Formative Assessment to Support Agile Teaching and Active Learning: A Case in Auditing Education Using the I-clicker Classroom Response System

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ABSTRACT

Significant changes in the field of auditing suggest an urgent need to employ educational methods that will enhance student learning. This paper describes a pedagogical approach using formative assessments for active learning method within the context of an auditing class. The focus of this study is on the pedagogy, with the use of classroom response systems for administering formative assessment. A survey is used to assess student perceptions of the use of i-clickers a comparative analysis is performed to review limited summary data from traditional and active-learning classes. Results show that students perceive benefits to their learning and meta-cognition.

INTRODUCTION

Auditing education is experiencing a period of rapid change (Johnson, Baird, Caster, Dilla, Earley, and Louwers, 2003). Increasing incidences of fraud and bankruptcies have had a negative impact on the public's confidence in the field of accounting and, specifically, auditing (Kahn, 2002; Zebihollah, 2004). The nature of the most frequent accounting frauds involves the overstatement of revenues and fictitious transactions, both of which increase the likelihood that auditors could be charged with negligence in their failure to detect the fraud (Zebihollah, 2004). At the same time, auditing education has become more complex due to the increasing number of accounting standards, changes in content (Johnson et al., 2003), proliferation of technology (Johnson, et al., 2003; Williams, 1993), and globalization (Johnson et al, 2003). In addition to growing expectations for public accountants, expectations for internal auditors are also increasing with emphasis on graduate degrees in business and certifications in either internal or public accounting being held by over 50% of internal auditors responding to a recent global research study (Steffee, 2011). The nature of these influences suggest an increasing importance to auditing education and an urgent need to employ educational methods that will enhance learning so that students are effectively prepared to address the growing challenges in the field of auditing.

This paper describes a pedagogical approach that implemented formative assessments as an active learning method (Bonwell & Eison, 1991) within the context of an undergraduate auditing class. The approach used in this case utilizes question-driven instruction (Beatty, Leonard, Gerace, & Dufresne, 2006b) as well as a constructivist framework (Beatty & Gerace, 2009) to support active learning. The focus of this study is on the pedagogy within auditing education, with the use of i-clickers CR system as a mechanism for administering formative assessment (Gray & Steer, 2012; Judson & Sawada, 2002). The integration of i-clickers within a targeted pedagogy is designed to align with Chickering and Gamson's (1987) seven principles for good practice in undergraduate education including active learning, prompt feedback, communication of high expectations and respect for diverse ways of learning. The implementation of formative assessment as a pedagogical approach resulted in a transformation of the learning environment by requiring a shift in roles for the faculty member and students, as the pedagogy changed from directed instruction to active learning (Bonwell & Eison, 1991).

The literature for this paper evolves from several threads which can be viewed as integral to the delivery of a question-based instructional approach including active learning, formative assessment as a form of active learning, agile teaching and the use of classroom response systems as a means to support the pedagogy. The literature suggests that technology should serve

as a tool to support pedagogy, rather than driving pedagogy (Gray & Steer, 2012; Judson & Sawada, 2002). The study also presents evaluations based on a student survey and some comparative data which offers a basis for further research.

LITERATURE REVIEW

Challenges in Auditing Education

Both historical and current research on the subject of auditing education suggests that this topic is challenging for students. Kanter and Pitman (1987) discussed challenges in auditing education, noting a tension between theory and practice in education courses, and indicating that debate between practitioners and educators about the direction, content and emphasis in auditing education has waged for years.

Increasing complexity also challenges accounting and auditing approaches that were designed decades earlier, many of which need to evolve to meet changes in the business environment (Kahn, 2002). Given the global business environment, the role of accountants is expanding and curricula and teaching methods may not keep pace with growing expectations (Uyar & Gungormus, 2011)

A review of the literature also indicates that the quality of auditing education is of international concern because of the challenges and complexities associated with global commerce and diverse cultures, which can increase risk (Johnson et al., 2003; Vinten, 2003). International fraud has emerged as an issue with the literature noting that there is no centralized or universal fraud statute (Vinten, 2003). Enron, Worldcom and other U.S. based frauds have international interest with other countries considering their exposure for similar incidents (Vinten, 2003). One Canadian journal article suggests that broad accounting and auditing reform is needed within the nation's accounting programs to address a string of Canadian financial failures, changes in the profession and growing business risks (Rosen, 2006). Academia and licensing agencies within the U.S. have responded to these challenges with many states adopting a 150-hour education requirement for certified public accountants as well as broad redesign of accounting curricula (Johnson et al., 2003).

In addition, auditing education is also affected by literacy challenges due to the technical vocabulary, theoretical content, nuanced text, and changing needs and expectations of the millennial generation of learners (Flint, 2011). A study conducted by Johnson et al. (2003) noted that auditing courses employ a range of learning activities, and that textbooks were cited as the most commonly used channel for learning. Their study also compared current pedagogical methods with those identified in an earlier study, noting a considerable shift in pedagogy from textbook-heavy activities towards additional methods such as case studies, group work and presentations (Johnson, et al., 2003).

Aside from the challenges and complexities inherent in the content, successful performance of an audit is dependent upon significant judgment and sound business ethics (Zabihollah, 2004).

Active Learning

Bonwell and Eison (1991) define active learning as "instructional activities involving students in doing things and thinking about what they are doing" (p. 2). They indicate that activities such as reading, writing, discussion or problem-solving in which students are engaged

in "higher-order thinking tasks such as analysis, synthesis, and evaluation" (p. 2) constitute examples of active learning (Bonwell & Eison, 1991).

Bonwell and Eison (1991) suggest that students may resist active learning because they are more accustomed to passive learning and view themselves as receivers of information. Other research suggests that students prefer teaching methods that incorporate active learning strategies over traditional lecture formats which are thought to limit students' learning (Bruff, 2009). At the same time, Kolikant, Drane & Calkins (2010) believe that in-class interaction helps students transform from passive note-takers to active learners. The feedback lecture and discussion are cited as two alternate formats that increase participation and engagement (Bonwell & Eison, 1991).

Bonwell and Eison (1991) offer potential obstacles to active learning such as concerns about the ability to adequately cover course material in the limited class time available, the increase in lesson preparation time, and lack of materials or resources. In addition, active learning carries perceived risks including the risk that students will not participate and the potential feelings of loss of control on the part of faculty members. To limit these concerns, the researchers suggest employing low-risk strategies that involve structured timeframes and content that is not too abstract, and that is familiar to the faculty member and student (Bonwell & Eison, 1991). Certain obstacles cited by Bonwell and Eison in 1991 may be somewhat less of a concern given advances in the development of computer-based educational materials and technology since the time of their research.

Formative Assessment as Active Learning

Formative assessment is grounded in the belief that active interaction between faculty and students forms the basis for learning (Black and Wiliam, 1998b). Early research by Black and Wiliam, (1998a; 1998b) identified formative assessment as an essential activity to support learning. In attempting to define formative assessment, Sadler (1989) indicated that, by evaluating student work, instruction may be more targeted to meet student needs, as well as being more efficient. He contrasts formative assessment with summative assessment, which focuses on the culmination and assessment of all work within a course for the purpose of concluding on the totality of a student's performance (Sadler, 1989). Sangster (1995) noted that much of the literature on assessment in accounting focused on summative assessment in the early 1990s, and he called for research into the extent to which formative assessment might contribute to better student outcomes on summative assessments.

An extensive review of 250 research studies on formative assessment revealed that formative assessment improves academic outcomes for students, particularly low achievers and students with learning disabilities (Black & Wiliam, 1998b). The studies were conducted within the context of various subjects and several countries.

Formative assessment serves to provide insight for faculty regarding student learning, as well as information to students as to their level of learning (Nolen, 2011; Sadler, 1989). Fluckinger, Vigil, Pasco and Danielson (2010) suggest that faculty and students are partners in formative assessment and that formative assessment provides feedback within a sufficient time for students to assess their own learning and modify their learning strategies prior to a summative assessment. Black and Wiliam (2009) agree that both instructor and student are responsible for learning and both are also responsible for taking actions to ensure that the contributions of the other are successful. Through formative assessment, faculty can identify student needs, which will likely vary between students, and adjust their teaching based on

student needs (Black and Wiliam, 1998b). The quality of feedback has a direct impact on learning outcomes; therefore, it is an essential pedagogical element (Black and Wiliam, 2009). In addition, Judson and Sawada (2002) note that question design is critical in achieving conceptual understanding, and in identifying misunderstandings or misconceptions, while Sadler (1989) suggests that formative assessment, when incorporated with effective feedback, can help students form linkages that contribute to more meta-cognition.

Some researchers suggest that formative assessment serves to motivate students. Bonwell and Eison (1991) noted that short quizzes serve as an active learning method and that modifying lessons to include short quizzes is a way to engage students in the material. They also note that quizzes serve to motivate students to study, but caution that the format of quizzes can affect or limit the focus of students' studying. For example, students' expectation of a multiple-choice quiz might direct their focus towards the retention of facts, rather than conceptual or theoretical knowledge (Bonwell & Eison, 1991). Beatty et al. (2006b) and Beatty and Gerace (2009) refer to question-driven instruction, in which the questions drive the instructional focus and note that it can be used to motivate students and supports the constructivist theory of sense-making as a learning approach.

Black and Wiliam (1998a), indicate that feedback is an important aspect of formative assessment and suggest four elements of an effective feedback system including a reference attribute an actual measurement of performance against the attribute, a process to compare the two and a method by which this data may be used to affect the gap. Similarly, Sadler (1989), notes that feedback provides information about knowledge gaps, and provides useful data for both faculty and students. Black and William (2009) note that classroom questioning is one way to initiate discussion and gain insight into students' comprehension. Kingston and Nash (2011) found that formative assessment had a greater impact on professional development or when delivered in a computer-based format.

While much of the research on formative assessment focuses on advantages and pedagogy, Bennett (2011) concluded that the definition of formative assessment and a set of well-defined elements for formative assessment have not been established. He also charges that quantitative evidence for the effectiveness of formative assessment overstates the significance of learning outcomes and lacks credibility because of being derived from "untraceable, flawed, dated or unpublished sources" (p5). He specifically critiques a number of studies, including Black and Wiliam (1998b), indicating that the study, although considered one of the most significant studies in the field of formative assessment, has limited validity in that it compares dissimilar studies and overstates the effects of formative assessment (Bennett, 2011). Sadler (1989) points out that even when formative assessment is specific, targeted and constructive, it may still not result in increases in active learning or student outcomes.

Agile Teaching

Based on the discussion of formative assessment, one key advantage is that the assessment provides information that can inform the lesson (Black & Wiliam, 1998a; 1998b; Sadler, 1989). "Agile teaching" refers to an approach in which instructors may shift the direction or focus of a lesson based on the cognitive needs of the students (Beatty et al., 2006b). Question-driven instruction using CR systems can provide the insight necessary for instructors to gauge student comprehension and then adjust lessons based on the needs identified. Further, the i-clicker technology provides immediate feedback which then allows the lesson to evolve in a student-centered approach (Beatty et al., 2006b). According to Bruff (2009), the concept of agile

teaching reflects student-driven teaching, as it relies on the identification of student learning gaps as the basis for instructor focus. He also indicates that classroom response systems can serve as a formative assessment to support agile teaching when they are used to provide feedback to inform teaching and learning.

In addition to the focus on student learning, Kolikant et al. (2010) focused on the potential impact of classroom response systems on instructor meta-cognition. This concept of instructor meta-cognition is not well covered in the literature, and holds potential for ongoing research. They noted that student responses provide an ongoing opportunity for instructors to gain insight into student challenges which "brought about a transformation in their conceptions of teaching, and in their approaches to teaching" (p. 133).

Classroom Response Systems

The use of classroom response (CR) systems has expanded in higher education, but their impact on student outcomes is linked to the integration of this technology within a sound pedagogical framework (Beatty, et al., 2006b). CR systems offer an opportunity for faculty to revolutionize the approach to lesson design and instruction. When integrated into lesson design, the opportunity for formative assessment can offer insight into student comprehension in real time in order to inform the focus of the lesson (Beatty et al., 2006b; Bruff, 2009). Based on student outcomes, faculty can identify concepts that need reinforcement of clarification (Beatty et al., 2006b; Beatty & Gerace, 2009; Bruff, 2009).

Literature on the subject of auditing education suggests the use of technology to support student learning (Patten & Williams, 1990). Classroom response systems permit students to respond to instructor's questions using an electronic transmission device that captures each student's individual response and tallies group responses. Instructors may pose questions using multi-media presentations or in an unstructured approach, and then capture student responses, which may be displayed anonymously in graph form and subsequently captured in individual performance reports for faculty review (Beatty et al., 2006b; Bruff, 2009; Judson & Sawada, 2002). This study utilizes the terms classroom response (CR) systems and i-clickers interchangeably, as the I-clicker device was specifically utilized for this study.

Classroom response systems have a long history of use within the field of science education, with studies dating back to the 1960s. While early research showed no correlation between the use of CR systems and increased academic achievement, student perception of increased learning was identified in several of the studies reviewed by Judson and Sawada (2002).

A historical review of the literature indicates that the multiple-choice format has been the predominant format for questions used in conjunction with CR systems (Judson & Sawada, 2002). In addition, early research indicated that prompt feedback on student responses and the ability for instructors to gauge individual student performance while maintaining student privacy, generated early interest in CR systems (Judson & Sawada, 2002).

Recent research has focused more on pedagogy that is supported by technology, rather than emphasizing the technology. In addition, recent studies suggest that the use of these devices to support constructivist pedagogy has contributed to increases in conceptual learning, with peer-based or instructor-driven instruction being a key component of the pedagogical approach (Judson & Sawada, 2002). Their review of the literature on CR systems indicates that such systems may contribute to increases in student achievement when integrated as part of constructivist pedagogy (Judson & Sawada, 2002). Hake (1998) found that student achievement

for those engaged in courses that employed an interactive-engagement pedagogy significantly outperformed students who were enrolled in courses that utilized traditional pedagogy. Halloun & Hestenes (1985) conducted a study that involved the analysis of pre- and post-test scores in an introductory physics class, concluding that a passive, lecture-based format yielded insufficient student learning; this suggests that active student learning would be preferable in terms of learning outcomes.

In addition to the impact that the use of i-clickers is reported to have relative to student learning, Kolikant et al. (2010) conducted research on the impact on instructors when using CR systems, noting that a classroom response system "may act as a powerful catalyst to transform faculty, moving them from teacher-centered conceptions and approaches to student-centered conceptions and approaches" (p.127).

Several advantages to the use of CR systems are noted in the literature including active student engagement (Bruff, 2009; Freeman, Blayney & Ginns, 2006), as well as increased participation based on the anonymity offered by the CR systems (Freeman, et al., 2006) and the opportunity for equal participation among student in large class settings (Bergtrom, 2006). In addition, CR systems increase faculty insight regarding student comprehension and offer the opportunity to modify lessons based on immediate feedback (Beatty et al., 2006b; Bruff, 2009; Halloun & Hestenes, 1985; Kolikant et al., 2010). Kolikant et al. (2010) found that "quiet interaction" (p. 133) was important in generating information for both instructors and students, suggesting that the anonymity afforded by CR systems is of particular value for agile teaching and active learning. Martyn (2007) notes that students may enjoy using i-clickers because they employ a "game approach" which supports the concept of student engagement.

Although the literature cites advantages to CR systems, Gray and Steer (2012) found that pairing CR systems with another instructional pedagogy, specifically, peer-led learning, did not contribute to additional learning. In addition, several issues regarding the use of CR systems have been cited in the literature including cost (Bruff, 2009), potential for student dissatisfaction with the frequency of assessments/quizzes (Beatty et al., 2006b), and the potential for student dissatisfaction as they compare their performance to their peers (Bruff, 2009). In addition, students who have become comfortable with their passive roles in class may resent what they perceive as an increased responsibility for learning and engaging with the material, while the role of the faculty member shifts away from being the primary source of learning (Bruff, 2009).

METHODS

Participants

This study presents an exploration of the use of CR systems, specifically, i-clickers as a mechanism to facilitate formative assessment to achieve active student learning and to employ agile teaching within the context of six undergraduate auditing courses. This researcher has taught all six auditing classes offered since 2007 at a small, liberal arts college and began using formative assessment and i-clickers in fall 2010. The classes taught in years 2007, 2008, and 2009 followed traditional lecture-based classroom pedagogy and the three classes that were taught in 2010 and 2011 utilized formative assessment to support agile teaching and active learning.

This study will initially consider the results and experiences expressed by students in a survey that was sent to the 25 students who completed the auditing class that employed the active

learning approach using i-clickers. Of the 25 students who were solicited, 21 responded to the survey.

In addition, a brief analysis is provided that compares average test scores, average multiple-choice scores, final grades and student GPA for students in the traditional classes against those in the active learning classes that followed in subsequent years. Due to the small size of the accounting program, it would not be feasible to set up multiple, simultaneous sections for a more traditional research structure. Since 2007, the combined total of the students who were enrolled and completed the course was 63; however, the number included in the comparative study was reduced to 58 to remove students who had repeated the auditing class at least once. Students who repeated the course were removed from the study as it would be impossible to discern the extent to which changes in their performance might have been affected by having repeated exposure to the material as opposed to changes due to the use of formative assessment, active learning and i-clickers. In addition, three outliers were identified in the data, and the three were removed so as to achieve a normal data distribution; therefore, the final number of participants used for the comparative analysis totals 55. The number of student participants for this study is very limited in size; however, additional data will be gathered in future course sections. The small population size serves as a limitation in terms of being able to generalize any results, but serves as the basis for future research in auditing education. In addition, some data for the year 2007 was unavailable, as disaggregated test scores were not recorded to capture performance on multiple-choice questions.

The researcher served as instructor for each of these auditing courses, and also taught all but 13 of the students in prior Intermediate Accounting courses; consequently, the typical level of student involvement and engagement in lessons were known to the researcher based on past experience.

Materials

Materials required for this course included the book entitled *Auditing and Assurance Services: An Integrated Approach by Arens, Elder and Beasley* and published by Prentice Hall (various editions) for all classes included in the study. This book served as students' primary source of content material for all classes. In addition, I-clicker polling devices were required for classes beginning in fall 2010. To facilitate the polling process, slides were created to display multiple-choice questions derived primarily from the textbook and related instructor materials. A screen was used to display the questions as well as the polling information (time lapse and number of responses) and histograms showing student responses.

Instructional Methodology

For classes conducted from 2007 through 2009, the instructional methodology included directed instruction, in-class exercises, homework, a case study, and three tests. Beginning in 2010, the instructor implemented formative assessment using i-clickers so the instructional methodology changed to include a 15-20 minute content-based discussion that would focus on clarification of complex topics or nuanced content material, followed by an active learning session utilizing i-clickers (Flint, 2011). Some classes included in-class activities. The number of tests was increased from 3 to 4, so study units were segmented differently. The extent to which the change in the number of tests may have affected the student learning outcomes was not assessed in this study.

The following information details the specific instructional methodology using formative assessment and i-clickers. The class utilized an agile teaching philosophy in which lessons evolve during the class based on feedback obtained from students (Bruff, 2009). Although a structured lesson plan was prepared in advance for each class, a portion of each class was designated for formative assessment using i-clickers and subsequent discussion of material based on the assessment outcomes. The lesson format for each class was grounded in concept of the "feedback lecture" which incorporates directed instruction and a question session with feedback and discussion (Bonwell & Eison, 1991). The concept of question-driven instruction informed the active learning portion of each class (Beatty et al., 2006b).

At the first class session, the instructional methodology was explained to the students. Students were expected to read the assigned text and readings in advance of the class, the lesson design presumed that students came prepared to engage with the material in class (Flint, 2011). Advance familiarity with the material supports a low-risk implementation strategy cited by Bonwell and Eison (1991) earlier in this study. Early research by Kanter and Pitman (1987) noted that, because of the volume of relevant content within the field of auditing, outside reading is essential to for maximizing the effectiveness of in-class learning. Previous research (Flint, 2011) indicated that the use of i-clickers in class encouraged students to read the material prior to attending class. The expectation that students would read in advance set expectations for student-initiated learning.

Although each class began with a discussion of the assigned material, the discussion did not include a presentation of the information and was not comprehensive; rather, the focus of the discussion targeted complex or nuanced points within the material and typically involved guided instruction with the instructor posing questions designed to help students construct learning. In some cases, directed instruction would be utilized for the more complex topics. This structured portion of the lesson typically lasted no longer than twenty minutes as research suggests that short directed lessons that are interwoven with alternative teaching methods and opportunities for student engagement can help students develop cognitive skills (Bonwell & Eison, 1991; Flint, 2011).

The structured portion of each lesson was followed by an assessment session involving the use i-clickers to administer a series of multiple-choice questions (Flint, 2011). To mitigate the concern expressed by Bonwell and Eison (1991) that students' anticipation of a quiz format may limit the focus of students' studying, the quizzes utilized in this course contained a combination of factual, situational and theoretical questions that tested knowledge, comprehension, application, analysis, synthesis, and evaluation (Bonwell & Eison, 1991). In addition, to ensure adequate assessment of each learning objective, questions included topics from all learning objectives identified for each content area (Bonwell & Eison, 1991).

Students were required to respond to all questions, so the polling response count was displayed on the screen until all students responded; consequently, once the polling counter indicated that all students had responded, the instructor closed the polling. The purpose of the forced participation approach was to remove the option for students to be passive learners. Generally, students were given approximately 60 seconds to respond to each question, but more time was provided for complex questions while less time might be given for a basic recall question (Flint, 2011).

Questions and responses were displayed one at a time, with guided discussion immediately following each question. For questions that involved recall, the correct answers were displayed and information was clarified for students as needed based on the results.

For questions that involved higher order thinking skills, the correct response was not immediately displayed. To address the possibility that a student may have guessed a correct response and to clearly differentiate responses, the instructor asked questions designed to elicit the rationale for the responses (Bruff, 2009). For example, students might be asked to identify the key factors that led to their choice. Through discussion of rationale and comparative analysis, students could consider their responses. Often, students found that the difference between the correct and incorrect answer was based on a single word in the question, so discussion would then centered on identifying the key point of differentiation among the various choices (Bruff, 2009). The guided discussion was used to help students construct understanding and focused on the rationale and theory behind each question in order to strengthen comprehension. In some cases, the discussion might also address issues of literacy and meta-cognition to increase students' awareness of their learning and to help them develop more advanced strategies for learning (Flint, 2011).

At the conclusion of the each discussion, the correct response was highlighted on the screen. Responses were displayed anonymously via histogram, and were used by the instructor to identify knowledge gaps and inform the subsequent guided discussion (Beatty et al, 2006b; Flint, 2011; Kolikant, 2010). Student responses were used to inform the progression of each lesson, which is consistent with Kolikant et al. (2010) who note that student responses may be used to make real-time decisions to guide the progression of the lesson.

This question-based session is supported by Beatty et al. (2006b) who concluded that question-based instruction can accomplish its objectives through cycles of questioning, responding, visually viewing responses using a histogram, and then examination of students' thoughts through discussion. The use of student feedback to inform the direction of subsequent teaching and learning reflects the concept of agile teaching (Beatty et al., 2006b; Bruff, 2009) and question-driven instruction (Beatty et al., 2006b).

I-clicker Question Design

Questions used for formative assessment were all multiple-choice format, which is the format noted most frequently in the literature (Judson & Sawada, 2002).

The choice of questions reflected an intention to link the questions to the learning objectives. Beatty et al. (2006a) suggest that every question used in a CR system-based lesson should be linked to pedagogical objectives that include content, process and meta-cognitive goals. In addition, questions assessed varying levels of comprehension including recall, conceptual understanding, application and critical thinking (Bruff, 2009). No computational questions were used as i-clicker questions as some literature suggests that i-clickers are less effective for computational questions (Kolikant et al., 2010) and auditing places less emphasis on computations than other accounting courses. During this auditing class, the degree of difficulty for i-clicker questions progressed from basic recall questions to more advanced levels. Questions were selected from textbook materials and may have included some CPA exam sample questions that were embedded with the text. Each multiple choice question contained 4 possible responses and that format was consistent with the format used on the multiple-choice portions of summative tests (Flint, 2011).

Questions varied in degree of difficulty, but generally were presented in order of increasing difficulty and included fact-based, theory-based and analytical questions. Some questions were chosen to call specific attention to nuanced material from the text that was likely, based on the instructor's experience, to be overlooked or misinterpreted (Beatty & Gerace,

2009). Beatty and Gerace (2009) note that "the limitations of knowledge are revealed only when it is applied (p. 153), suggesting that question-based instruction is highly effective in identifying comprehension gaps. The number of questions for each class ranged from approximately 20 to 30 questions, depending on the volume and complexity of the content material.

Students were awarded one point for every correct response, and scoring was captured by the i-clicker system (Flint, 2011). Beatty et al. (2006b) discourage faculty from assigning credit for correct responses; however, points were used to motivate student preparation and also as a mechanism to identify instances of poor preparation or issues with comprehension. The early and continual assessment allowed for early intervention with students. This intervention was important to ensure that misunderstanding or lack of comprehension did not hinder the scaffolding required for effective learning (Anderson, Spiro & Pearson, 1977, Mestre, 1994).

Questions were not distributed prior to the i-clicker sessions nor were they distributed following the i-clicker sessions, although literature identified following the conclusion of these course sections points to some advantages in distributing the questions following a session in order to reinforce concepts (Bruff, 2009).

Procedure

Following each course in which i-clickers were used, students were asked to complete a survey to provide feedback on their learning experiences with classroom response systems, specifically, i-clicker devices (Attachment A). Since the survey was originally crafted to assess the use of i-clickers, this survey was not administered to the students in the traditional classes, specifically, those classes held prior to 2010.

Although the questions ask students to reflect on their experiences with i-clickers, the instructional methodology used in the class suggest that the i-clickers were integrated as a component of the pedagogy. On that basis, this study relies on the belief that the survey questions and responses generally refer to the overall pedagogical approach. The mere use of a device was not the focus of the survey questions, but rather the way in which the i-clickers were used to support the structure of the course and student learning. This aligns with Judson and Sawada (2002) who indicate that technology should be viewed as a means to support the pedagogy, to support increases in conceptual learning, while discussion is a key element of the pedagogical approach.

The survey was administered using Survey Monkey and was originally generated for an earlier study of i-clickers to support literacy in auditing education (Flint, 2011). Surveys are a common method used in studies of classroom responses systems based on a literature review by Fies and Marshall (2006) in which they indicated that 10 of 14 studies included in their review utilized surveys are the primary means of data collection. The survey was administered originally to an undergraduate auditing class in fall 2010 and was recently administered to students who subsequently took the course in summer and fall 2011.

Because the original purpose of the survey was to identify students' perceptions regarding the impact that the CR system had on their learning experiences, behaviors, and engagement with the material, some survey items do not directly apply to the study of formative assessment; however, some questions do have applicability based on the literature and will be included for analysis and discussion. Some questions included on the survey, were similar to questions used in a previous study by Nelson & Hauck (2006) and are identified in the survey.

The original survey included the 10 questions and provided an opportunity for comment and used a five-point Likert scale (strongly disagree to strongly agree). Throughout the courses,

the i-clicker devices were often referred to as ‘clickers’, so that term was used throughout the survey.

The survey results were analyzed to measure the percentage of agreement (those responding with “agree” or “strongly agree”) and percentage of disagreement (those responding with “disagree” or “strongly disagree”).

RESULTS

Survey Data

The results section of this study presents the updated survey data and includes analysis of survey questions that are believed to have some link to the research on formative assessment or active learning as noted in this report, or to a stated learning objective. As noted, the survey was originally designed to address an earlier study, but some of the questions are relevant for discussion relative to formative assessment, active learning and the use of classroom response systems. Although the survey has been updated to reflect the responses gathered from the 2011 classes, the population size is still small. Based on the small population, the results are presented as a reflection of the outcomes of this particular teaching initiative. Nonetheless, the results provide insight into student perceptions, behaviors and experiences while engaged in formative assessment and active learning using i-clickers.

Table 1 reflects students’ survey responses on all questions. A review of student responses indicates that the majority of students believe that the use of i-clickers in an interactive classroom model provided benefits to learning and also affected student engagement and preparation for class.

TABLE 1

ALL STUDENT SURVEY RESPONSES

Responses	Improved Understanding		Greater Retention		More Attentive		More Participation		Advance Reading	
	No.	%	No.	%	No.	%	No.	%	No.	%
Strongly Agree	15	71	10	48	14	66	11	53	16	76
Agree	6	29	10	48	5	24	7	33	5	24
Undecided	0	0	1	4	2	10	2	10	0	0
Disagree	0	0	0	0	0	0	1	4	0	0
Strongly Disagree	0	0	0	0	0	0	0	0	0	0
Total	21	100	21	100	21	100	21	100	21	100

TABLE 1 (CONTINUED)

ALL STUDENT SURVEY RESPONSES

Responses	Increased Attendance		Meta-cognition		Discussion Clarification		Meaningful Discussion		Class More Interesting	
	No.	%	No.	%	No.	%	No.	%	No.	%
Strongly Agree	9	43	14	66	15	71	12	58	10	48
Agree	5	24	5	24	6	29	8	38	9	44
Undecided	4	19	2	10	0	0	1	4	1	4
Disagree	3	14	0	0	0	0	0	0	1	4
Strongly Disagree	0	0	0	0	0	0	0	0	0	0
Total	21	100	21	100	21	100	21	100	21	100

The issue of student learning and comprehension is addressed through survey questions 1, 2, 7, 8, and 9 and results are segregated for purposes of analyzing the perceived impact of i-clickers on student learning. Survey results for these items are presented in Table 2.

All students surveyed agreed or strongly agreed with the statement that "The use of clickers improved my ability to understand the material", while the majority also felt that the use of i-clickers helped them remember course material. These survey items align with the research by Judson and Sawada (2002) that asserts that the use of CR system devices to support constructivist pedagogy contributes to increases in conceptual learning. In addition, Black and Wiliam (1998b) assert that formative assessment improves academic outcomes, although this survey captures student perceptions of learning, so does not directly serve to support or disprove this theory; however, it but may provide insight into the connection between the use of the i-clickers for formative assessment and students' perception that this approach to learning was effective.

Most students also noted that their ability to view their performance as presented by the histograms provided insight into their level of mastery, as the histograms measured their

responses relative to the correct response and peers' responses. This is consistent with research by Sadler (1989) who found that formative assessment, when incorporated with effective feedback, can help students form linkages that contribute to more meta-cognition.

A key element of formative assessment for active learning is discussion in which the instructor and students engage in discussion designed to identify and address misunderstandings, while strengthening connections and suggesting learning strategies. Survey questions 8 and 9 center on the extent to which students found the class discussions meaningful and useful in clarifying concepts. While the majority found that the use of the i-clickers led to meaningful discussions of important concepts, all survey respondents indicated that the use of the i-clickers helped clarify concepts. These two questions align with research by Beatty et al. (2006b) who suggest that question-driven instruction provides opportunity for meaningful discussion and clarification of concepts.

TABLE 2

STUDENT RESPONSES TO QUESTIONS RELATED TO LEARNING AND COMPREHENSION

Responses	Improved Understanding		Greater Retention		Meta-cognition		Discussion Clarification		Meaningful Discussion	
	No.	%	No.	%	No.	%	No.	%	No.	%
Strongly Agree	15	71	10	48	14	66	15	71	12	58
Agree	6	29	10	48	5	24	6	29	8	38
Undecided	0	0	1	4	2	10	0	0	1	4
Disagree	0	0	0	0	0	0	0	0	0	0
Strongly Disagree	0	0	0	0	0	0	0	0	0	0
Total	21	100	21	100	21	100	21	100	21	100

The remaining survey questions serve to assess the extent to which the use of i-clickers to support active learning may affect student behavior. All respondents indicated that the use of i-clickers motivated them to read their material in preparation for class. This supports the findings of Bonwell and Eison (1991) who noted that short quizzes serve as an active learning method and that quizzes serve to motivate students to study. In addition, the literature indicates that question-driven instruction serves to motivate students (Beatty et al., 2006b; Beatty & Gerace, 2009). Although the assessment sessions were never referred to as quizzes and were not used for summative assessment, the format of question-based instruction may have suggested some level of accountability for performance and, therefore, may have served as motivation to study.

Results related to attendance, attentiveness are participation showed more mixed results, although the rationale for student responses may not be easily gleaned from the information obtained. One cannot discern whether the i-clickers did not motivate them to change their actions or whether they perceive that their attendance, attentiveness and participation were already at a high level. It is worth noting that, despite mixed agreement regarding students' perceived level of participation, this question can definitively be shown to be true based on the required participation format of the i-clicker sessions. Given that every student was required to answer

every question presented simultaneously, the resulting level of participation greatly exceeded the potential opportunities for participation in a traditional classroom.

Comparative Analysis

In addition to the survey results, comparative data was used to assess whether student perceptions of learning using formative assessment for active learning might be reflected in student outcomes. The ability to perform a research study using a control group to gauge changes in student outcomes is not currently feasible due to the small size of the accounting program at the college. The only data available for comparison would be certain limited data related to courses taught prior to the implementation of the new active learning format. The traditional course data, while minimal, was originally captured to support reflection of teaching methods by the instructor and, therefore, does not conform to the depth and structure that is typically employed by a research study. However, the comparative data may serve to prompt discussion regarding potential applications in auditing education and serve as a catalyst for institutions with larger programs to consider the literature as well as the potential for improving pedagogy as it relates to formative assessment, active learning and agile teaching.

As indicated earlier, enrollment records indicate that a total of 63 students were enrolled and completed the undergraduate auditing course between 2007 and 2011; however, the number included in the comparative study was reduced to 58 to remove students who had repeated the auditing class at least once. The rationale for this decision lies in the fact that students who repeat the course may show improvement due to repeated exposure to the material, so changes in student outcomes relative to the active learning model are not easily discerned. Upon review of the data to assess the distribution, three outliers were identified and removed so as not to skew the analysis of the data. Following these changes, 55 students were used for the analysis and the data reflected a normal distribution.

Table 3 reflects the variables used for this comparative analysis and while data to support all students were available for three of the variables, the average multiple-choice score was not available for the eight students who took the class in 2007.

The analysis compares the average audit test scores for the two groups as well as student performance on the multiple-choice portions of those tests. Comparison of multiple-choice questions was performed to consider whether the use of i-clickers may impact students' performance on the multiple-choice portion of tests as suggested by Bonwell and Eison (1991) who noted that a quiz-based format may affect or limit the focus of students' studying. Based on the previous experience of the instructor with many of these student participants in an earlier Intermediate Accounting class, many students expressed dislike for multiple-choice questions, so whether the question-based, active instruction may have affected student performance on multiple-choice questions is a matter of interest. The fact that the certification exam for public accountants utilizes a high percentage of multiple-choice questions in its test design suggests that students must become comfortable with this testing format. As noted earlier, multiple-choice data was not available for the class of 2007, which was comprised of 8 students.

Although the final audit grade represents the culmination of several assessments of learning such as tests, homework, a case study, and participation, differences in final scores between the two groups, traditional and active learning, provide interesting insight. Undergraduate GPA is also compared and may be used in the future, along with the other variables, for a more detailed analysis of the data.

TABLE 3

CASE PROCESSING SUMMARY

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Final Auditing Grade * Class Format	55	100.0%	0	.0%	55	100.0%
Average Audit Test Score * Class Format	55	100.0%	0	.0%	55	100.0%
Student Undergrad GPA * Class Format	55	100.0%	0	.0%	55	100.0%
Average Multiple Choice Score * Class Format	47	85.5%	8	14.5%	55	100.0%

Table 4 presents the comparison of student performance measures of students who studied auditing in the traditional classroom with those who studied auditing under the active learning model, designated as the i-clickers group.

Initial review of the data reveals that the students comprising the i-clickers group have a mean undergraduate GPA of 3.43 as compared with the traditional group's GPA of 3.18, which suggests that the overall academic preparation of the i-clickers group is slightly higher than the traditional group. Also, the standard deviation for the traditional group is .614 compared with the i-clicker group's standard deviation of .391which suggests a greater range of skill levels within the traditional group, as opposed to the i-clickers group in which performance is more consistent among group members.

Students in the i-clickers group showed an average test score of 82.36, while the traditional group's average score was 75.21 and again, the traditional group showed greater variation in scores. The difference between average test score and average multiple-choice test score was 4 points on average for both groups; however the i-clickers group showed higher average multiple-choice grades. The extent to which this outcome for the traditional group is affected by the lack of data for 2007 cannot be assessed.

Finally, the comparative data shows that final audit grades were four points higher for the i-clickers group; however, the difference between average audit test scores and final grades is greater for the traditional group. These differences may reflect changes in weighting of assignments or other factors that are not readily discerned for the earlier classes.

TABLE 4

COMPARATIVE ANALYSIS

Class Format		Final Auditing Grade	Average Audit Test Score	Student Undergrad GPA	Average Multiple Choice Score
Traditional	Mean	81.4242	75.21	3.18336	71.3600
	N	33	33	33	25
	Std. Deviation	7.00906	7.995	.614029	7.36478
i-clickers	Mean	85.0909	82.36	3.43632	78.9545
	N	22	22	22	22
	Std. Deviation	5.87091	5.394	.391601	5.81031
Total	Mean	82.8909	78.07	3.28455	74.9149
	N	55	55	55	47
	Std. Deviation	6.76777	7.855	.546538	7.64094

DISCUSSION

Because this study is based on a very small sample of students and involves only one instructor, one must be cautious about making generalizations regarding the outcomes. At the same time, this study attempts to integrate research in active learning, formative assessment as a form of active learning, agile teaching and the use of classroom response systems as a means to transform teaching and learning within the context of auditing education. This study may have broader interest despite these limitations, as the literature is applicable across a wide range of subject areas. In addition, this pedagogical approach may be applicable to professional development for those studying auditing or other complex, nuanced subjects.

In applying formative assessment to support active learning and agile teaching, a shift in mindset and focus was required by the instructor. Prior to implementation, considerable planning was necessary to align the questions with the learning objectives and present varying degrees of difficulty and question formats. In addition, the concept of agile teaching requires tremendous flexibility as well as the ability to interpret results, diagnose potential points of misunderstanding, and formulate an action plan while the lesson is in action. The shift from a teacher-directed perspective to a student-centered perspective required considerable reflection and study. The desire to engage students in their own learning was measured against concerns regarding the potential loss of control, as cited in the literature by Bonwell & Eison (1991).

As lessons progressed, a considerable shift was noted in each class as students initially were surprised and frustrated by the shift in their roles from passive learners to active learners.

Within several lessons, students exhibited more energy in class, were very engaged, sometimes challenging the answers and citing page numbers. At the same time, the transformation from directed teaching to student-centered agile teaching was also significant. When one realizes that a student inquiry serves as an opportunity for students to construct learning, the role of the instructor becomes one of skilled facilitation with shared responsibility for learning.

LIMITATIONS

One of the limitations of conducting research in a small college is the limited access to sizeable populations for research. Alternatively, one of the significant advantages of conducting research in a small college is the ability to engage in applied research that reflects the literature with few barriers to such activities. Without having to affect a large number of students or faculty, it is possible to employ ideas suggested in larger research studies. Levels of bureaucracy are few, so program changes do not require one to secure consensus on major shift in institutional direction with regard to pedagogy or materials.

The interest in the idea of using i-clickers to support formative assessment, active learning and agile teaching grew out of a brief presentation of the technology by a fellow faculty member. While the study reflects all currently-available data and information within the accounting program, it does not reflect sufficient size or depth of data to perform a detailed quantitative analysis. The combined population for this study was 55, which reflected several years of classes. As a result, analysis is limited and the results of this study may be different than experiences in large class settings. While the literature points to the potential for academic gains in the field of auditing education based on the challenges for this subject combined with the opportunities for active learning and agile teaching, the assessment of outcomes rely on our ability to apply this knowledge to sufficient data. There are opportunities for future research which may yield benefits for developing the concept of active learning and applying it beyond higher education, perhaps for those in practice.

The i-clicker questions were focused exclusively on textbook content in an effort to assess the impact of the devices on student reading and preparation. No effort was made to use the i-clickers with cases or other content. Further study would be required to assess the effectiveness of i-clickers with auditing cases or other course content.

While an effort has been made to integrate several threads of literature, specifically the literature on active learning, formative assessment, agile teaching and CR systems, additional areas of literature may be useful in informing future studies.

ATTACHMENT A

I clicker Survey Questions
Auditing

Survey questions for I-clicker impact on student learning experience:

1. The use of clickers improved my ability to understand the material (Nelson & Hauck, 2008).
2. I was able to better remember the course material more as a result of using the clickers.
3. I listened more attentively in class as a result of using the clickers (Nelson & Hauck, 2008).
4. I participated more in class as a result of the clickers
5. The use of clickers in class encouraged me to read the material before attending class (Nelson & Hauck, 2008).
6. I attend more classes as a result of the clickers being used.
7. The ability to see the class results projected on the screen helped me understand my own level of learning.
8. The ability to immediately discuss the results of clicker questions helped to clarify the material.
9. The use of clickers led to meaningful discussion of important concepts in class.
10. The use of clickers makes the class more interesting (Nelson & Hauck, 2008).

Scale: 5-point Likert Scale

Strongly disagree
Disagree
Undecided
Agree
Strongly Agree

(Flint, 2011)

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