involvement of and communication of findings to stakeholders against the relevant standards -Yes
- Maintain a record of all metaevaluation steps, information, and analyses –Yes

Stufflebeam's 30 metaevaluation standards have been chosen to use for the metaevaluation. The lead evaluator will document and assess the evaluation process. There are no resources to contract for an independent metaevaluation. The

metaevaluation will be included in the final report and so will be made available to participants in the study and the client. The methods and procedures of data collection and analysis will be compared against the standards. Records will be maintained of the metaevaluation steps and analysis. This report is the formative metaevaluation.

APPENDIX G: Schedule and Budget

Schedule and Budget					
Task	Duration	Work	Budget	Cost	Timeframe
Evaluation Preliminary Work	8 weeks	30 hours	\$390.00	\$390.00	October-December 2006
Write proposal	6 weeks	80 hours	\$1040.00	\$1040.00	November-December 2006
Meet with Stakeholders to Develop and Revise Evaluation	8 weeks	30 hours	\$390.00	\$390.00	October 2006-December 2006
Develop Data Collection Instruments	5 days	10 hours	\$130.00	\$130.00	December 2006
Get Approval for Questions	3 days	1 hour	\$35.00	\$35.00	December 2006
Conduct Classroom Observations	3 months	50 hours	\$650.00	\$650.00	January-March 2007
Make Interview Schedule	7 days	4 hours	\$52.00	\$52.00	January 21-28
Conduct Instructor Interviews	12 weeks	48 hours	\$624.00	\$624.00	January – March 2007
Conduct Student Focus Groups	2 weeks	20 hours	\$260.00	\$260.00	March 2007
Student Focus Group Food and Gift Card	-----	-----	\$600.00	\$600.00	March 2007
Conduct Student and Professor Survey	1 week	5 hours	\$65.00	\$65.00	March 2007
Transcribe Interview and Focus Group Data	3 weeks	40 hours	\$520.00	\$520.00	April 2007
Consolidate Observation data	5 days	4 hours	\$52.00	\$52.00	April 2007
Analyze Results	6 weeks	80 hours	\$1040.00	\$1040.00	June 2007
Write Reports	8 weeks	100 hours	\$1300.00	\$1300.00	June-July 2007
Metaevaluation	2 weeks	10 hours	\$130.00	\$130.00	July 2007
Conduct Post-Evaluation Meeting	2 days	2 hours	\$26.00	\$26.00	August 2007

APPENDIX H: Final Meta-Evaluation

Utility U1 Stakeholder Identification

1. Clearly identify the evaluation client—Yes
2. Engage leadership figures to identify other stakeholders—Yes
3. Consult potential stakeholders to identify their information needs—Yes
4. Use stakeholders to identify other stakeholders—Yes
5. With the client, rank stakeholders for relative importance—Yes
6. Arrange to involve stakeholders throughout the evaluation—Yes
7. Keep the evaluation open to serve newly identified stakeholders—No
8. Address stakeholders' evaluation needs—Yes
9. Serve an appropriate range of individual stakeholders—Yes
10. Serve an appropriate range of stakeholder organizations—Yes

The evaluation client was identified as administrators at the Center for Teaching and Learning (CTL). The client (administrators at CTL) identified professors who would be using the student response system (SRS) iClicker Winter semester 2007 as stakeholders in the evaluation and the students in their classes as other stakeholders in the evaluation. Since the evaluation has only addressed the needs of the CTL, the administrators were consulted about what information they would like from the evaluation. No other stakeholders were identified beyond professors and students. Stakeholders at the CTL were involved throughout the evaluation. The interim report was prepared and given to administrators at CTL in February. Since the evaluation only addressed the needs of the CTL and the evaluation was a very large project additional information was not been collected for new stakeholders outside of the CTL. The

evaluation was designed to directly serve one group of stakeholders (The Center for Instructional Design) and indirectly two other groups (faculty members and students at Brigham Young University). It was not the purpose of the evaluation to address specifically each individual professor's and student's needs because of the large number of professors and students using the system. It was not feasible to address each of their needs in the evaluation. By addressing the Center for Teaching and Learning needs the evaluation indirectly addresses professors' and students' needs in general, but not individually. The evaluation was open to newly identified stakeholders at the CTL, but not outside of it because it was not feasible to address new stakeholders' needs outside of the CTL in the scope of this evaluation. The evaluation serves a range of stakeholders at the CTL, those interested in how the technology is functioning and those interested in the perceived benefits of incorporating the technology into specific instructional methods or the benefit to students. The evaluation only serves the CTL. For the scope of this evaluation, the range of stakeholders being served is appropriate. There is one main evaluator assigned to this project, who can recruit the help of co-workers (other evaluators) when they have time to spare from their own projects. For that reason, the scope of this project could not be as large, which restricted the number of stakeholders' needs the evaluation could directly serve.

U2 Evaluator Credibility

1. Engage competent evaluators—Yes
2. Engage evaluators whom the stakeholders trust—Yes
3. Engage evaluators who can address stakeholders' concerns—Yes

4. Engage evaluators who are appropriately responsive to issues of gender, socioeconomic status, race, and language and cultural differences—Yes
5. Assure that the evaluation plan responds to key stakeholders' concerns
6. Help stakeholders understand the evaluation plan—Yes
7. Give stakeholders information on the evaluation plan's technical quality and practicality—Yes
8. Attend appropriately to stakeholders' criticisms and suggestions –Yes
9. Stay abreast of social and political forces—Yes
10. Keep interested parties informed about the evaluation's progress—Yes

The lead evaluator employed the help of other student evaluators at the Center for Teaching and Learning when their workload would accommodate their help. The lead evaluator in this evaluation worked more than most of the other evaluators and so was able to accommodate more work. The team does include the head evaluator at the CTL and three faculty members from the Instructional Psychology and Technology department. Stakeholders trusted the evaluators as competent to conduct the evaluation and trusted them to release information to them. Evaluators received training in evaluation and talked with stakeholders to appropriately address stakeholders' concerns. Evaluators were sensitive to issues of gender, socioeconomic status, race, and language and cultural differences. The lead evaluator met with the supervisor (head stakeholder) of the evaluation to explain the plan. The evaluation plan was written up and given to the CTL. Changes were made to attend to stakeholders' suggestions. The evaluator attended meetings at the CTL where the use and administration of student response systems was discussed by administrators at the CTL. The lead evaluator made changes in a couple of

the instruments used in the evaluation based on feedback from piloting the instruments and from other evaluators on the team. An interim report was prepared and given to the client.

U3 Information Scope and Selection

1. Understand the client's most important evaluation requirements—Yes
2. Interview stakeholders to determine their different perspectives—Yes
3. Assure that evaluator and client negotiate pertinent audiences, questions, and required information—Yes
4. Assign priority to the most important stakeholders—Yes
5. Assign priority to the most important questions—Yes
6. Allow flexibility for adding questions during the evaluation—Yes
7. Obtain sufficient information to address the stakeholders' most important evaluation questions—Yes
8. Obtain sufficient information to assess the program's merit—Yes
9. Obtain sufficient information to assess the program's worth—Yes
10. Allocate the evaluation effort in accordance with the priorities assigned to the needed information—Yes

The evaluation supervisor at CTL and the team responsible for the implementation of the student response systems were both consulted to determine their perspectives regarding the evaluation. Stakeholders at CTL approved the questions and populations from which the data were collected. Priority was assigned to administrators at CTL as the most important stakeholders. After piloting the student survey and focus group questions, it was determined that changes needed to be made to the questions. The length of the

survey discouraged students from taking it and accurately responding (most seemed to rush through clicking the first answer available). Changes were made to condense the survey. The focus group questions were also changed to reflect how the questions were being asked on the survey. Information was collected from two populations and there were three data collection methods for each population to obtain sufficient information to address stakeholders' questions, assess the program's merit, and assess the program's worth.

U4 Values Identification

1. Consider alternative sources of values for interpreting evaluation findings—Yes
2. Provide a clear, defensible basis for value judgments—Yes
3. Determine the appropriate party(s) to make the valuational interpretations—Yes
4. Identify pertinent societal needs—No
5. Identify pertinent customer needs—Yes
6. Reference pertinent laws—N/A
7. Reference, as appropriate, the relevant institutional mission—Yes
8. Reference the program's goals—Yes
9. Take into account the stakeholders' values—Yes
10. As appropriate, present alternative interpretations based on conflicting but credible value bases—Yes

All value judgments were based on the data collected. Value judgments were supported by an objective interpretation of the information. Evaluators will make valuational interpretations. Stakeholders at the CTL will also make valuational

interpretations of the data. Societal needs have been identified, the lead evaluator identified cost of the clickers to students as a societal need. Customer needs have been identified by stakeholders at the CTL as part of the CTL's needs. There are no laws that are pertinent to the use of student response systems at BYU. The CTL's institutional mission and goals (criteria) regarding the student response system were referenced as value judgments were made about the student response systems. Stakeholders' values at the CTL were taken into account. Values of stakeholders outside of the CTL (professors and students) did not conflict with stakeholders at the CTL.

U5 Report Clarity

1. Clearly report the essential information—Yes
2. Issue brief, simple, and direct reports—Yes
3. Focus reports on contracted questions—Yes
4. Describe the program and its context—Yes
5. Describe the evaluation's purposes, procedures, and findings—Yes
6. Support conclusions and recommendations—Yes
7. Avoid reporting technical jargon—Yes
8. Report in the language(s) of stakeholders—Yes
9. Provide an executive summary—Yes
10. Provide a technical report—Yes

The evaluation report is clear and concise. The report focused on the questions stakeholders at the CTL requested. The report included descriptions of the program, evaluation purposes, procedures and findings. Conclusions and recommendations were supported by information collected from the evaluation. No conclusions or

recommendations were made without support from information collected from the evaluation. The report for the CTL is condensed to provide easier access to the information for stakeholders. The report for the CTL includes an executive summary and a technical report of the data collected.

U6 Report Timeliness and Dissemination

1. Make timely interim reports to intended users—Yes
2. Deliver the final report when it is needed—Yes
3. Have timely exchanges with the program's policy board—Yes
4. Have timely exchanges with the program's staff—Yes
5. Have timely exchanges with the program's customers—Yes
6. Have timely exchanges with the public media—N/A
7. Have timely exchanges with the full range of right-to-know audiences—Yes
8. Employ effective media for reaching and informing the different audiences—Yes
9. Keep the presentations appropriately brief--Yes
10. Use examples to help audiences relate the findings to practical situations—Yes

An interim report was provided to users in February 2007. More interim reports were not requested by stakeholders at the CTL and so only one was written. The final report was delivered at the end of July 2007. The report was not requested earlier than this. All entities involved in the evaluation were kept up to date on the status of the evaluation with the interim report. After the interim report the program's staff requested a shorter final report of the evaluation and also a summary of technical problems to address with the manufacturer. These requests were fulfilled. There were also several informal

exchanges with an iClicker support team a couple of other times during the evaluation. There were no exchanges with the public media as they had no interest in the evaluation. All participants involved in the evaluation will have access to the interim and final report. Several participants requested a copy of the final evaluation report and were notified by email when it was available. The evaluation assessed practical applications and so examples from the evaluation were reported.

U7 Evaluation Impact

1. Maintain contact with audience—Yes
2. Involve stakeholders throughout the evaluation—Yes
3. Encourage and support stakeholders' use of the findings—Yes
4. Show stakeholders how they might use the findings in their work—Yes
5. Forecast and address potential uses of findings—Yes
6. Provide interim reports—Yes
7. Make sure that reports are open, frank, and concrete—Yes
8. Supplement written reports with ongoing oral communication—Yes
9. Conduct feedback workshops to go over and apply findings—Yes
10. Make arrangements to provide follow-up assistance in interpreting and applying the findings—Yes

Contact was maintained with the client during the evaluation. An interim report was distributed to audience members. The final report encouraged stakeholders at the CTL to use the information to provide better technical and instructional support to professors. An interim report was provided to users. The reports were concise and report all information

collected from the evaluation even if it is contradictory to what stakeholders would like. Oral communication continued throughout the evaluation with meetings with stakeholders at the CTL. Contact information has been given to stakeholders of the lead evaluator in the case they need follow-up assistance in interpreting or applying the findings.

Feasibility F1 Practical Procedures

1. Tailor methods and instruments to information requirements—Yes
2. Minimize disruption—Yes
3. Minimize the data burden—Yes
4. Appoint competent staff—Yes
5. Train staff—Yes
6. Choose procedures that the staff are qualified to carry out—Yes
7. Choose procedures in light of known constraints—Yes
8. Make a realistic schedule—Yes
9. Engage locals to help conduct the evaluation—No
10. As appropriate, make evaluation procedures a part of routine events—Yes

Methods and instruments were developed to collect the information requested by stakeholders at the CTL. Changes were made to the student survey and focus group questions to better collect the information required. Disruptions for collecting the data were as minimal as possible. The evaluator limited the longest data collection procedure to 50 minutes (student focus groups). The data burden was minimized by only selecting 10 professors to interview and sit-in on their classes. Evaluators appointed to the

evaluation have been trained in evaluation and research. All staff has had experience conducting the procedures to collect the information. Procedures were chosen in light of known constraints. The main constraint on the evaluation was time and evaluator resources, meaning the number of evaluators assigned to conduct the evaluation. There was only one evaluator assigned and so procedures for collecting information were chosen because one evaluator could accomplish them with a little help from one or two other evaluators. The other constraint was time. The evaluation was scheduled to take place Winter semester 2007, which only created a three and a half month time frame to collect information. The schedule to collect the information includes a realistic timeline (three and a half months). The design of evaluation and the constraints on it did not accommodate engaging locals to help conduct the evaluation. The data collection procedure that was part of routine events was the classroom observations.

F2 Political Viability

1. Anticipate different positions of different interest groups-Yes
2. Avert or counteract attempts to bias or misapply the findings-Yes
3. Foster cooperation-Yes
4. Involve stakeholders throughout the evaluation-Yes
5. Agree on editorial and dissemination authority-Yes
6. Issue interim reports-Yes
7. Report divergent views-Yes
8. Report to right-to-know audiences-Yes
9. Employ a firm public contract-No
10. Terminate any corrupted evaluation-Yes

It was anticipated that stakeholders at the CTL would be interested in both the technical issues of the evaluation as well as the instructional methods; where as professors interested in the report may be more interested in the section on the instructional methods. Both sections were included in the report in full detail to accommodate both interests. Findings were reported objectively and were reviewed by other evaluators involved in the evaluation to ensure the lead evaluator did not misapply the findings. Stakeholders at the CTL have been involved throughout the evaluation. The CTL has the authority to disseminate the final report to all right-to-know audiences since they are the client that requested and paid for the evaluation. Divergent views in the findings were reported in the final report. A formal proposal was written and approved for the evaluation but there was no formal public contract. The evaluation did not become corrupted and so was not terminated.

F3 Cost Effectiveness

1. Be efficient—Yes
2. Make use of in-kind services—Yes
3. Produce information worth the investment—Yes
4. Inform decisions—Yes
5. Foster program improvement—Yes
6. Provide accountability information—Yes
7. Generate new insights—Yes
8. Help spread effective practices—Yes
9. Minimize disruptions—Yes
10. Minimize time demands on program personnel—Yes

Evaluators were as efficient as possible while collecting the data. Classroom observations were not as efficient because each one took approximately an hour. The interviews with professors lasted anywhere from 10-30 minutes, which did not go over the allotted time the evaluator scheduled with them. The evaluator made use of services within the CTL. The data collected was valuable to stakeholders. Stakeholders at CTL should be able to use the information to develop the program to better support it's users (professors and students). Accountability information has been given for the CTL in general, but not for one specific individual because many individuals are involved in its administration. New insights were generated from the data that was collected; the intent of the evaluation was to also spread better instructional practices among professors using iClicker. This is partially dependent on the CTL developing a guide for effective instructional methods for professors to use with the SRS. Disruptions to participants were minimized to the best ability of the evaluator. The main disruption was entering the classrooms; however, the evaluators sat near the back and simply watched and listened and did not disrupt the lecture. There were no significant time demands placed on program personnel as a result of the evaluation.

Propriety P1 Service Orientation

1. Assess needs of the program's customers—Yes
2. Assess program outcomes against targeted customers' assessed needs—Yes
3. Help assure that the full range of rightful program beneficiaries are served—Yes
4. Promote excellent service—Yes
5. Make the evaluation's service orientation clear to stakeholders—Yes
6. Identify program strengths to build on—Yes

7. Identify program weaknesses to correct—Yes
8. Give interim feedback for program improvement—Yes
9. Expose harmful practices—Yes
10. Inform all right-to-know audiences of the program's positive and negative outcomes—Yes

Negative and positive information from the evaluation was reported. Needs of users were assessed and users reported how well they felt the system was meeting their needs in the evaluation. Interim feedback was given in the evaluation, consisting of a written report and verbal communication with stakeholders at the CTL. The evaluation has sought to assure the full range of program beneficiaries are served and promote excellent service by providing information for administrators at the CTL to develop support materials for users of iClicker. The orientation of the evaluation was detailed in the proposal. Program strengths and weaknesses have been identified in the final report. The interim report provided some general feedback for program improvement. No “harmful” practices were exposed, but there were some less helpful practices that students perceived that has been reported. All right-to-know audiences will have access to the report which contains positive and negative outcomes from the evaluation.

P2 Formal Agreements

Reach advance written agreements on:

1. Evaluation purpose and questions –Yes
2. Audiences—Yes
3. Evaluation reports—Yes

4. Editing—No
5. Release of reports—Yes
6. Evaluation procedures and schedule—Yes
7. Confidentiality/anonymity of data—Yes
8. Evaluation staff—Yes
9. Metaevaluation—Yes
10. Evaluation resources—Yes

All of the information above was included in the evaluation proposal, except the editing. There will be no outside source contracted for the editing of the evaluation report; it will be done within the CTL.

P3 Rights of Human Subjects

1. Make clear to stakeholders that the evaluation will respect and protect the rights of human subjects—Yes
2. Clarify intended uses of the evaluation—Yes
3. Keep stakeholders informed—Yes
4. Follow due process—Yes
5. Uphold civil rights—Yes
6. Understand participant values—Yes
7. Respect diversity—Yes
8. Follow protocol—Yes
9. Honor confidentiality/anonymity agreements—Yes
10. Do no harm—Yes

All data that was collected had informed consent from participants. IRB approval was obtained for the evaluation, which ensured the proper treatment of all participants.

P4 Human Interactions

1. Consistently relate to all stakeholders in a professional manner—Yes
2. Maintain effective communication with stakeholders—Yes
3. Follow the institution's protocol—Yes
4. Minimize disruption—Yes
5. Honor participants' privacy rights—Yes
6. Honor time commitments—Yes
7. Be alert to and address participants' concerns about the evaluation—Yes
8. Be sensitive to participants' diversity of values and cultural differences—Yes
9. Be even-handed in addressing different stakeholders—No
10. Do not ignore or help cover up any participants incompetence, unethical behavior, fraud, waste, or abuse—Yes

Evaluators employed by the CTL working on this project maintained professional behavior in all interactions with stakeholders and participants. Protocol established by the institution was followed. Data collection methods did not overstep the time allotted for each procedure which helped ensure the disruptions on participants were minimized and time commitments were honored. IRB approval was obtained for this evaluation which ensured participants privacy and rights were honored. The evaluator was even-handed in addressing different stakeholders; however, since the CTL was the client and the evaluation was designed to address their questions, other stakeholders' (professors and

students) questions were not addressed. Ethical behavior was upheld during the evaluation; no unethical behavior was ignored or covered up during the evaluation.

P5 Complete and Fair Assessment

1. Assess and report the program's strengths _-Yes
2. Assess and report the program's weaknesses -Yes
3. Report on intended outcomes -Yes
4. Report on unintended outcomes -Yes
5. Give a thorough account of the evaluation's process -Yes
6. As appropriate, show how the program's strengths could be used to overcome its weaknesses -Yes
7. Have the draft report reviewed-Yes
8. Appropriately address criticisms of the draft report -Yes
9. Acknowledge the final report's limitations –Yes
10. Estimate and report the effects of the evaluation's limitations on the overall judgment of the program-Yes

The final report is fair and complete. It addresses each evaluation question as objectively as possible using the data collected to support the conclusions. Challenges encountered during the evaluation have been reported. Limitations of the evaluation have been reported and how that affected judgments made by the evaluators. A discussion of the strengths of iClicker and how those may be used to address weaknesses in using it has been included in the final report. Other evaluators at the CTL as well as several faculty members at Brigham Young University have reviewed the draft of the final report.

Criticisms and suggestions for improvements to the draft report were addressed. The reports limitations were acknowledged. Limitations of the evaluation were acknowledged and included a description of how the limitations may have affected judgments about the program.

P6 Disclosure of Findings

1. Define the right-to-know audiences-Yes
2. Establish a contractual basis for complying with right-to-know requirements -Yes
3. Inform the audiences of the evaluation's purposes and projected reports -Yes
4. Report all findings in writing -Yes
5. Report relevant points of view of both supporters and critics of the program -Yes
6. Report balanced, informed conclusions and recommendations -Yes
7. Show the basis for the conclusions and recommendations -Yes
8. Disclose the evaluation's limitations -Yes
9. In reporting, adhere strictly to a code of directness, openness, and completeness -
Yes
10. Assure that reports reach their audiences-Yes

The evaluation proposal stated that the final report would be available to the audience through the CTL. The right-to-know audiences were formally defined in the final report; however, since the project fulfills a project requirement for Coral Hanson it will be published in the BYU library and online enabling access of almost any individual. Also the evaluation does not contain identifying information of any individual involved and does not contain sensitive information. Audiences were not allowed to access the raw

data since that did contain some identifying information from participants. Audiences were informed of the evaluation purpose and of the schedule for the projected reports in the proposal. All of the findings from the evaluation have been reported in writing in the final report. The final report gave both the negative and positive information from participants. Limitations of the evaluation have been disclosed in the final report. The report has been written to the best of the lead evaluator's ability to be direct, open and complete. All conclusions and recommendations will be supported by the information in the report. All audiences that have specifically stated they would like to see the report were sent a copy of it.

P7 Conflict of Interest

1. Identify potential conflicts of interest early in the evaluation -Yes
2. Provide written, contractual safeguards against identified conflicts of interest -Yes
3. Engage multiple evaluators -Yes
4. Maintain evaluation records for independent review -Yes
5. As appropriate, engage independent parties to assess the evaluation for its susceptibility or corruption by conflicts of interest -No
6. When appropriate, release evaluation procedures, data, and reports for public review -Yes
7. Contract with the funding authority rather than the funded program -No
8. Have internal evaluators report directly to the chief executive officer -Yes
9. Report equitably to all right-to-know audiences -No
10. Engage uniquely qualified persons to participate in the evaluation, even if they have a potential conflict of interest; but take steps to counteract the conflict-No

Conflicts of interest were identified and addressed in the evaluation proposal. The proposal stated if conflicts of interest arose with the evaluator, the evaluator would be replaced. Two evaluators were engaged in the evaluation. Other evaluators were also involved in constructing the instruments to collect the data and making revisions to them. Evaluation records have been maintained and are available for other evaluators at the CTL to review if desired. The records will not be made available for independent review outside of the CTL because of identifying information contained in them of participants. Resources were not available to engage independent parties outside of the CTL to assess the evaluation. The final report will release the evaluation data and procedures to the public. The CTL was the funding authority of the evaluation and the authority of the funded program. The only part of the funding of the program the CTL is not responsible for is student clickers; students purchase those themselves. The lead evaluator reports directly to the Director of Evaluation who reports directly to the Director of the Center for Teaching and Learning. Several uniquely qualified persons have participated in the evaluation. They were uniquely qualified by either their expertise in evaluation or previous research done on student response systems.

P8 Fiscal Responsibility

1. Specify and budget for expense items in advance -Yes
2. Keep the budget sufficiently flexible to permit appropriate reallocations to strengthen the evaluation -Yes
3. Obtain appropriate approval for needed budgetary modifications -Yes
4. Assign responsibility for managing the evaluation finances -Yes
5. Maintain accurate records of sources of funding and expenditures -Yes

6. Maintain adequate personnel records concerning job allocations and time spent on the job -Yes
7. Employ comparison shopping for evaluation materials -Yes
8. Employ comparison contract bidding -No
9. Be frugal in expending evaluation resources -Yes
10. As appropriate, include an expenditure summary as part of the public evaluation report-Yes

The schedule and budget were specified in advance in the evaluation proposal. The budget was flexible and was adjusted based on the needs of the evaluation. Approval was obtained for modifications in the budget for gift cards for the student focus groups. Project managers at the CTL managed the evaluation budget and kept records of expenditures. Personnel at the CTL are required to record how many hours are spent on each project; the evaluators working on this project logged their hours accordingly. Comparison shopping was done for the food purchased for the evaluation and the most inexpensive route was chosen. There were no contract resources needed for the evaluation; hence, there was no comparison for contract bidding. A table including the schedule and budget has been included in the final report.

Accuracy A1 Program Documentation

1. Collect descriptions of the intended program from various written sources -Yes
2. Collect descriptions of the intended program from the client and various stakeholders -Yes
3. Describe how the program was intended to function -Yes

4. Maintain records from various sources of how the program operated -Yes
5. As feasible, engage independent observers to describe the program's actual operations -No
6. Describe how the program actually functioned -Yes
7. Analyze discrepancies between the various descriptions of how the program was intended to function -No
8. Analyze discrepancies between how the program was intended to operate and how it actually operated -Yes
9. Ask the client and various stakeholders to assess the accuracy of recorded descriptions of both the intended and the actual program -Yes
10. Produce a technical report that documents the program's operations –Yes

There was a brief description of the program collected from the CTL website.

Descriptions were collected from the client. A description of how the program should function was included in the client's criteria in the final report. Data was collected using multiple methods about how the program was actually functioning was described in the final report. The evaluation design did not engage independent observers because of the time constraints and limited availability of independent observers. A discussion of how the program operated and how the client said it should operate is included in the final report. The client reviewed the description of how the program should function in the evaluation proposal. The final report is the technical report that documents the program.

A2 Context Analysis

1. Use multiple sources of information to describe the program's context -Yes
2. Describe the context's technical, social, political, organizational, and economic features -Yes
3. Maintain a log of unusual circumstances -Yes
4. Record instances in which individuals or groups intentionally or otherwise interfered with the program -Yes
5. Record instances in which individuals or groups intentionally or otherwise gave special assistance to the program -Yes
6. Analyze how the program's context is similar to or different from contexts where the program might be adopted -Yes
7. Report those contextual influences that appeared to significantly influence the program and that might be of interest to potential adopters -Yes
8. Estimate effects of context on program outcomes -Yes
9. Identify and describe any critical competitors to this program that functioned at the same time and in the program's environment -Yes
10. Describe how people in the program's general area perceived the program's existence, importance, and quality –Yes

Data was collected using multiple methods about how the program was actually functioning and was described in the final report. The context of the program at the CTL has been described. Contextual influences that appear to significantly influence the program have been recorded (for example, the fact that at BYU students are required to

purchase their own clicker). A log of unusual circumstances was not specifically kept but was recorded in the data if there were any. Special assistance to the program was recorded in the data collected, such as professors mentioning assistance from the computer support representative in their office. A description of the programs similarities to other contexts was included in the introduction of the final report. Contextual influences that appeared to significantly influence the program were reported in the final report (cost, etc.). Estimates of the context or critical competitors of the program, such as year in school, and graduation requirement on the program outcomes were given in the final report. Only participants were asked about their experience with the program (iClicker) because of the scope of the evaluation and limited resources.

A3 Described Purposes and Procedures

1. At the evaluation's outset, record the client's purposes for the evaluation -Yes
2. Monitor and describe stakeholders' intended uses of evaluation findings -Yes
3. Monitor and describe how the evaluation's purposes stay the same or change over time -Yes
4. Identify and assess points of agreement and disagreement among stakeholders regarding the evaluation's purposes -No
5. As appropriate, update evaluation procedures to accommodate changes in the evaluation's purposes -Yes
6. Record the actual evaluation procedures, as implemented -Yes
7. When interpreting findings, take into account the different stakeholders' intended uses of the evaluation -Yes

8. When interpreting findings, take into account the extent to which the intended procedures were effectively executed -Yes
9. Describe the evaluation's purposes and procedures in the summary and full-length evaluation reports -Yes
10. As feasible, engage independent evaluators to monitor and evaluate the evaluation's purposes and procedures –No

The client's purposes for the evaluation and their intended uses of it were recorded in the evaluation proposal. Evaluation procedures have remained the same over the course of the evaluation. Changes were made to the student survey to condense it and to the student focus group questions to mirror the changes made in the student survey. The procedures of the evaluation have been recorded in the final report. The interpretation of the findings and organization took into account the intended uses of the evaluation, such as developing instructional support on effective instructional methods to use with iClicker. The evaluation procedures and purposes were described fully in the final report. It was not feasible (no resources available) to engage independent evaluators outside of the CTL to monitor the evaluation purposes and procedures.

A4 Defensible Information Sources

1. Obtain information from a variety of sources -Yes
2. Use pertinent, previously collected information once validated -Yes
3. As appropriate, employ a variety of data collection methods -Yes
4. Document and report information sources -Yes

5. Document, justify, and report the criteria and methods used to select information sources -Yes
6. For each source, define the population -Yes
7. For each population, as appropriate, define any employed sample -Yes
8. Document, justify, and report the means used to obtain information from each source -Yes
9. Include data collection instruments in a technical appendix to the evaluation report -Yes
10. Document and report any biasing features in the obtained information –Yes

For the purposes of this evaluation, information was obtained from the participants in the program (professors and students). Previously conducted research from other institutions was cited in the literature review. A variety of data collection methods were used. Information sources and the methods that collected the information have been documented in the final report. A description of the reasons for choosing data collection methods is included in the report. The populations and samples have been defined. All data collection instruments have been included in appendices of the final report. Any biases in the information have been reported.

A5 Valid Information

1. Focus the evaluation on key questions -Yes
2. As appropriate, employ multiple measures to address each question -Yes
3. Provide a detailed description of the constructs and behaviors about which information will be acquired -Yes

4. Assess and report what type of information each employed procedure acquires -
Yes
5. Train and calibrate the data collectors -Yes
6. Document and report the data collection conditions and process-Yes
7. Document how information from each procedure was scored, analyzed, and
interpreted -Yes
8. Report and justify inferences singly and in combination -Yes
9. Assess and report the comprehensiveness of the information provided by the
procedures as a set in relation to the information needed to answer the set of
evaluation questions -Yes
10. Establish meaningful categories of information by identifying regular and
recurrent themes in information collected using qualitative assessment
procedures-Yes

The evaluation focused on the questions clients wished to have answered. Multiple methods were employed to answer each question. A description of what information each method or question will collect has been included. The other evaluator that aided in the data collection was trained by the lead evaluator on the protocol for collecting the data. The data collection methods have been described and documented in the final report. Information on how the results were analyzed is included. The report justified judgments and inferences from the combination of data collected. A description of the comprehensiveness of the material collected and limitations has been recorded in the final report. A table has been provided with the evaluation questions and the data collection

procedures in addition to the discussion. Qualitative analysis identified themes in the data.

A6 Reliable Information

1. Identify and justify the type(s) and extent of reliability claimed -Yes
2. For each employed data collection device, specify the unit of analysis-Yes
3. As feasible, choose measuring devices that in the past have shown acceptable levels of reliability for their intended uses -No
4. In reporting reliability of an instrument, assess and report the factors that influenced the reliability, including the characteristics of the examinees, the data collection conditions, and the evaluator's biases -Yes
5. Check and report the consistency of scoring, categorization, and coding -Yes
6. Train and calibrate scorers and analysts to produce consistent results -Yes
7. Pilot test new instruments in order to identify and control sources of error-Yes
8. As appropriate, engage and check the consistency between multiple observers-
Yes
9. Acknowledge reliability problems in the final report -Yes
10. Estimate and report the effects of unreliability in the data on the overall judgment of the program-Yes

A description of how reliability will be maintained for each instrument was provided in the proposal. The methods described were followed during the evaluation. How each data set was analyzed has been included in the final report. Specific instruments were created for this evaluation, so it was not possible to choose measuring devices previously

used. A description of factors that may have influenced the instruments reliability has been included in the final report. The other evaluator that helped conduct the classroom observations and student focus groups was trained in each method's protocol. For the classroom observations, a sheet with questions (protocol) was used to help ensure consistency between observers. Instruments were piloted; needed changes were identified in the student survey as a result of piloting the instruments. Reliability problems and consistency between the evaluators has been reported in the final report. The final report includes an estimate of the effects of unreliability in the data on the overall judgments made about the program.

A7 Systematic Information

1. Establish protocols for quality control of the evaluation information -Yes
2. Train the evaluation staff to adhere to the data protocols -Yes
3. Systematically check the accuracy of scoring and coding- Yes
4. When feasible, use multiple evaluators and check the consistency of their work -
Yes
5. Verify data entry-Yes
6. Proofread and verify data tables generated from computer output or other means -
Yes
7. Systematize and control storage of the evaluation information -Yes
8. Define who will have access to the evaluation information -Yes
9. Strictly control access to the evaluation information according to established
protocols -Yes
10. Have data providers verify the data they submitted-Yes

Evaluators were trained in the protocol for the interviews, focus groups, and classroom observations. Only two evaluators worked on the evaluation. This was due to the fact that the other evaluators were busy with their own projects and the main evaluator worked more and so had time to collect the data on her own. The two evaluators' results from the classroom observations were checked against each others. The lead evaluator did all of the data entry (transcribing) and verified what was recorded from the tapes by replaying them. The storage of the evaluation data was maintained by the lead evaluator on a USB drive or the evaluator's own work computer. Who had access to the data was defined in the proposal; no other individuals were given access to the data that were not defined in the proposal and IRB application.

A8 Analysis of Quantitative Information

1. Begin by conducting preliminary exploratory analyses to assure the data's correctness and to gain a greater understanding of the data -Yes
2. Choose procedures appropriate for the evaluation questions and nature of the data -Yes
3. For each procedure specify how its key assumptions are being met -Yes
4. Report limitations of each analytic procedure, including failure to meet assumptions -Yes
5. Employ multiple analytic procedures to check on consistency and replicability of findings -Yes
6. Examine variability as well as central tendencies -Yes
7. Identify and examine outliers and verify their correctness -Yes
8. Identify and analyze statistical interactions -Yes

9. Assess statistical significance and practical significance -Yes
10. Use visual displays to clarify the presentation and interpretation of statistical results-Yes

Simple descriptive statistics were run on the quantitative data and the lead evaluator read through the qualitative data to gain a general sense of the data. Appropriate data analysis procedures were chosen for the data to answer the evaluation questions. The assumptions of each data analysis procedure and limitations have been explained in the final report. Descriptive statistics and tests of significance will be used. Visual displays of the data have been included in the final report.

A9 Analysis of Qualitative Information

1. Focus on key questions -Yes
2. Define the boundaries of information to be used -Yes
3. Obtain information keyed to the important evaluation questions -Yes
4. Verify the accuracy of findings by obtaining confirmatory evidence from multiple sources, including stakeholders -Yes
5. Choose analytic procedures and methods of summarization that are appropriate to the evaluation questions and employed qualitative information -Yes
6. Derive a set of categories that is sufficient to document, illuminate, and respond to the evaluation questions -Yes
7. Test the derived categories for reliability and validity -No
8. Classify the obtained information into the validated analysis categories -Yes

9. Derive conclusions and recommendations and demonstrate their meaningfulness -
Yes

10. Report limitations of the referenced information, analyses, and inferences-Yes

Qualitative data focused on questions stakeholders at the CTL wished to have answered. The information to be used and collected was defined in the proposal. Multiple sources and methods were used to collect the data for the evaluation questions. The qualitative data was appropriate for the type of data collected. The categories to respond to the evaluation questions are organized around specific questions from each of the data collection methods. Conclusions and recommendations have been derived from the data. Limitations from the qualitative data have been listed in the final report.

A10 Justified Conclusions

1. Focus conclusions directly on the evaluation questions -Yes
2. Accurately reflect the evaluation procedures and findings -Yes
3. Limit conclusions to the applicable time periods, contexts, purposes, and activities
-Yes
4. Cite the information that supports each conclusion -Yes
5. Identify and report the program's side effects -Yes
6. Report plausible alternative explanations of the findings -Yes
7. Explain why rival explanations were rejected -Yes
8. Warn against making common misinterpretations -Yes
9. Obtain, address results of a prerelease review of the draft evaluation report -Yes
10. Report the evaluation's limitations-Yes

The report results and conclusions have been focused on the evaluation report. Procedures and findings were reported accurately. All conclusions were supported by information collected in the evaluation. Side effects of the program were reported in the final report. Any plausible alternative explanations of the findings were reported in the final report. Warnings were given in the final report against misinterpreting the data. The evaluation report was reviewed by the evaluation supervisor and several faculty members at BYU before it was released to other administrators at the CTL and right-to-know audiences. The final report will contain a section detailing limitations of the evaluation.

All Impartial Reporting

1. Engage the client to determine steps to ensure fair, impartial reports -Yes
2. Establish appropriate editorial authority -Yes
3. Determine right-to-know audiences -Yes
4. Establish and follow appropriate plans for releasing findings to all right-to-know audiences -Yes
5. Safeguard reports from deliberate or inadvertent distortions -Yes
6. Report perspectives of all stakeholder groups -Yes
7. Report alternative plausible conclusions -Yes
8. Obtain outside audits of reports -No
9. Describe steps taken to control bias -Yes
10. Participate in public presentations of the findings to help guard against and correct distortions by other interested parties -Yes

The client has reviewed the report to ensure that it is fair and impartial. The Director of Evaluation at the CTL had the final editorial authority in the project. Right-to-know audiences were stated in the final report, but the report will also be generally available. The plan for releasing the report to the client and evaluation participants was followed. The report was objective and reflected the actual results obtained. Plausible alternative conclusions were also included in the final report. A description of steps taken to control bias was included in the final report. The evaluators are independent from the client and so will not write the report according to what the client wishes to hear. One public representation of the evaluation was given.

A12 Metaevaluation

1. Designate or define the standards to be used in judging the evaluation -Yes
2. Assign someone responsibility for documenting and assessing the evaluation process and products -Yes
3. Employ both formative and summative metaevaluation -Yes
4. Budget appropriately and sufficiently for conducting the metaevaluation -Yes
5. Record the full range of information needed to judge the evaluation against the stipulated standards -Yes
6. As feasible, contract for an independent metaevaluation -No
7. Determine and record which audiences will receive the metaevaluation report -
Yes
8. Evaluate the instrumentation, data collection, data handling, coding, and analysis against the relevant standards -Yes

9. Evaluate the evaluation's involvement of and communication of findings to stakeholders against the relevant standards -Yes
10. Maintain a record of all metaevaluation steps, information, and analyses –Yes

Stufflebeam's 30 meta-evaluation standards were chosen to use for the metaevaluation. The lead evaluator documented and assessed the evaluation process using the 30 standards. There were resources to contract for an independent metaevaluation. The metaevaluation was included in the final report and so was made available to participants in the study and the client. The methods and procedures of data collection and analysis were compared against the standards. This report is the summative metaevaluation.