

AN EVALUATION OF PROFESSIONAL DEVELOPMENT ON USING STUDENT  
RESPONSE SYSTEMS AND INTERACTIVE WHITEBOARDS FOR FORMATIVE  
ASSESSMENT IN THE MIDDLE SCHOOLS OF A SOUTHEASTERN SCHOOL  
DISTRICT

By

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To my husband, Chet, and our children Corene and Jenelle

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## TABLE OF CONTENTS

	<u>page</u>
ACKNOWLEDGMENTS.....	4
LIST OF TABLES.....	8
LIST OF FIGURES.....	9
LIST OF ABBREVIATIONS.....	10
ABSTRACT.....	11
CHAPTER	
1 INTRODUCTION.....	13
A Need for Professional Development Evaluation.....	13
Role in the Field of Educational Technology.....	15
Impetus for the Study.....	16
Purpose of the Study.....	18
Components of the Study.....	20
Summary.....	21
2 LITERATURE REVIEW.....	23
Adult Learning Theory.....	23
Professional Development.....	27
Technology-Based Professional Development.....	31
Instructional Design of Professional Development.....	33
A Framework for Technology-Based Professional Development.....	35
3 METHODOLOGY.....	41
Guiding Questions.....	42
Context of the Study.....	42
Participants.....	43
Description of the Professional Development.....	44
Overview.....	45
Lesson Development.....	45
Lesson Goals and Objectives.....	47
Lesson Activities.....	48
Data Collection.....	54
Guiding Question for Level 1: Participants' Reactions.....	55
Guiding Question for Level 2: Participants' Learning.....	56
Participants' Learning Artifact.....	57
Participants' Learning Artifact Rubric.....	57

Post-Instruction Reflective Journal .....	58
Guiding Question for Level 3: Organization Support and Change .....	59
Guiding Questions for Levels 4 and 5: Participants' Use of New Knowledge and Skills and Student Learning Outcomes.....	60
Pre-Observation Interview .....	61
Observation .....	62
Post-Observation Interview .....	65
Data Analysis.....	66
Quantitative Data Analysis .....	66
Qualitative Data Analysis.....	70
Information for Triangulation.....	71
Timeline .....	72
Trustworthiness and Limitations of the Study .....	73
Summary .....	74
<b>4 RESULTS .....</b>	<b>85</b>
Participation in the Study .....	85
Guiding Questions .....	86
Guiding Question for Level 1: Participants' Reactions .....	87
Guiding Question for Level 2: Participants' Learning .....	88
Participants' Learning Artifact Rubric .....	89
Post-Instruction Reflective Journal .....	90
Guiding Question for Level 3: Organization Support and Change .....	90
Guiding Questions for Levels 4 and 5: Participants' Use of New Knowledge and Skills and Student Learning Outcomes.....	91
Pre-Observation Interview .....	92
Observation .....	94
Post-Observation Interview .....	97
Summary .....	98
<b>5 DISCUSSION AND IMPLICATIONS.....</b>	<b>107</b>
Summary of the Study .....	107
Findings .....	110
Conclusions .....	112
Guiding Question for Level 1: Participants' Reactions .....	112
Guiding Question for Level 2: Participants' Learning .....	113
Guiding Question for Level 3: Organization Support and Change .....	115
Guiding Question for Level 4: Participants' Use of New Knowledge and Skills....	117
Guiding Question for Level 5: Student Learning Outcomes .....	122
Additional Outcomes.....	124
Implications for Future Work and Research.....	125
Formative Assessment to Meet Individual Needs.....	126
More Time to Work with the Technologies .....	127
Instructional Coaching.....	127
Future Use of Guskey's Evaluation .....	129

Recommendations for Implementation of Guskey's Evaluation .....	130
APPENDIX	
A SESSION HANDOUT .....	134
B POST-INSTRUCTION REFLECTIVE JOURNAL.....	135
C PERCEPTIONS QUESTIONNAIRE.....	136
D PARTICIPANTS' LEARNING ARTIFACT RUBRIC .....	137
E ORGANIZATION SUPPORT QUESTIONNAIRE.....	138
F PRE-OBSERVATION INTERVIEW .....	139
G OBSERVATION FIELD NOTES RECORD .....	140
H OBSERVATION RUBRIC .....	141
I POST-OBSERVATION INTERVIEW .....	142
J INTERVIEW CODING PROTOCOL FORM .....	143
K POST-INSTRUCTION REFLECTIVE JOURNAL EXCERPTS .....	144
L EXAMPLE OF CODING QUALITATIVE DATA.....	148
LIST OF REFERENCES .....	149
BIOGRAPHICAL SKETCH.....	156

## LIST OF TABLES

<u>Table</u>	<u>page</u>
2-1 Application of Adult Learning Assumptions during the Professional Development .....	38
2-2 Alignment of Professional Development Core Features to the Technology-Based Professional Development.....	38
3-1 Alignment of Evaluation Levels and Guiding Questions .....	76
3-2 School Facts for Middle Schools A & B .....	76
3-3 Description of the Professional Development.....	77
3-4 Clicker Strategy Components.....	81
3-5 Alignment of the Five Evaluation Levels, Guiding Questions, and Data Collection Methods .....	82
3-6 Implementation Timeline .....	84
4-1 Participation in the Study.....	99
4-2 Means and Standard Deviations for the Perceptions Questionnaire .....	100
4-3 Means and Standard Deviations for the Participants' Learning Artifact Rubric.	100
4-4 Means and Standard Deviations for the Organization Support Questionnaire .	101
4-5 Frequency Data for the Observation Rubric .....	101
4-6 Pre-Observation Interview Taxonomy .....	102
4-7 Classroom Observation Taxonomy .....	103
4-8 Post-Observation Interview Taxonomy.....	105



## LIST OF FIGURES

<u>Figure</u>		<u>page</u>
1-1	Framework for the Components of the Study .....	22
2-1	Relationship between the Literature and Purpose .....	39
2-2	Proposed Framework for Designing Technology-Based Professional Development .....	40
5-1	Venn Diagram Highlighting Similarities Among the Pre-Observation Interview and Observation Data .....	133
5-2	Connections Among the Data From the Observation Field Notes and the Post-Observation Interviews.....	133
L-1	Example of Coding Qualitative Data Using Hypertext™ .....	148

## LIST OF ABBREVIATIONS

ADDIE	Components of Instructional Systems Design: Analysis, Design, Development, Implementation, and Evaluation.
ISD	Instructional Systems Design: Also referred to as instructional design.
ITS	Instructional Technology Specialist.
IWB	Interactive Whiteboard: A device controlled by a stylus that provides an interactive display on the computer for projection. The Interactive Whiteboards used in the study were mobile and contained a screen for displaying clicker data.
SRS	Student Response Systems: Also referred to as clickers. These devices allow learners to submit multiple-choice and numeric answers to a database for data collection.

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By

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The purchase of 21st-century technologies for each middle school teacher in my school system coinciding with a historic lack of significant professional development in technology integration provided the impetus for the study. To address the problem, professional development focused on helping teachers use student response systems and mobile interactive whiteboards for formative assessment. The professional development incorporated adult learning theory, professional development literature, and instructional systems design. This study examined the design, development, and implementation of the technology-based professional development.

This study used a combination of qualitative and quantitative methods for collecting and analyzing data within the framework of Guskey's Five Levels of Professional Development Evaluation (1998) to assess and improve the effectiveness of the professional development. Data-collection methods included Likert-Scale questionnaires about perceptions and organization support, rubrics for evaluating the learning and its application, and field notes from an observation cycle for examining use of new knowledge and student engagement. The findings revealed that the

professional development was effective and provided information for developing plans to improve my professional practice. Additional outcomes point to future research about implementing an instructional coaching model to serve teachers in their technology-integration needs.

This work is significant in that it demonstrates using a systematic framework for evaluating professional development. Few professional development evaluations assess effectiveness beyond the participants' perceptions of the experience. Completing comprehensive evaluations is important for continuous improvement of professional development. Recommendations for coordinating a professional development evaluation in other organizations are provided.

## CHAPTER 1 INTRODUCTION

This project consists of an introduction, a literature review, methodology, results, and conclusion. The first component is the introduction, which details the impetus for the study and an overview of the framework for the study. The literature review is a synthesis of my understanding regarding the research and theory concerning my role in educational technology. The next chapter explains the methodology for data collection and analysis. The results section presents the findings from the study. I discuss and interpret the data in the last chapter, which details the overall experience and its contributions to my learning, including implications for future work and research.

### **A Need for Professional Development Evaluation**

Appropriate professional development is necessary in a variety of settings and particularly in education for instructional improvement (Desimone, 2009; Guskey, 2002b). To provide adequate professional development and support, it is essential to address adult learning assumptions, professional development research, and instructional design issues when implementing professional development (Desimone, 2009; Guskey, 2002b; Hill, 2007; Knowles, 1980; Knowles et al., 1998; Reiser & Dempsey, 2002). As described in this study's literature review, effective design, development, and implementation of professional development opportunities are important to ensure successful outcomes. The challenge becomes knowing whether the professional development is indeed effective.

Evaluating professional development is vital for determining the outcomes regarding its purpose—affecting teacher learning and student achievement (Guskey, 2002a). Literature in the field confirms the importance of evaluating professional

development for improving practice (Kirkpatrick et al., 1998; Guskey, 1998, 2000, 2002a); however, few professional development evaluations assess effectiveness beyond the participants' perceptions of the experience. Implementing a systematic and comprehensive evaluation plan is important for continuous improvement of professional development. Just as evaluation is significant during instructional design, evaluating professional development at levels beyond the participants' initial impressions ensures that the impact of the professional development is evident in the classroom (Guskey, 2002a).

This study examines the effectiveness of a technology-based professional development series for helping teachers use the Student Response Systems (SRS) and mobile Interactive Whiteboard (IWB) data for formative assessment. Implementing formative assessment to affect learning can lead to improvement in student achievement (Guskey, 2003a; Stiggins & Chappuis, 2005; Wiggins & McTighe, 1998). Incorporating SRS throughout instruction coinciding with clicker strategies provides feedback for modifying instruction immediately in response to students' learning needs (Bruff, 2009b). The foundation for effectively accomplishing such strategies is appropriate professional development for helping teachers use the technologies for formative assessment that influences instruction (Guskey, 2002b; Hill, 2007). Evaluation is essential to ensure that professional development achieves its purpose (Guskey, 2002a).

This study is significant because it demonstrates the role of literature in designing and implementing professional development, and it uses a comprehensive approach—Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a)—to

determine the value of the professional development for supporting teachers in their technology integration and affecting student engagement. This study details important considerations for the instructional design of professional development and demonstrates the value of evaluating professional development in educational settings.

### **Role in the Field of Educational Technology**

In my Instructional Technology Specialist (ITS) role I help teachers implement technology as an effective instructional tool for collecting formative data and engaging students. As a leader-practitioner I reflect on and evaluate my application of the research literature related to professional development and instructional design to refine my practice for the benefit of teachers and students. My professional goal as an ITS is to foster among educators an understanding of technology as an enabler for teaching and learning. As technology is frequently changing and research-based instructional practices are continually developing, my goal entails using technologically innovative resources to increase instructional effectiveness, academic achievement, and engagement. Accordingly, I am cognizant of the leadership role that comes with my position, and I work toward improving my skills, which include designing and implementing professional development that meets teachers' needs as learners and helping teachers integrate new technologies into their curriculum.

As an ITS I facilitate technology-based professional development in a variety of venues and support educators' use of 21st-century technologies. I work to use professional development practices supported by research in the field (Bradshaw, 2002; Desimone, 2009; Garet et al., 2001; Guskey, 2002b, 2003; Hill, 2007, 2009; Mouza, 2003; National Staff Development Council, 2001; Sparks, 2002; Wilson & Ball, 1996). I also integrate adult learning principles (Knowles, 1980; Knowles et al., 1998) and

instructional design methods (Alessi & Trollip, 2001; Brown & Green, 2006; Mager, 1997; Morrison, Ross, & Kemp, 2007; Reiser & Dempsey, 2002; Schnackenberg et al., 2001) in my work. As a part of my work, I attempt to identify teachers' limitations in the area of technology integration and help them with educational application of the technologies by designing and developing sessions that address their needs (Morrison, Ross, & Kemp, 2007; Schnackenberg et al., 2001) and promote a community of practice. I reflect on my practice and evaluate its merit based on my improvement as a practitioner, as well as on the teachers' implementation of technology as an instructional tool that positively affects students in the classroom (Guskey, 2002; Hill, 2007; National Staff Development Council, 2001).

### **Impetus for the Study**

The impetus for the study stems from a problem in my school system. Widespread integration of 21st-century learning technologies among the teachers in my school system requires adequate professional development and support so that teachers may use the technologies for the benefit of the students. There is a historic lack of significant technology integration training among the school system's middle school teachers, which hinders them from independently using these new technologies during instruction. Not only is it difficult to learn a new technology, but application may not occur without appropriate support (Williams & Kingham, 2003). A lack of technology-supported pedagogical knowledge and skills is an identified hindrance to technology integration, and conducting professional development is a strategy to overcome this barrier (Hew & Brush, 2006). Thus, there is a need for professional development and support to integrate these technologies into the curriculum. This



section details the problem and related issues that give substance to the study's purpose.

A contributing factor to the need for technology-based professional development is the recent purchase by the school system of 21<sup>st</sup>-century learning technologies. During school year 2009-2010, my school system purchased a SRS and mobile IWB for every secondary core academic classroom. Classroom implementation of 21<sup>st</sup>-century technologies can be daunting for teachers. A study by Williams & Kingham (2003) suggests that the lack of technology use in the classroom may result from teachers' lack of preparation for integrating technology into their lessons. It takes time to learn to use and integrate new technologies for the benefit of the students.

Middle school teachers in my school system have an average of 14.59 years of teaching experience (Georgia Department of Education, 2010b). Many of the system's teachers did not receive technology integration training while in college due to a lack of need for such courses at the time. Currently, a local state university offers only one course—Teaching, Learning and Technology Integration—as a part of the Bachelor of Science degree in middle school education (Georgia State University, 2010). As a result, there is a compelling need in my schools for professional development focused on technology integration.

In my school system the implementation of technology-based professional learning started with the recent hiring of several ITSs. Previously, the only option for teachers desiring to gain skills in technology integration has been to take a college course or pay for a class at the regional Educational Technology Center. In each of these situations, past strategies for professional development did not consistently employ research-

based best practices to meet the needs of the teachers, as some classes were one-day sessions located off campus and lacked a content focus.

Analysis of survey data from middle school teachers in the district has indicated a need for appropriately designed professional development (Fuller, 2010) that focuses on integrating the school district's new 21<sup>st</sup>-century technologies (Fuller, 2009). At the start of school year 2010, I conducted a needs assessment to help define the problem for the study and purpose of the study. This included reviewing district technology goals and school improvement plans, as well as meeting with the principals and gaining teacher feedback from school-based leadership teams. Based on a need to improve use of the available technologies for collecting formative data, I developed four sessions for this study focusing on using technology for formative assessment to promote increased student engagement. Because there is not a strategic method in place in my school system for evaluating the technology professional development conducted by the ITSs, this study established an opportunity for developing a plan for continuous improvement of the technology-based professional development in which teachers participate.

### **Purpose of the Study**

The purpose of this mixed method research study was to evaluate the design, development, and implementation of the technology-based professional development I provided to teachers at two Georgia middle schools regarding integration of the SRS and mobile IWB for formative assessment. Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a) served as a framework for the data-collection components of the study as outlined in Figure 1-1.

This study is significant in that it caused me to consider ways to improve the professional development I facilitate. This study suggests ideas to share with other ITSs and professional development coordinators. The study's components demonstrate my understanding of theory, research, and instructional design and my ability to implement an academic inquiry that will benefit the teachers with whom I work as well as other practitioners in educational technology.

Accordingly, during this experience I studied the design of the professional development I conducted related to integrating the SRS and mobile IWB into instruction for formative assessment at the middle schools in my school system. This study provided information concerning the effect of the professional development I conducted and the ways in which the teachers used the tools for formative assessment to elicit engagement among their students, which is an effective instructional strategy (Hake, 1998). Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a) provided data for informing and improving my practice and implementing future professional development in the school district. The model also offered information regarding the students' engagement when their teacher integrates the technologies into instruction. Additionally, the literature review is the foundation of knowledge I gained in the field and outlines the importance of applying research-based strategies to my technology-based professional development.

The study demonstrates my ability to apply the evaluation component of instructional systems design (ISD) to my professional practice. The evaluation component of ISD bridges the teaching and scholarship components of the study. Specifically, the study examined the professional development I provided regarding the

needs of the teachers, as well as data for improving my future instruction. In addition, Guskey's Evaluation (1998, 2000, 2002a) helped me determine if I have adequately applied adult learning principles and professional development concepts during the design and implementation of the instruction I facilitate.

### **Components of the Study**

The central focus of the study was to assess the technology-based professional development that I provided. The framework for the study, Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a), addressed teaching, scholarship, and leadership components of the study with the scholarship component of the study spanning all five levels of the evaluation protocol as noted in Figure 1-1. Guiding questions for the study's components align with the levels of Guskey's Evaluation (1998, 2000, 2002a). The data collected to answer these questions helped me reflect deeply on my teaching.

For this study I examined the effectiveness of the instruction I provided the middle school teachers. Research strategies discussed in the literature review guided the instructional design of the professional development I conducted for supporting teachers with technology integration. Adult learning principles and professional development literature helped me deliver instruction for helping teachers implement technology tools for student engagement, specifically during formative data collection. Goals for my instruction address the elements pinpointed as areas of need (Mager, 1997; Schnackenberg et al., 2001) during discussions with the schools' principals. I designed and developed my lessons based on the established goals and revised as needed based on formative evaluations (Reiser & Dempsey, 2002). As indicated in Figure 1-1, Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a)

guided the data collection process for the components of this study, as research questions are aligned to each Level. Using Guskey's (1998, 2000, 2002a) research-based model for the study helped facilitate thoughts about future improvement in the instructional design of the professional development I conducted.

### **Summary**

The impetus for the study stems from a problem in the middle schools at which I work. All of the core academic teachers received 21<sup>st</sup>-century technologies, a SRS and mobile IWB, for their classrooms. There is a need for adequate professional development and support so that teachers can use the technologies for formative assessment to benefit their students. Due to a lack of training and support in previous years, the teachers have difficulty using new technologies independently during instruction. Additionally, no strategic method was in place for evaluating the technology professional development conducted by the ITSs; therefore, use of Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a) provided an opportunity for evaluating and improving the technology-based professional development in the schools.

The following four chapters include a literature review, methodology, results, and discussion and implications. The literature review is a synthesis of my understanding regarding the research and theory concerning my role in educational technology. The next section explains the methodology for data collection and analysis. The results section presents the findings. In the last section I discuss and interpret the data, which details the study's findings and contributions to my learning, including implications for future work and research.

<b>Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a)</b>	<b>Guiding Questions</b>	<b>Component</b>	
<b>Level 1:</b> Participants' Reactions	What are the teachers' perceptions about the professional development?	Teaching	Scholarship
<b>Level 2:</b> Participants' Learning	In what ways did the teachers acquire the intended knowledge?		
<b>Level 3:</b> Organization Support and Change	In what ways does the organization support teachers with their implementation of the technologies?	Leadership	
<b>Level 4:</b> Participants' Use of New Knowledge and Skills	In what ways are the teachers using the mobile interactive whiteboard and student response system?		
<b>Level 5:</b> Student Learning Outcomes	What effect did the professional development have on student engagement?		

Figure 1-1. Framework for the Components of the Study

## CHAPTER 2 LITERATURE REVIEW

Each of the elements described in this literature review was essential for this study, which examined the design, development, and implementation of the technology-based professional development I provided. The development of this study considered literature from adult learning theory, professional development, technology-based professional development, instructional design, and evaluation of professional development. Figure 2-1 shows the areas of literature that contributed to the evaluation process for providing instruction that met teachers' needs, helped teachers integrate technology, and refined my professional practice. In addition, as Beile & Boote (2005) suggest, this literature review moves beyond summarizing the research into a synthesis of the various literature bases and their application to the foundation of this study.

### **Adult Learning Theory**

Andragogy is a set of methods and techniques regarding the characteristics of adult learners (Knowles, 1980) and is essential to consider when designing professional development for practicing teachers. Using these methods and techniques to design instruction helps facilitate learning for adult learners. The following section describes the assumptions and gives examples in educational practice.

According to Knowles et al. (1998) learning should be oriented to an apparent learning need so the learner understands why the learning is important. Traditional learners may not consider why a particular concept is valuable for them to learn, whereas with adult learners instruction should include information about why it is necessary to learn about a particular topic (Knowles et al., 1998). Adult learners need to understand why and how things are important (Knowles et al., 1998). A facilitator

may accomplish this by creating a learning environment that focuses on practicality and relevance of the content. Examples that illustrate the concept provide a meaningful context to help the adult learner understand the significance of the learning.

With the development of self-concept, learners move beyond depending on the instructor (Knowles, 1980); therefore, instruction must facilitate self-directedness in the learner (Knowles et al., 1998). Traditional learners need direction from their instructors, whereas facilitating adult learners' responsibility for making decisions about their learning stimulates respect and acknowledges the need for self-directedness in the learning design. Involving the participants in planning and evaluating their instruction develops self-concept and self-directedness. Additionally, a learner-centered course that is somewhat open ended helps adult learners decide the direction and strategy that they will use in their learning. An open-ended environment may help learners choose what to learn or how to learn it.

Although traditional learners may rely significantly on the instructor's knowledge, adult learners' most valued resources are their own experiences. During learning, the learner increasingly uses experiences as a resource (Knowles, 1980). Even errors made during learning are experiences that provide the foundation for learning activities. Since adult learners bring experiences and knowledge to their various learning situations, instruction for adults should consider the learners' backgrounds (Knowles et al., 1998). Offering learning opportunities that draw on experiences, such as the use of collaborative activities or open-ended questioning, can allow learners to reflect, broaden their perspective of the content, and learn from each other.



An adult's readiness to learn relates to the tasks and expectations in his or her everyday life (Knowles, 1980). Traditional learners are typically motivated to learn content regardless of its relationship to their personal goals, whereas topics having immediate relevance to work and/or personal situations are of most interest to adult learners. Adults have a practical outlook; therefore, instruction should focus on a real-world task (Knowles et al., 1998). Opportunities for teachers to develop technology-integrated lesson plans or work in an active learning environment to learn a new technology will help make the learning authentic.

An adult's orientation to learning shifts from a focus on content toward the perspective of immediate application of knowledge for problem solving (Knowles, 1980). Whereas postponed application of knowledge was once acceptable, the adult learner does not realize the significance of learning unless it has immediate application to his or her job and/or personal situation. This goal-oriented nature of adults suggests that instruction should focus on solving a current problem or learner need (Knowles et al., 1998). This may be accomplished through a variety of strategies when considering how to integrate a new technology, including asking learners to describe an instructional problem that may be solved by using the tool and developing a plan for implementation. A task such as this will help to keep the focus on applying the knowledge to a relevant problem.

Maturation causes a person's motivation to learn to shift from external to internal (Knowles et al., 1998). Adults tend to respond better to internal motivators than to external ones. Since adults are internally motivated, intrinsic motivational factors are important to the development of adult instruction (Knowles et al., 1998). For example,

whereas traditional learners' motivation stems from how others perceive them as learners, the sense of self-fulfillment gained from being successful personally and professionally motivates an adult learner. An instructor offering the sort of professional development I do may facilitate teachers' development of self-esteem regarding their ability to integrate technology effectively by giving positive feedback to them about their plans for technology integration, respecting their input during discussions about technology-integrated lessons, and offering time for the teachers to collaborate to develop innovative lessons.

In considering how to apply adult learning assumptions to instruction on technology integration, facilitators should provide opportunities for self-directedness and address the participant's background with the technology. The training should focus on solving an instructional problem, and the structure of the professional development should give teachers the opportunity to consider ways to apply the content to a classroom situation. Additionally, instruction should address intrinsic motivational factors, such as how the content will help the teachers improve student learning.

Accordingly, the professional development I provided addressed the adult learning assumptions as displayed in Table 2-1. During my instruction a focus on the importance of formative assessment and student engagement helped the teachers understand the value of using the technologies to meet these instructional needs. As noted by Fredricks et al. (2004), low engagement in the classroom tends to correspond with low achievement levels. A focus on formative assessment during instruction can improve learning (Black & William, 2010). Questionnaires administered throughout the professional development I conducted gave participants an opportunity to offer

feedback for making decisions regarding future instruction. The teachers had occasions to incorporate their background knowledge during the instruction, as I posed open-ended questions regarding formative assessment to the group. Additionally, the instruction I facilitated on the use of the SRS and mobile IWB provided technology-savvy users with opportunities to experiment and create while less-experienced users worked at learning stations and asked questions. During the sessions, the teachers worked collaboratively or independently on developing a multimedia lesson with embedded questions to collect formative data for enhancing student engagement. Each of the professional development sessions I conducted provided the teachers with a chance to discuss how the use of the tools may benefit the students in their content area to help them immediately apply their new knowledge. Last, I addressed the need for internal motivation during the instruction as teachers shared with each other the benefits they experienced from using the technology in their classrooms. This study focused on evaluating the professional development and determining further ways to improve my practice.

### **Professional Development**

Student learning can increase because of teacher improvement via research-based professional development strategies. Emphasis on appropriately designed and implemented instruction for teachers affects students' acquisition of knowledge (Hill, 2007) as teachers use instructional technologies to maximize their instruction and facilitate student success. As noted in learning theory, Guskey (2002b) suggests that successful professional development addresses the needs of teachers as learners, which enhances their effectiveness with students. It is important to consider the context, process, and content standards established by the National Staff Development

Council (2001), which focus on providing research-based professional development that will improve the learning of all students through data-driven decision making. In the two middle schools in which I work, as teachers collected data to help with instructional decisions, their efforts to continue implementing strategies learned through the professional development were reinforced (Guskey, 2002b). This gives relevance to the instruction I facilitated on the use of SRS as a tool for formative data collection. The emphasis on improving student achievement is a common thread throughout the professional development literature.

The literature on professional development pinpoints specific valuable components for adult learners. A review of empirical studies by Desimone (2009) describes a core set of features for effective professional development in a variety of contexts. The framework components include (a) content focus, (b) active learning, (c) coherence, (d) duration, and (e) collective participation (Desimone, 2009). Desimone (2009) suggests a relationship between increased teacher knowledge, instructional changes, student improvement, and the core professional development features.

Professional development with a content focus connects content-related activities and the students' learning of the content (Desimone et al., 2002; Desimone, 2009; Garet et al., 2001). A focus on content is essential to providing effective professional development for educators (Guskey, 2003b; Hill, 2007, 2009; National Staff Development Council, 2001). Additionally, professional development for educators should emphasize content-related strategies that teachers may use to improve student outcomes (Hirsh and Killion, 2009; Sparks, 2002).

Active learning provides teachers with an opportunity for engaging in the learning process (Desimone, 2009). This instructional method results in better retention of knowledge as well as a greater level of involvement among learners (Bonwell & Eison, 1991). The strategy of active learning is related to effective professional development (Garet et al., 2001) and allows teachers to learn techniques for supporting student achievement (Desimone et al., 2002; Hirsh & Killion, 2009), as is also suggested by the focus on content.

When the content that teachers learn is consistent with their own goals as well as aligned with reform policies, the design of professional development is coherent (Desimone et al., 2002; Desimone, 2009; Garet et al., 2001). Coherence, consistency between learning and beliefs, gives the professional development meaning to teachers by providing relevance to what they are learning. Similarly, professional development aligned to instructional goals and curriculum can enhance teaching and learning (Hill, 2007). In the school system in which I work, the district-level leaders have determined that there is a need for engaging students in the learning process, including during the collection of formative data. Collaboration among (1) the district leadership and principals and (2) the principals and teachers in determining this need helped establish coherence (Desimone, 2009) in the design of the technology-based professional development sessions I conducted.

Research supports professional development that lasts several days or longer and many hours (Desimone et al., 2002; Garet et al., 2001; Hill, 2007), preferably more than 20 hours of contact time (Desimone, 2009). Additionally, it is important for professional development to include time for reflective practice over sustained blocks of time

(National Staff Development Council, 2001). In-depth study over an extended number of days can provide teachers with time to complete an authentic task or work in a self-directed manner to solve an instructional problem.

The last component in Desimone's (2009) framework, collective participation, is a successful strategy for teacher learning (Ball, 1996; Georgia Department of Education, 2008; Hill, 2009; National Staff Development Council, 2001; Wilson & Ball, 1996).

Collective participation provides an opportunity for collaboration among participants from within the same school and department (Desimone et al., 2002; Desimone, 2009; Garet et al., 2001). For collaboration to be effective, a focus on improving student achievement must guide it (Guskey, 2003b; Desimone, 2009).

As noted in Table 2-2, professional development literature is applicable to the development and implementation of technology-based instruction for educators. Table 2-2 describes how I incorporated the core professional development elements into the professional development I facilitated. The sessions I conducted focused on considering instructional strategies and resources for affecting student achievement. Through a focus on content, I attempted to help teachers understand how to use technology as a tool to support the learning of content. In addition, I worked to provide teachers with the opportunity to gather collectively and collaborate on a goal-related topic in an active learning environment taking place over an extended period. In professional development sessions in which teachers are learning about a technology and considering its uses during instruction, implementation of active learning may occur via occasions to work with the technology or collaborate on a technology-integrated lesson plan. Implementing these professional development core features benefited the

teachers as learners and influenced their instruction in the classroom. This study helped me to consider ways to implement these core features more effectively.

### **Technology-Based Professional Development**

A review of the literature related to technology-based professional development revealed similarities to the professional development literature. For each of the components described by Desimone (2009) as core features of professional development there is supporting literature in educational technology. This connection among the two literature bases is important to consider when applying the professional development literature to technology training.

It is important for facilitators of professional development to provide teachers with the opportunity to consider how they may implement particular content in their classroom (Hirsh & Killion, 2009; Sparks, 2002). A focus on content during technology inquiry groups is effective (Hughes & Ooms, 2004). A content focus is also influential because of the impact it has on teacher knowledge and practice as well as on student learning (Desimone, 2009).

An active learning environment in which teachers are involved in hands-on instruction regarding technology integration is essential. The inclusion of practice in professional development opportunities helps teachers implement technology in the classroom (Bradshaw, 2002). Providing time for practice is an important component that contributes to technology integration (Mouza, 2003). As Hooper and Rieber (1995) suggest, to move beyond integration in their adaption of technology teachers must actively construct knowledge regarding instructional technology.

Essential to coherent professional development is an in-depth focus on a limited number of topics (Firestone et al., 2005). The traditional approach to professional

development in which several topics are addressed in a short time is not effective for helping teachers maximize their learning and implement instructional changes (Firestone et al., 2005). As recent research suggests, coherence—as described by Desimone (2009)—is important for improving implementation of professional development (Penuel et al., 2008). For teachers to integrate technology consistently and effectively, they must have adequate access and support. Teachers may evaluate the coherence of the professional development based on the association between instructional expectations and available technological resources (Penuel et al., 2008). Considering technology use within the context of practice promotes teachers to use the technology in the way in which it was demonstrated (Matzen & Edmunds, 2007). In a study in one district implementing technology professional development (Firestone et al., 2005), the teachers struggled to connect content knowledge with standards and the details of teaching strategies due to lack of coherence, as the professional development was fragmented with no systematic connection to state educational goals. Firestone et al. (2005) suggest that focusing on specific content areas helps build cohesion.

For intellectual and pedagogical change to occur, professional development requires sufficient duration (Desimone et al., 2002; Garet et al., 2001; Hill, 2007; National Staff Development Council, 2001). Besides practice, theory, and demonstration, Bradshaw (2002) found follow-up to professional development vital to technology implementation by teachers. Additionally, follow-up on the application of the new skill or strategy is a fundamental component to coherent professional development (Firestone et al., 2005). Follow-up adds to the duration of the learning experience.



Collective participation can assist with discussion, collaboration, and reflection. As indicated in the professional development literature, collaboration among participants is an essential component of technology-based professional development (Hur & Brush, 2009). Mouza (2003) notes that in addition to addressing instructional relevance and time for practice, it is essential to discuss and reflect on the use of the technology in instruction. Especially when teachers are learning new technologies, administrative support, student needs, teacher collaboration, and technological resources affect the efficiency and degree of the teachers' implementation of technology (Mouza, 2003). One-on-one opportunities for collaboration, as well as goal setting and reflection, are critical for successful professional development (Orrill, 2001).

The professional development literature contributes to the knowledge of technology-based professional development. It is important to consider this base of literature in addition to that specifically related to technology instruction. Designing, developing, implementing, and evaluating technology-based professional development that incorporates elements described in the literature is essential for maximizing the integration of technology during instruction.

### **Instructional Design of Professional Development**

The generic ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) of ISD is the foundation of many modern models (Reiser & Dempsey, 2002). Use of these essential components in the development of technology-based instruction occurs in systematic linear formats such as the Dick and Carey Systems Approach Model (2004), as well as a systematic flexible application of the Morrison, Ross, and Kemp model (2001). In many of the models, the preferred approach is that

of implementing evaluation throughout instructional design. The essential components of ISD models assist in the effective design of professional development.

During the analysis phase of instructional design, goal setting for the professional development focuses on meeting the learners' needs (Morrison, Ross, & Kemp, 2007; Schnackenberg et al., 2001). A needs assessment helps determine goals and objectives for the instruction (Mager, 1997; Schnackenberg et al., 2001). During the analysis phase it is important to consider any factors relevant to the professional development and the learners. To ensure a thorough analysis, the data are evaluated after this phase. One formative evaluation activity is to share the data from the needs analysis with someone in the target group for feedback (Brown & Green, 2006).

Learning objectives are specified during the design phase. Also during this phase the scope and sequence of instruction and the methods of delivery are decided (Brown & Green, 2006; Morrison, Ross, & Kemp, 2007). The content of the professional development session is determined and plans are detailed. Revisions resulting from formative evaluations take place (Reiser & Dempsey, 2002).

Development entails creating materials decided on during the design to use during the professional development (Morrison, Ross, & Kemp, 2007). Creating instructional activities results from the needs analysis and development of goals and objectives (Brown & Green, 2006) for developing content to correct the instructional problem (Morrison, Ross, & Kemp, 2007). An evaluation of developed materials may indicate a need for revision based on their alignment with instructional goals and objectives.

The implementation phase involves providing the instruction to the learners. An effective presentation facilitates an instructional situation created to accommodate a

variety of learners (Brown & Green, 2006) in the setting for which the instruction was designed (Reiser & Dempsey, 2002). Formative evaluations assess the overall worth of the instruction during implementation (Reiser & Dempsey, 2002).

The evaluation phase emphasizes measurement of the objectives (Alessi & Trollip, 2001) for each phase of the instructional design. Conducting formative and summative evaluations will enhance programs (Morrison, Ross, & Kemp, 2007). Dick and Carey (2004) indicate that formative evaluation should take place throughout the design of instructional systems to determine the instruction's value, not just at the end as indicated by the ADDIE model. The summative evaluation provides information about expected program outcomes and evidence of program achievement of the outcomes (Morrison, Ross, & Kemp, 2007). Evaluating professional development throughout the instructional design process is essential for continuous improvement.

It is important to consider the fundamental components of ISD when planning professional development. The ISD components help develop appropriate instruction to meet the needs of learners. Applying data from the analysis phase to the design, development, and implementation phases of professional development helps meet instructional needs. In addition, the evaluation phase of ISD provides data for modifying instruction to make it appropriate for learners.

### **A Framework for Technology-Based Professional Development**

The principles described in this study establish a cohesive approach to professional development upon which I ground my practice. The literature revealed an inherent connection between adult learning assumptions, professional development literature, technology-based training literature, and ISD. It is because of the importance of incorporating systematically all of these elements into my own technology-based

professional development sessions that I propose the framework in Figure 2-2, which demonstrates the relationship among adult learning assumptions, findings in the professional development literature, technology-based professional development, and instructional design of professional development.

This “Proposed Framework for Designing Technology-Based Professional Development” displayed in Figure 2-2 begins with an examination of adult learning assumptions. An analysis of the professional literature in the areas of professional development and technology-based professional development revealed that adult learning theory is the foundation, as identified in the framework (Figure 2-2). The professional development literature is founded on adult learning methods and techniques as is apparent in the core elements described by Desimone (2009). In turn, the professional development literature provides the groundwork for the literature on technology-based training. Additionally, as noted in Figure 2-2, each of these affects the instructional design.

It is necessary to consider adult learning assumptions and the related professional literature during the analysis, design, development, and implementation phases of instructional design. As displayed in Figure 2-2, each of the ISD phases informs the others during the design process. Last, the framework (Figure 2-2) emphasizes that the other six components each influences the evaluation of the professional development.

In conclusion, implementing technology-based professional development with teachers requires several considerations. Adult learning assumptions, which include the teachers’ need to know, self-concept, experience, readiness to learn, orientation to learning, and motivation to learn (Knowles et al., 1998), not only affect learning

outcomes as discussed in the literature, but also influence instructional design. The literature related to professional development, including that conducted in technology integration settings, incorporates particular effective elements with a focus on improving student achievement, including (a) content focus, (b) active learning, (c) coherence, (d) duration, and (e) collective participation as described by Desimone (2009). It is important to consider each of these components during instructional design, as without such considerations the professional development will not include the core aspects to meet the needs of practitioners. Therefore, I work to incorporate all of the elements in Figure 2-2 as a foundation for consistently providing the best professional development possible and continually evaluate and reflect on my professional practice to achieve that end.

Table 2-1. Application of Adult Learning Assumptions during the Professional Development

Adult Learning Assumptions	Application of the Assumptions
Need to Know	Focus on related supporting research.
Self-Concept	Elicit feedback from learners, as well as provide feedback.
Experience	Differentiate instruction by process and product, consider learner backgrounds, provide online instructions for self-paced learning, and work with individuals as needed.
Readiness to Learn	Focus on a real-world task such as developing a technology-integrated lesson.
Orientation to Learning	Facilitate discussion among teachers regarding how the tools may solve an instructional problem.
Motivation to Learn	Facilitate discussion among teachers regarding beneficial classroom experiences with the technologies.

Table 2-2. Alignment of Professional Development Core Features to the Technology-Based Professional Development

Professional Development Research-Based Core Features	Application of the Core Features during Technology-Based Professional Development
Content Focus	Focus on using technologies for formative assessment.
Active Learning	Opportunities for hands-on experimentation with technologies and strategies.
Coherence	Topics support instructional goals of the system and schools.
Duration	Sessions on similar topics offered weekly with time to complete an authentic task such as a multimedia lesson that incorporates strategies for formative assessment.
Collective participation	Teachers attend during their grade level planning times. Opportunities for collaboration with a focus on improving student achievement.

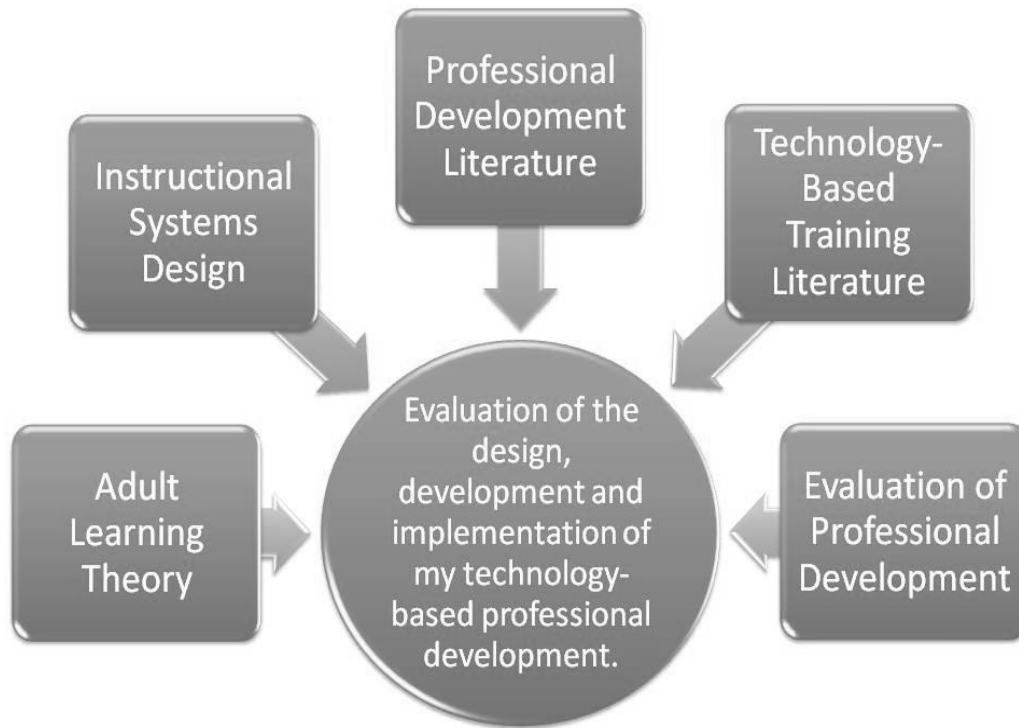


Figure 2-1. Relationship between the Literature and Purpose

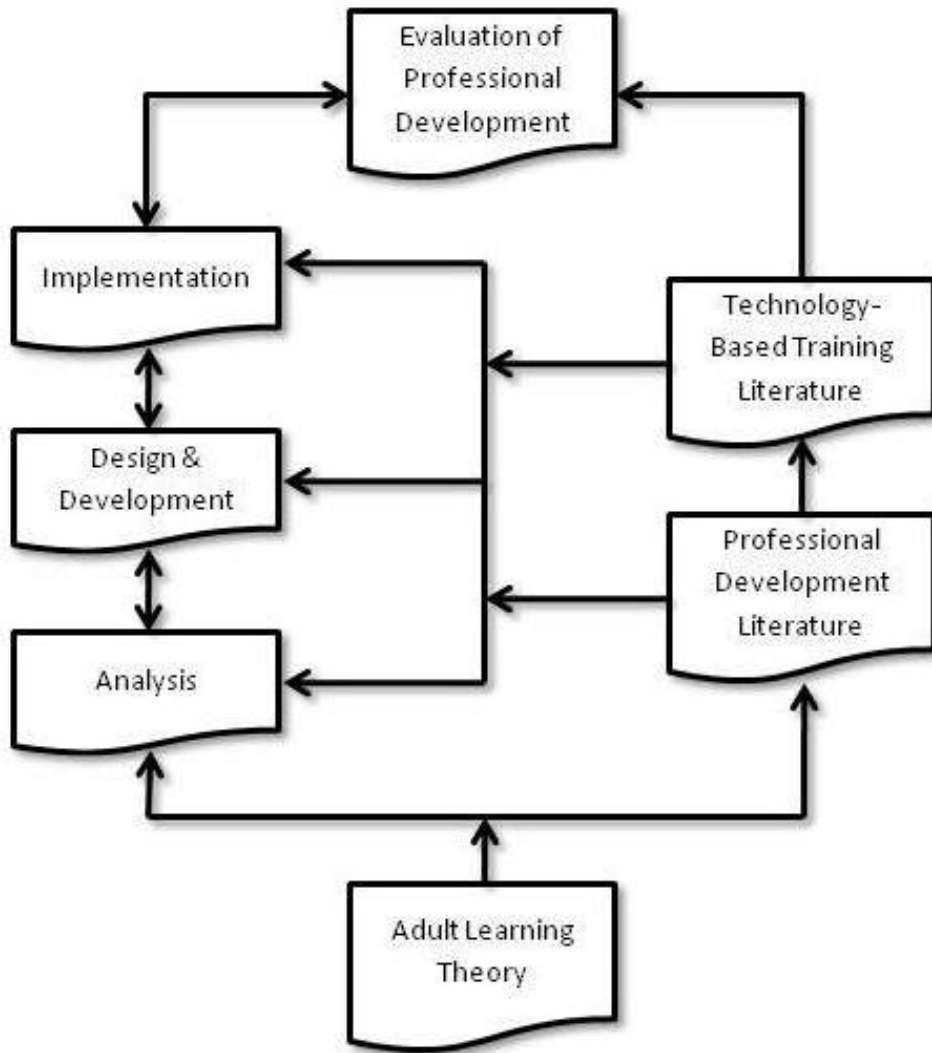


Figure 2-2. Proposed Framework for Designing Technology-Based Professional Development



## CHAPTER 3 METHODOLOGY

This study used a combination of qualitative and quantitative methods for collecting and analyzing data within the framework of Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a), a model designed to provide formative and summative information for improving and assessing the effectiveness of professional development (Guskey, 2006). Additionally, the levels are designed to build upon one another to measure improvement (Guskey, 1998, 2006). This model (Guskey, 1998, 2000, 2002a) helped me address the problem of the study, which is to design, develop, and implement professional development to help teachers use the SRS and mobile IWB for formative assessment and evaluate this professional development for continuous improvement.

The first of Guskey's Five Levels (1998, 2000, 2002a), Participants' Reactions, helped evaluate the basic requirements of the professional development such as its usefulness to the teachers. Analyzing data at this level provided information to judge the teachers' satisfaction and improve the design and delivery of the professional development. The second level, Participants' Learning, helped gauge the level of knowledge the teachers had acquired during the sessions. The third level, Organization Support and Change, helped determine whether the professional development and organizational factors gave the teachers enough support to implement their new knowledge. The fourth level, Participants' Use of New Knowledge and Skills, helped identify how the teachers were applying their learning from the sessions during classroom instruction. The fifth and final level of the model, Student Learning Outcomes, helped me assess the impact of the Professional Development on

classroom instruction, specifically student engagement. Application of Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a) provided information for helping me improve the technology-based professional development I conducted.

### **Guiding Questions**

The guiding questions for the study helped pinpoint the potential learning resulting from the professional development and application of that learning in the classroom. The guiding questions align with Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a) as displayed in Table 3-1. The development of each question helped facilitate data collection for the five corresponding levels of Guskey's Evaluation (1998, 2000, 2002a). Accordingly, the following questions guided the data collection for studying the professional development:

- What are the teachers' perceptions about the professional development?
- In what ways did the teachers acquire the intended knowledge?
- In what ways does the organization help teachers implement the technologies?
- In what ways are the teachers using the mobile interactive whiteboard and student response system?
- What effect did the professional development have on student engagement?

### **Context of the Study**

I serve two middle schools (School A and School B) in a rural school district in Georgia as their ITS. As noted in Table 3-2, the Georgia Department of Education rated both schools as "Distinguished" in their improvement status for 2009. Due to the low percent of economically disadvantaged students, neither of the schools held Title I

status for the school year 2008-2009. Additionally, the number of students with disabilities and English language learners at each of the schools does not currently meet the minimum requirement to qualify as a sub group for determining annual yearly progress.

There are two computer labs at each school used by the Career, Technical, and Agricultural Education Departments. Each school also has two computer labs for the teachers to use for instructional purposes. The media center at School A has six networked computers for student use, and the media center at School B has 28 netbook computers that access the Internet via a wireless network hub in addition to 14 desktop computers. All of the computers at the two schools provide Internet access, a home drive for storage, a student and teacher shared drive, and a variety of software for instructional and productivity purposes. Each core academic teacher also has a classroom set of SRSs and a mobile IWB.

### **Participants**

The population, or potential target audience for the study, consisted of teachers from the two middle schools in which I serve who attended the professional development related to using the SRS and mobile IWB for formative assessment (N=40). The sample consisted of the teachers who attended the professional development sessions and consented to participate in one or more aspects of the study (n=36). For a teacher's data to be included in the study, he or she was required to participate in the professional development sessions. Each participant in the study signed a consent form approved by the Institutional Review Board.

A strategy that Patton (1987) refers to as "convenience sampling" designated participants in the evaluation, as the teachers are naturally present in the setting of the

study. This sampling strategy is appropriate and typical in evaluating professional development. Since the middle school teachers are a natural part of the school environment and the professional development that I conduct there, I approached the teachers before the first professional development session to ask if they would like to participate in the sessions and be a part of the study. When meeting with the teachers I explained the main parts of the study including the purpose of studying the professional development I offer to improve future sessions. I also confirmed participants' anonymity in my writing and discussions of the data, which helped to increase participation in the study. Face-to-face interactions increased rapport and teachers' interest in participating in the interviews and observations. The data I collected from the participants provided me with information for improving the future professional development that I conduct.

Of the thirty-six (N=36) participants 72.2% were female (n=26) and 27.8% were male (n=10). Of the participants 22.2% hold a bachelor's degree (n=8) and 77.8% hold a graduate degree (n=28) including 17 masters, 10 specialists, and 1 doctorate. The participants' mean years experience teaching in Georgia is 14.6 with the frequency distribution as follows: 6 teachers with 1-5 years, 6 teachers with 6-10 years, 7 teachers with 11-15 years, 12 teachers with 16-20 years, and 5 teachers with 21 or more years. The primary subject areas of the participants are as follows: 1 teaches technology education, 8 teach language arts, 9 teach math, 10 teach science, and 8 teach social science.

### **Description of the Professional Development**

As described in the problem and purpose sections of this paper, the professional development design included input from the building principals and a review of system and school goals in the initial needs assessment. Development of the professional

development sessions considered research-based best practices, and the goals and objectives align with the Georgia Department of Education (2008, 2010a) evaluation standards. The sessions emphasized using the SRS and a corresponding mobile IWB screen along with clicker strategies for formative assessment. Additionally, the professional development sessions included four main parts described below.

### **Overview**

The initial needs assessment identified the need for technology integration sessions focusing on formative assessment leading to engagement of students. In contemplating how the SRS and mobile IWB technologies could support this content focus during learning, I developed a list of possible session descriptions for the professional development. I shared the draft session list with the leadership teams at each of the schools during the initial needs assessment.

This study examines four professional development sessions, which occurred during the teachers' grade level planning time. The sessions were approximately an hour each and occurred weekly at each of the schools. Additionally, the sessions incorporated the SRS and mobile IWB for demonstration and participant experimentation to help the teachers learn to use the technologies for formative assessment. I placed materials online for teachers to access at their convenience for self-paced learning and helped teachers individually as requested during and outside of the sessions.

### **Lesson Development**

Tables 2-1 and 2-2 in the Literature Review detail how the professional development addressed adult learning assumptions and the core professional development elements. Because of my recent research (Fuller, 2010), I worked to

design my instruction with a focus on adult learning assumptions (Knowles et al., 1998) and the following elements found in the professional development literature: (a) content focus, (b) active learning, (c) coherence, (d) duration, and (e) collective participation (Desimone, 2009). Each of these components contributes to effective professional development.

In keeping with adult learning assumptions (Knowles et al., 1998), I designed the professional development with a focus on formative assessment to affect the teachers' data-collection methods in the classroom and to help the teachers value the instruction. The teachers had opportunities to work collaboratively or independently with the SRS and mobile IWB, which helped address their levels of experience with technology. Working collaboratively on a real-world task, a multimedia lesson for collecting formative data, addressed the teachers' readiness to learn by preparing them to implement the new concepts. I facilitated the teachers' orientation to learning as they collaborated on ideas for applying their knowledge and skills regarding instructional use of the technologies. Finally, opportunities to share their experiences with each other about past trials with the technologies or plans for future implementation motivated the teachers. Using adult learning assumptions in the design of the instruction helped me meet the teachers' learning needs related to using the SRS and mobile IWB for formative assessment.

The lesson activities incorporated the key aspects of professional development as well (Desimone, 2009). Each lesson focused on how the SRS and mobile IWB technologies could affect student achievement. A focus on formative assessment strategies helped teachers consider ways to use the technologies to examine student

understanding of content as well as adjust instruction to meet students' needs. During the sessions the teachers had opportunities to participate actively by experimenting with the SRS and mobile IWB at stations to develop their skills and confidence using the technologies. Alignment of the instructional goals for the sessions with the needs of the teachers based on discussions with the principals helped establish coherence during the initial needs assessment. Teachers felt more comfortable with the technologies, as four lessons taking place over five weeks gave them time to learn and practice their new skills. As the sessions were during planning periods, the teachers also had an opportunity for collective participation, which helped them gain ideas for using the clickers and mobile IWB for formative assessment.

### **Lesson Goals and Objectives**

The Georgia Department of Education (2008, 2010a, 2011) considers Formative Assessment to be a tool for guiding and monitoring the progress of student learning during instruction and for adjusting instruction to maximize student achievement on the Georgia Performance Standards. An overarching goal is to provide teachers with professional development that will help them integrate their new 21<sup>st</sup>-century technologies into their instruction. The following learning goals were adapted from the School Keys (Georgia Department of Education, 2008) and designed to incorporate the needs of the learners as based on the discussions with school principals:

- The teachers will be able to design lessons guided by the instructional technology literature that integrate technology for collecting formative data.
- The teachers will be able to use the technology-collected formative data for monitoring student learning during instruction.
- The teachers will explain ways to adjust instruction based on the technology-collected formative data.

I developed the objectives, learning activities, and an assessment based on the instructional goals as detailed in Table 3-3. I intentionally aligned the objectives to the learning goals. I designed the learning activities and assessment to address and measure mastery of the objectives respectively. The objectives for each of the lessons (Table 3-3) focused on three main issues:

- Using the technologies with a clicker strategy for formative assessment.
- Experimenting with using the technologies to collect formative data.
- Creating a multimedia lesson for formative assessment.

The following sections describe the technologies I addressed during the lessons, the SRS and mobile IWB, and the lesson development process. Additionally, I explain the activities I used during the lessons to help achieve the instructional goals and objectives.

### **Lesson Activities**

Each lesson focused on using the SRS and a mobile IWB for formative assessment. When considering use of the technologies, I focused on using the verbal question feature and corresponding charting components of the clickers along with the mobile IWB data screen. The verbal question allows a teacher to ask a question instantaneously or use one typed in any digital file and display the results from the clicker data in a charting format. Simultaneously, individualized student results from the SRS display on the mobile IWB screen, providing the teacher with data for immediate modification of instruction.

I designed the first lesson to assess the teachers' needs and to build background knowledge (Table 3-3). The initial activity for this lesson included a review of the



technology's key functions and modeling of use. For this lesson I also incorporated a modified K-W-L activity in which the teachers expressed what they “knew” and what they “wanted to learn” from each other about the clicker-charting feature and the mobile IWB report screen as formative assessment tools. To gather this information I asked clicker questions such as (1) Are you comfortable with what you know about verbal questions and charts? and (2) Are you comfortable with what you know about the mobile interactive whiteboard screen? Open-ended question such as the following provided information regarding the teachers' knowledge and preferred strategies, which I recorded using the mobile IWB for reference as the sessions were proceeding:

- What do you want to learn about verbal questions and charts?
- What do you want to learn about the mobile interactive whiteboard screen?
- How would you best learn about these technologies?

Additionally, in this lesson I included a cooperative learning activity in which the teachers discussed how they would use the technologies to monitor the progress of student learning and ways to adjust instruction to maximize student achievement. This initial lesson helped guide the development of my instruction during the following sessions on using the technologies and considering formative assessment strategies. During the remainder of the session, the teachers began to work on a multimedia lesson for use with their students.

Similar to the first lesson, the general instructional sequence of activities (Table 3-3) for Lessons 2 through 4 was as follows:

- An introduction to the technology and a strategy for using it formatively.
- A technology-integrated formative assessment discussion facilitated by cooperative learning activities.

- An opportunity for teachers to experiment with the technology and strategy at their discretion.
- Time to work on a multimedia lesson that incorporates formative assessment strategies.

The following sections explain in detail each lesson component described in Table 3-3 according to the instructional sequence.

**Technology-integrated formative assessment strategies.** Each of the lessons used a similar approach for the introduction to the technology and formative assessment strategies. During the professional development I facilitated discussions to help the teachers consider instructional strategies for using their SRS and mobile IWB report screen to collect formative data about their students. I incorporated three literature-based strategies into Lessons 2 through 4 for this purpose (Table 3-4). The strategies I used are Contingent/Agile Teaching clicker strategy (Bruff, 2009b; Beatty et al., 2006; Draper & Brown, 2004), Discussion Warm-up/Think-Vote-Share clicker strategy (Bruff, 2009a, 2009b; Lyman, 1981), and Peer Instruction clicker strategy (Bruff, 2009a, 2009b; Mazur, 1997). Each of these strategies incorporates SRS, referred to as “clickers,” and the mobile IWB screen for formative assessment by providing an avenue to collect data and an approach for adjusting instruction.

For example, by using the Contingent/Agile Teaching clicker strategy (Bruff, 2009b; Beatty et al., 2006; Draper & Brown, 2004) as the teacher instructs he or she can collect real-time clicker data to monitor student achievement and then use the data to modify instruction immediately. The Discussion Warm-up clicker strategy (Bruff, 2009a, 2009b; Lyman, 1981) also helps a teacher monitor the students’ progress. The students’ thinking about a question posed by the teacher and voting on an answer using the SRS promotes discussion about the concept to help identify the students’

understandings as well as misinterpretations. The Peer Instruction strategy (Bruff, 2009a, 2009b; Mazur, 1997) discussed during the fourth session helps students learn content that is more difficult. For this strategy a teacher would involve the students in an instructional cycle of questioning and peer interaction until the group understood the material.

During the sessions (Table 3-3) we also discussed that during use of clickers for formative assessment, the literature suggests between three and six clicker questions for a 50-minute lesson (Bruff, 2009a; Beatty & Gerace, 2009). Pacing the questions appropriately between segments of content allows a teacher to create an opportunity for formative data collection. Additionally, pacing the questions rather than asking them all at once keeps the students attentive and engaged throughout the lesson. During the professional development the teachers considered this research in their discussions about formative assessment. I presented the clicker research and formative assessment strategies concisely (Table 3-4) and facilitated a cooperative activity to engage the teachers in considering use of the strategies in the classroom.

**Cooperative activities.** Following introduction to the technology and one of the clicker strategies discussed above, a cooperative activity helped the teachers consider and discuss how they may use the strategy during instruction for data collection. During the sessions (Table 3-3) the teachers received a handout (Appendix A) containing the formative assessment and technology-integration components of the Class Keys teacher evaluation rubric (Georgia Department of Education, 2010a). The teachers referred to this handout during the cooperative activities when considering how they might incorporate the formative assessment strategies into their instruction to meet the

expectations of the State. The handout also helped spark ideas for using the technologies formatively. During the cooperative activity I incorporated questions such as “How would you use the clickers and mobile IWB to implement this clicker strategy in your classroom?” to facilitate discussion among the teachers.

Cooperative learning activities during the professional development also facilitated discussions regarding how to integrate technology for data collection, monitor student learning using the data, and adjust instruction as a result of the data to meet the needs of individual students. “Considering the Formative Assessment Class Keys strands, in what way(s) can the strategy help you to monitor the progress of student learning as described in the Proficient category?” and “Considering the charting and mobile IWB screen data, what strategies might you implement to adjust instruction immediately?” were questions that cooperative groups discussed. To facilitate their thinking about the Exemplary level on the evaluation rubric, during the third session I had the teachers discuss the following: “In what way(s) could you use the technologies to facilitate student reflection of their own learning to involve them in instructional decisions?” I archived the information from these discussions using the mobile IWB to record the thoughts that teachers shared with the group. I referred to this type of information from the sessions each week to help decide which concepts to review in future sessions. Additionally, I recorded my observations in a Reflection Journal (Appendix B) for reference throughout the study.

During the final lesson (Table 3-3) I incorporated a cooperative activity to review the teachers’ thoughts regarding using the SRS and mobile IWB for formative assessment. Before the session I set up two mobile IWBs for the teachers to record

their thoughts for displaying on the screen in addition to a computer with presentation software for recording notes. At each of these three technology stations, there was one question for each teacher group to answer. At the mobile IWB stations, the teachers wrote on the mobile IWBs, and their responses were projected. At the computer station the teachers typed on a shared online presentation document. The teacher groups rotated to each station and answered the following questions during this cooperative activity:

- How might you use the clickers and/or mobile interactive whiteboard to monitor the progress of student learning?
- Based on formative data, if re-teaching is needed what strategies would you use to adjust instruction immediately?
- How might you use the technologies to involve students in decisions about re-teaching?

These questions were a culmination of the objectives for the sessions (Table 3-3) and the items on the Observation Rubric (Appendix H). I reviewed the answers to these questions to provide information regarding the teachers' understanding and recorded my reflections in the journal.

**Experimentation with the technologies.** The teachers had an opportunity to experiment with the technologies and the associated formative assessment clicker strategies (Table 3-4) during each of the second through fourth sessions (Table 3-3). Two stations were set up in the computer lab with a SRS and mobile IWB. During this part of the sessions, teachers gathered around the stations to work with the technologies. I circulated and helped the teachers as needed answering any questions they had about the technologies or their use. Between five and 15 teachers participated at the stations each week while the other teachers at the session either experimented

with the technologies independently or began to work on a multimedia lesson designed to integrate the formative assessment strategies.

### **Data Collection**

I used Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a) as the framework for the study's data collection. For each of Guskey's Levels (1998, 2000, 2002a), there is alignment among the guiding questions and data-collection methods (Table 3-5). The guiding question for each level helped me study the effectiveness of four professional development sessions I conducted regarding using the SRS and mobile IWB screen for formative assessment. The study's data-collection instruments (Table 3-5) include a Perception Questionnaire for Level 1, a Participants' Learning Artifact Rubric for Level 2, an Organization Support Questionnaire for Level 3, and an Observation Cycle for Levels 4 and 5 including Pre- and Post-Observation Interviews.

At the end of the second professional development session, I asked teachers in attendance to complete the Level 1 Perceptions Questionnaire (Appendix C). Although some respondents to this questionnaire had not attended the first session, I still included their data in the study on the basis that the data may help me meet teachers' needs and improve future sessions. I also asked teachers attending at least two of the sessions to complete this survey later using this same rationale. Teachers worked on a multimedia lesson throughout the four sessions. If teachers attended all four sessions and displayed their multimedia lesson, then I reviewed it using the Participants' Learning Artifact Rubric (Appendix D). I asked the teachers who attended all of the sessions to complete the Level 3 Organization Support Questionnaire (Appendix E) following the fourth session. The prerequisite for participation in the Observation Cycle

was attendance at all four of the professional development sessions and completion of the Level 1 and Level 3 questionnaires, which ensured that my cases provided the information I required.

### **Guiding Question for Level 1: Participants' Reactions**

As noted in Table 3-5, I administered the Perceptions Questionnaire (Appendix C) to address this guiding question of Guskey's Evaluation (1998, 2000, 2002a): "What are the teachers' perceptions about the professional development?" Questionnaires focusing on teacher perceptions and reflections are an appropriate method for gathering data (Guskey, 1998). I administered questionnaires to collect data for Level 1 and Level 3 of the model.

During the design of both questionnaires, I focused on collecting data aligned with adult learning assumptions and the professional development literature. I modified the questionnaires as appropriate to ensure their alignment with the goals of the evaluation level and the lesson objectives. Additionally, to assist with face and content validity in the questionnaires, a panel of education experts, including a technology director, ITS, and three professional development directors, reviewed the questionnaires. For face validity each expert agreed that the questionnaires appeared to measure what I had intended. For content validity the experts determined each item on the questionnaires to be essential to the data collection.

I used several strategies found in the literature to help with data collection. The format for the majority of the questionnaire items is a matrix that uses space efficiently to facilitate participants' perception that they can complete the questionnaire quickly (Babbie, 2007). Additionally, I considered the importance of question order and placed the more interesting questions at the beginning of the questionnaires (Babbie, 2007).

To increase the response rate, I also used a bimodal method that included web-based and paper versions of the questionnaires (Dillman, 2007). Dillman's "Tailored Design Method" (2007) suggests making multiple contacts for increasing participation in questionnaires. I asked the teachers to complete the Perceptions Questionnaire at the end of the second session; however, based on initial response rates I sent out the link to the web-based survey to gather sufficient data for analysis.

The questionnaire for Level 1 elicited information from the teachers regarding the usefulness of the professional development. Items on this four-point Likert-Scale questionnaire range from Strongly Disagree (1) to Strongly Agree (4). The Perceptions Questionnaire (Appendix C) includes items such as (1) The professional learning related to my school's improvement plan and (2) The professional learning connected to my prior knowledge. I administered this questionnaire to all participants during the second week of the evaluation process, as noted in Table 3-6, to gather formative data and make needed adjustments as the sessions were proceeding. Additionally, I asked teachers attending at least two of the professional development sessions to complete the survey following the session sequence. Identification numbers on the questionnaires allowed me to consider perceptions and ideas of individual teachers while allowing for anonymity.

### **Guiding Question for Level 2: Participants' Learning**

I used two instruments to collect data for this guiding question of Guskey's (1998, 2000, 2002a) model: "In what ways did the teachers acquire the intended knowledge?" One instrument is a Participants' Learning Artifact Rubric (Appendix D) for rating a teacher-developed multimedia lesson. The other instrument is a Reflective Journal (Appendix B) I completed following each lesson I conducted. The Reflective Journal



helped me consider the teachers' learning and provided useful information for triangulation (Denzin, 2006) during the professional development to help me meet the teachers' needs; however, it did not provide data for the study.

### **Participants' Learning Artifact**

The Participants' Learning Artifact for Level 2 helped gauge the teachers' learning because of the professional development. The artifact is a teacher-developed multimedia lesson that demonstrated evidence of its intended use for formative assessment. The participants worked on their multimedia lesson during each of the sessions. Since Guskey (1998) notes that the preceding levels must be successful for the following levels to be successful, I offered teachers suggestions and answered questions during the professional development sessions regarding use of formative assessment strategies in their lessons' design.

### **Participants' Learning Artifact Rubric**

To evaluate the teacher-developed multimedia artifact for Guskey's (1998, 2000, 2002a) Level 2, Participants' Learning, I developed a rubric (Appendix D). I aligned the rubric to the literature on using clicker questions formatively during instruction (Bruff, 2009a), as well as to the standards for implementing formative assessment strategies, which are outlined in the Class Keys (Georgia Department of Education, 2010a). I used the rubric for evaluating the artifact to rate the teachers' ability to design lessons that will facilitate (1) using the technologies for formative assessment and (2) using formative data to change instruction in response to learning needs. I reviewed the artifacts the teachers' submitted, and we discussed their formative assessment plan. The completion of the Participants' Learning Artifact Rubric provided data on the teachers'

learning as a result of the professional development and for me to use to improve my future instruction.

### **Post-Instruction Reflective Journal**

After each lesson I reflected on my teaching using the focus questions on the Post-Instruction Reflective Journal (Appendix B) designed to gather information to answer the guiding question for Guskey's (1998, 2000, 2002a) Level 2: "In what ways did the teachers acquire the intended knowledge?" Following each session I kept a Reflection Journal to help gauge the teachers' learning and reflect on my teaching. This activity helped me review the strategies that I used during the instruction and consider the teachers' understanding of the content. Journaling helps with constructing meaning from and reflecting on experiences (Killion, 2008). The reflections in the journal provided valuable information during triangulation (Denzin, 2006) of the results for Level 2, but were not considered data for the study.

During the lessons I observed the teachers' interactions and considered the value of the teachers' experimentation with the technologies, as well as the teachers' understanding of how they could use the clickers to monitor student progress and adjust their instruction to maximize student understanding. I recorded a part of this observation process during the sessions as I used the mobile IWB to record the teachers' responses during the cooperative learning activities. I reviewed the files from the cooperative activities in which the teachers answered questions to demonstrate their understanding of using the technologies for formative assessment. I recorded my observations and thoughts about the cooperative activities in the Reflective Journal.

Each week after the session I reviewed the previous written reflections in the Reflective Journal to formatively review the professional development sessions related

to the items this tool addresses, which are (1) how the teachers responded to the various parts of the sessions, (2) how I monitored their learning, and (3) considerations for modifying the sessions. My observations during the sessions provided me with important information to help consider the methods that I use during instruction and to study the teachers' understanding. My reflections helped me learn more about my practice and ways I may improve it (Dewey, 1938).

### **Guiding Question for Level 3: Organization Support and Change**

As noted in Table 3-5, I administered the Organization Support Questionnaire (Appendix E) to provide data related to this guiding question for Guskey's (1998, 2000, 2002a) model: "In what ways does the organization help teachers implement the technologies?" For face and content validity, the panel of experts who reviewed the Level 1 Perceptions Questionnaire (Appendix C) also reviewed this questionnaire. Similar to the Level 1 Perceptions Questionnaire, I designed this questionnaire in a matrix format considering the research on increasing response rate (Babbie, 2007), and I administered it using a bimodal method of distribution (Dillman, 2007).

During Week 5 of the study, I administered the questionnaire for Level 3 to gather data regarding the support structure provided by the professional development. Items on this four-point Likert Scale range from Strongly Disagree (1) to Strongly Agree (4). This instrument includes items such as (1) I identified strategies for using the technologies for formative assessment and (2) I am able to use the technologies for formative assessment. I administered this questionnaire following the intervention as designated on the timeline (Table 3-6).

## **Guiding Questions for Levels 4 and 5: Participants' Use of New Knowledge and Skills and Student Learning Outcomes**

For Levels 4 and 5 of Guskey's Evaluation (1998, 2000, 2002a) I systematically employed a three-part Observation Cycle (Danielson, 2007) consisting of a Pre-Observation Interview, a classroom observation, and a Post-Observation Interview. I implemented the Observation Cycle to address these guiding questions for Guskey's model (1998, 2000, 2002a):

- Level 4 - In what ways are the teachers using the mobile interactive whiteboard and student response system?
- Level 5 - What effect did the professional development have on student engagement?

I administered several instruments to collect data for Levels 4 and 5 of Guskey's (1998, 2000, 2002a) model. The instrument for the Pre-Observation Interview (Appendix F), the first component of the Observation Cycle, consisted of interview questions that I asked the participants for collecting data for Level 4. For the second component of the Observation Cycle, the Levels 4 and 5 classroom observation, I used two instruments—the Observation Field Notes Record (Appendix G) and the Observation Rubric (Appendix H)—to record data from the observation of the teacher implementing the SRS and IWB for formative assessment during instruction and observations regarding student engagement. For the last part of the Observation Cycle, which I implemented for the Level 5 guiding question, I asked the participants a set of questions for the Post-Observation Interview (Appendix I).

The Pre-Observation Interview for Level 4 helped me clarify the teachers' lesson plans for the observed lesson and determine if they needed assistance before I observed the lesson. The Observation Rubric for Level 4 and the Observation Field

Notes Record for Levels 4 and 5 helped me understand thoroughly the teachers' use of the technologies for formative assessment and gave me an opportunity to reflect deeply on how my instruction contributed to their use as well as student engagement. The Post-Observation Interview for Level 5 gave me further insight into how the teachers used the technologies for formative assessment; teacher input into how the technologies engaged their students, if at all; and their thoughts regarding the professional development and its effect. The following sections describe how each of the components of the Observation Cycle addressed the guiding questions for Levels 4 and 5 of Guskey's (1998, 2000, 2002a) model.

### **Pre-Observation Interview**

I designed the Pre-Observation Interview to address the question for Guskey's (1998, 2000, 2002a) Level 4: "In what ways are the teachers using the mobile interactive whiteboard and student response system?" The interviews helped me confirm or invalidate the data gained through the observations (Fraenkel & Wallen, 2006). Interviewing also helped elicit information that was not directly observable (Patton, 1987). For example, I designed the Pre-Observation Interview (Appendix F) questions to relate to the teachers' thought processes during the planning stage of the lesson. The interview questions also provided information regarding the teachers' plans for using the technologies for formative assessment, which gave me insight into each teacher's understanding.

To facilitate comparison of responses for data collection and to avoid leading questions, I created the Pre-Observation Interview questions using a "standardized open-ended" format (Patton, 1987). Having a standard set of questions for each interviewee reduced the potential bias that can result from analyzing data from different

interviews (Patton, 1987). The interview questions asked about the teachers' experience and for their opinion (Patton, 1987) to help me study the effects of the professional development I provided. The probing questions helped gather particular details not explained by the interviewee's initial response.

I conducted the interviews in the teachers' classrooms. At the beginning of the interview, I asked each teacher's permission to record the interview to capture the actual words of the interviewee and avoid misinterpretations (Patton, 1987). Recording the interview also enabled me to concentrate on the interviewee's responses and ask additional probing questions if needed. To help devise follow-up questions and later find quotations within the recording (Patton, 1987), I took some notes on the pre-observation form (Appendix F) during the interview. Since I have been working with the teachers for two years, I have developed a rapport with the teachers that helped keep a conversational tone throughout the interview; however, I remained neutral to the interviewee's responses by accepting their opinions without judgment.

### **Observation**

The classroom observation's purpose in the study was to provide data for the guiding questions for Levels 4 and 5 of Guskey's (1998, 2000, 2002a) model: "In what ways are the teachers using the mobile interactive whiteboard and student response system?" and "What effect did the professional development have on student engagement?" I developed a protocol that includes a Field Notes Record (Appendix G) and an Observation Rubric (Appendix H) for the second component of the Observation Cycle, the classroom observation, to help collect data. This observation protocol helped me study the teachers' efforts to integrate technology with a focus on their use of SRS

and a mobile IWB. This protocol guided my observations for determining how using the technologies affected the teachers' instruction and students' engagement.

I conducted one observation for each of the participating middle school teachers (N=12) as a part of the Levels 4 and 5 data collection. I observed the participants while they were using the technologies during instruction. To be long enough to "get a full description and deep understanding" (Glense, 2006, p. 51), the length of the observation was the length of the lesson. On average the time spent in each classroom was an hour.

**Observation Field Notes Record.** I created the Observation Field Notes Record (Appendix G) to facilitate organization during the observation and collection of data. Using the Field Notes Record, I collected specific details regarding the teachers' use of technology and observations regarding student engagement. The format includes focus points at the top of the record as a constant reminder of what to observe in the classroom, which helped direct the data collection. There is a place on the record for a description of the environment and reflections (Patton, 1987). Additionally, I documented reflective thoughts noted by brackets around the text to differentiate from observation notes. The format of this Field Note Record also provides space for documenting "descriptive and analytic" field notes (Glesne, 2006, p. 56).

In my role of observer as participant (Glesne, 2006), I recorded my observations on the Field Notes Record while in the teacher's classroom (Glesne, 2006; Patten, 1987). The field notes are a detailed description of what I observed in the classroom (Patton, 1987) and include an environmental description, direct quotes, specific

behaviors, and reflections. My recorded observations focused on data regarding how my instruction has affected classroom use of the technology:

- In what ways is the teacher using the technologies?
- In what ways is the teacher collecting formative data?
- In what ways has the teacher directed the students to use the technologies?
- In what ways are the students engaged because of the teacher's lesson?

**Observation Rubric.** I developed the indicators on the Observation Rubric (Appendix H) considering the Class Keys (Georgia Department of Education, 2010a) teacher evaluation standards for formative assessment and technology integration. In the rubric I also addressed the specific features of the clickers and mobile IWB relating to their potential formative assessment use. I carefully aligned each indicator on the rubric with the teacher evaluation standards (Georgia Department of Education, 2010a) to help obtain an accurate measurement of teacher proficiency. The format of this Observation Rubric is modeled after the Rubric for Evaluating North Carolina Teachers (North Carolina State Board of Education, 2007), which is used for classroom observations.

Following each observation I completed the Observation Rubric considering how the teacher used the technologies for formative assessment during the lesson. Additionally, for accuracy I reviewed each rubric following the Post-Observation Interview.

The observations generated data for studying the effectiveness of the professional development as it relates to the teachers' application of their new skills for collecting formative data using the technologies and the effect of the instruction on student



engagement. On the Field Notes Record I collected data for Level 4, and regarding student engagement I described the behaviors of the class as a whole to indicate the active participation level of the students and their use of the technologies, which provided additional insight during the analysis of Level 5 data. The Observation Rubric data gave insight into the teacher's use of the technologies for formative assessment for Level 4.

### **Post-Observation Interview**

I administered the Post-Observation Interviews (Appendix I) to collect data for Level 5 of Guskey's (1998, 2000, 2002a) model: "What effect did the professional development have on student engagement?" I designed the Post-Observation Interview questions similar to the Pre-Observation Interview questions to confirm or invalidate data gained through the observations (Fraenkel & Wallen, 2006). Additionally, and in a similar fashion, I used a "standardized open-ended" format to avoid leading questions and to help reduce bias (Patton, 1987).

Just as with the Pre-Observation Interviews, I conducted the interviews in the teacher's classroom, recorded their responses, and took notes on the post-observation form as needed to avoid any misinterpretations. The method and its rationale during the Post-Observation Interview process are the same as during the Pre-Observation Interview.

The Post-Observation Interviews helped me understand the teachers' use of the technologies during instruction for formative assessment and their thoughts about the technology on student engagement. Additionally, since it was the last component of the study I asked the teachers questions related to improving the professional development. The questions related to the professional development provided valuable information

regarding the strategies that teachers found most useful, as well as strategies they would like me to use to meet their needs.

### **Data Analysis**

The data for Guiding Questions 1, 2, 3, and part of 4 are represented quantitatively, as the instrument for the data collection was a Likert-Scale questionnaire for 1 and 3 and a rubric for 2 and 4. Additionally, I reported qualitative data from the Pre-Observation Interviews for Guiding Question 4, Observation Field Notes Record for Guiding Questions 4 and 5, as well as the Post-Observation Interviews for Guiding Question 5. Additionally, I used the information from the Reflection Journal for triangulation.

### **Quantitative Data Analysis**

I collected quantitative data during Weeks 2-11 of the study using the questionnaires and Weeks 5-12 using the rubrics. I analyzed the quantitative data continually through Weeks 3-15 of the study (Table 3-6). This section describes the analysis of the questionnaire and rubric data.

**Questionnaires.** I reported the data for the Guskey's (1998, 2000, 2002a) Level 1 and Level 3 questionnaires using descriptive statistics. For each Likert-Scale item on the questionnaires, table data displays the mean and standard deviation. I calculated these statistical measures for the Likert-Scale items using the formulas in Microsoft Excel. These data helped determine areas of strength or needs improvement. Additionally, these surveys' data identified commonalities among the teachers' initial perceptions about the professional development strategies for the Level 1 Perceptions Questionnaire (Appendix C) and perceptions about how the organization supported the

teachers' learning and application resulting from the professional development for the Level 3 Organization Support Questionnaire (Appendix E).

**Participants' Learning Artifact Rubric.** The Participants' Learning Artifact Rubric for Guskey's (1998, 2000, 2002a) Level 2 (Appendix D) incorporates two components: (1) Plan for use of technology for formative assessment and (2) Use of questions. Using these components on the rubric, I evaluated each teacher's artifact individually. I selected observed indicators on the rubric and determined the rating for each component based on the category with the highest frequency of indicators recorded. For each of the two components the ratings were as follows: 1 = Emerging, 2 = Proficient, and 3 = Exemplary. The sum of the two scores designated the total score for the rubric, which was applied to the following scale: 6 points = Exemplary, 4-5 points = Proficient, and 2-3 points = Emerging.

An Emerging rating essentially means that a teacher only minimally considers using the technologies for formative assessment. The lesson incorporates very few clicker questions for collecting data. Additionally, the questions in the lesson lack clear alignment to the standards.

For a teacher to receive a Proficient rating, the lesson plan includes charting for displaying the clicker data, the mobile IWB screen data, or another form of data to monitor the progress of individual students. The formative assessment plan also includes ideas for adjusting instruction to meet learners' needs. The questioning strategies for this rating may include more than the recommended three to six clicker questions for collecting formative data (Bruff, 2009a; Beatty & Gerace, 2009); however,

the questions have appropriate alignment to the standards and grouping in the lesson is unobtrusive.

In addition to the elements found in an artifact scoring Proficient, an Exemplary multimedia lesson includes use of a variety of clicker strategies to gain formative data as well as adjust instruction. A lesson of this caliber includes ideas for using clicker data to facilitate students' reflection about their own learning and involves the students in instructional decisions.

Due to the calculation of the two rubric components, a teacher scoring Exemplary in only one section and Proficient in the other would still receive an overall rating of Proficient. I compiled the data for the Participants' Learning Artifact Rubric by placing the overall rating data set into a frequency distribution before calculating descriptive statistics. For each item on the rubric, I reported the mean and standard deviation. I calculated each of these statistical measures using the formulas in Microsoft Excel.

**Observation Rubric.** The Observation Rubric for Guskey's (1998, 2000, 2002a) Level 4 (Appendix H) combines elements from the Class Keys (Georgia Department of Education, 2010a) technology integration and formative assessment teacher standards. The rubric reflects the teachers' ability to implement a lesson that facilitates (1) using a SRS and mobile IWB for formative assessment, (2) using formative data to monitor instruction in response to individual learning needs, and (3) involving students in decisions about adjustments to instruction to enhance their learning. Based on the observation of each teacher's lesson, I used the Observation Rubric to rate the teacher's proficiency accordingly as Not Evident, Emerging, Proficient, or Exemplary. I selected observed indicators on the rubric and determined the overall rating based on

the category with the highest frequency of indicators recorded. I reported the data from the Observation Rubric during Level 4 of Guskey's (1998, 2000, 2002a) Evaluation in the form of a frequency distribution for comparative analysis of the various levels of proficiency regarding use of the SRS and IWB for formative assessment.

A teacher scoring Emerging on the Observation Rubric used the technologies primarily for drill and practice such as a series of questions with no discussion. This score also results from lack of descriptive feedback or other methods for adjusting instruction. For this rating a teacher may use formative assessment strategies to help adjust whole-class instruction, but may not be consistent and rarely uses it at the individual level. The teacher inconsistently addresses student misconceptions during the lesson. For example, if the majority of the class does not understand the concept based on the data, the teacher makes plans to alter the teaching method and re-teach the concept later.

For a teacher to receive a Proficient rating, the lesson must align with the Georgia Performance Standards (Georgia Department of Education, 2011), use technology to enhance student learning, and substantiate formative assessment strategies used at the individual level, which teachers may accomplish via use of the SRS and mobile IWB. The teacher may accomplish this through two methods for this observation based on the rubric. One method is for the teacher to use the charting results from the clickers to monitor and adjust instruction at the individual level. This is observable when the teacher re-teaches a concept in a way that meets the instructional needs of students that have not understood the concept based on the data.

To earn a score of Exemplary on the rubric, the lesson must go beyond using the technologies for formative assessment at the individual level. The lesson demonstrates evidence of a comprehensive approach for technology use that enhances the achievement of all students. A variety of activities and technologies may monitor student progress and adjust instruction to maximize achievement for all learners. A teacher may achieve the Exemplary rating in a variety of ways, including implementing the clicker strategies (Table 3-4) discussed during the professional development. For example, a teacher may adjust instruction using techniques such as the Peer Instruction clicker strategy (Bruff, 2009a, 2009b; Mazur, 1997), which involves pairing students based on the mobile IWB screen data and then having them answer the question again after their discussion to check for increased understanding. Additionally, in an exemplary lesson students are involved in instructional decisions preferably via use of the technologies for data collection regarding needed instructional modifications.

### **Qualitative Data Analysis**

During Weeks 6-12 of the study I collected qualitative data using the Observation Cycle. I analyzed the qualitative data continually through Weeks 1-15 of the study (Table 3-6). This section describes the analysis of the qualitative Observation Cycle data for Levels 4 and 5.

**Interviews and Observations.** A qualitative analysis (Glesne, 2006) of the interviews and the observations provided data for evaluating the professional development (Glesne, 2006; Patten, 1987). I transcribed the audio from interviews accurately for the Pre- and Post-Observation Interviews onto the Interview Coding Protocol Form (Appendix J). I recorded notes and observations from the classroom observations on the Observation Field Notes Record (Appendix G). I used a process

called “thematic analysis” that entailed coding and dividing the data by commonalities for further analysis and description (Glesne, 2006). I continually reviewed the data to locate codes and sub codes and categorized the codes (Glesne, 2006; Patten, 1987). Using the “constant comparative method” I compared and contrasted the data as I collected it for categorizing into codes in order to understand how the teachers applied their learning regarding using the SRS and mobile IWB reports for formative assessment (Glaser, 1965). As codes became saturated the categories developed (Glaser, 1965). As I reviewed the codes, I refined them until they were no longer repetitive, and grouped the codes based on patterns in the data to create an organizational framework (Glesne, 2006). Categorizing the codes lead to the development of themes for analyzing the data into the common areas (Fraenkel & Wallen, 2006; Glesne, 2006; Patten, 1987). I also reviewed the open-ended questionnaire items for common themes during triangulation (Denzin, 2006).

By using the HyperText™ software to designate codes on the interview and observation records and grouping them in taxonomy, I created an organized visual representation of the data for understanding the relationships among the codes and locating themes in the data (Glesne, 2006; Spradley, 1979). The themes represented the most pervasive thoughts among the coded items. It is important to find meaningful connections when interpreting the data, which involves transforming the data through description, analysis, and interpretation (Wolcott, 1994). I organized the data, reflections, coding, and analysis in a digital fieldwork folder to help analyze the data.

### **Information for Triangulation**

I collected information for triangulation during Weeks 1-5 using the Reflection Journal. These reflections were not coded data, but were a source of valuable

information for Level 2. This section describes the analysis of the information from the Reflection Journal for triangulation.

**Reflection Journal.** The information from the Reflection Journal (Appendix B) helped with Methodological Triangulation (Denzin, 2006), allowing me to compare findings across multiple data types. This cross-examination helped me to be more confident in the study's findings. As I documented my observations in the Reflection Journal, I reflected on the instruction for this study to determine if it met the basic instructional needs of the adult learners. I also observed the teachers' interactions and responses during the sessions and used this information formatively to help me determine any adjustments required for future professional development. Answering questions in the journal about the introductory material, cooperative activities, and discussions provided information about the structure of the lessons. Other questions in the journal helped me consider the effectiveness of the technology stations and other activities on teachers' learning. Last, I reflected on what I could have done differently for each of the lessons. This Reflection Journal was a source of reference for me throughout the study, providing an opportunity to contemplate ways to improve the professional development I provide.

### **Timeline**

The timeline for the study (Table 3-6) focuses on implementing each part of the evaluation in a timely manner. I taught each of the four lessons during the first five weeks of the study. I initially distributed the Perceptions Questionnaire during Week 2, but I continually worked to gather further data from this survey through Week 10. For efficiency I began tabulating quantitative survey data after administering this first questionnaire. The teachers worked on developing their multimedia lessons during the



first five weeks of the study and I completed the Reflection Journal as well. I administered the Organization Support Questionnaire during Week 5; however, as with the first questionnaire I continued to collect data throughout the remainder of the study, as some participants completed the paper version and others completed the online version. Because of the teachers' schedules, seven weeks were required for completing interviews and observations. The components of the Observation Cycle took place during Weeks 6 through 12. The timeline was fluid to facilitate maximum data collection.

### **Trustworthiness and Limitations of the Study**

To increase my objectivity, I assessed my interpretations of the data (Glesne, 2006) which helped me realize the evaluation's limitations as well as increase the trustworthiness of the study and limit researcher bias (Glesne, 2006). To increase validity I collected data at both of the middle schools. In addition to multiple sites for data collection, I addressed possible validity issues and increased the trustworthiness of the evaluation by being objective (Glense, 2006).

For face and content validity a panel of experts agreed that the questionnaires appeared to measure what I had intended and determined each item to be essential to the data collection. I developed a set of questions for each interviewee using a "standardized open-ended" format to avoid leading questions and to reduce the potential bias that can result from analyzing data from different interviews (Patton, 1987). I recorded the interviews to avoid misinterpretations (Patton, 1987). I used the interview questions to confirm or invalidate data gained through the observations (Fraenkel & Wallen, 2006). Similarly, the observation data helped to confirm or invalidate data gained through the questionnaires and rubrics. I validated the

observations by observing the teachers before drawing conclusions about the effectiveness of the professional development. Additionally, I achieved validity of the study through triangulation (Denzin, 2006); I carefully inspected and interpreted multiple sources of data. Surveys, assessment of teacher-created lessons, interviews, and observations, all provided data that contributed to determining the effectiveness of the professional development and decisions regarding future modifications.

Limitations of the study include the focus on using the technologies for formative assessment. This limited focus may have caused me to overlook other valuable uses of the technologies or other instructional strategies used during classroom instruction. Self-reported data obtained from questionnaires and interviews pose a potential bias as participants may not remember experiences or recall events correctly. Self-reported data may also attribute negative events to other people or situations for which he or she is not responsible. Another limitation of the study is the sample size because it may not accurately reflect the thoughts or abilities of all teachers in the school. Additionally, in determining the study's sample I did not consider the teachers' ability with the technologies such as previous difficulty with formative assessment strategies, limited use of the technology, or expertise. Because the participants volunteered their motivation or prior knowledge and instructional practice may vary from non-participants in the schools, which may have resulted in selection bias (Wayne et al., 2008).

### **Summary**

The participants for the study were teachers who attended the professional development I conducted. I designed four professional development sessions to incorporate adult learning assumptions and professional development literature for

meeting the teachers' learning needs. The four sessions focused on using the SRS and mobile IWB for formative assessment.

I used Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a) model as the framework for developing guiding questions for the study. I developed a data collection strategy for each guiding question and its corresponding level of the model (Table 3-5). I used quantitative and qualitative analysis for collecting data for the evaluation.

Table 3-1. Alignment of Evaluation Levels and Guiding Questions

Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a)	Guiding Questions
Level 1: Participants' Reactions	What are the teachers' perceptions about the professional development?
Level 2: Participants' Learning	In what ways did the teachers acquire the intended knowledge?
Level 3: Organization Support and Change	In what ways does the organization help teachers implement the technologies?
Level 4: Participants' Use of New Knowledge and Skills	In what ways are the teachers using the mobile interactive whiteboard and student response system?
Level 5: Student Learning Outcomes	What effect did the professional development have on student engagement?

Table 3-2. School Facts for Middle Schools A & B

School Facts for 2008-2009 School Year	School A	School B
Number of Students in 2009	752	775
Economically Disadvantaged	19.00%	20.00%
Students with Disabilities	10.00%	10.00%
English Language Learners	3.00%	1.00%
Did this School make Adequate Yearly Progress in 2009?	Yes	Yes
Improvement Status in 2009	DIST	DIST

Note: Data retrieved from the Georgia Department of Education (2010b).

Table 3-3. Description of the Professional Development

Lesson	Objectives	Activities to Meet the Objectives
<p>Lesson 1: Formative Assessment using the Charting Feature and Mobile IWB Screen</p>	<p>Considering the charting feature, teachers will explain how they could use the student response system to monitor the progress of student learning and idea(s) for adjusting instruction to maximize student achievement.</p> <p>Considering the method of using the mobile interactive whiteboard screen reports, teachers will explain how they could use the student response system to monitor the progress of student learning and idea(s) for adjusting instruction to maximize student achievement.</p> <p>Considering the charting feature, the teachers will begin creating a multimedia lesson that incorporates questions for collecting formative data via student response system and is aligned with the Georgia Performance Standards.</p>	<p>Use a modified KWL chart to help facilitate the lesson content related to the teachers' knowledge of using the technologies.</p> <p>Model how to modify software settings and the process for engaging a clicker question to display the data chart in verbal and standard modes.</p> <p>Model how to navigate through the various mobile interactive whiteboard screen reports.</p> <p>Use a cooperative learning strategy to consider, collaborate, and explain how to use the student response system and/or mobile interactive whiteboard report screen to monitor the progress of student learning and discuss ways to adjust instruction based on formative data to maximize student achievement.</p> <p>Ask the teachers to share their ideas with the group.</p> <p>Circulate and pose the question to teachers while they are working on their multimedia lesson.</p> <p>Explain that they may select which software to use for developing their lesson.</p> <p>Ask the teachers to select the standard(s) and work on the lesson content to develop a multimedia lesson for use in their classroom.</p> <p>Have the teachers work collaboratively or independently on the lesson. Ask them to share the lesson with others upon completion.</p>

Table 3-3. Continued

Lesson	Objectives	Activities to Meet the Objectives
<p>Lesson 2: Formative Assessment using the Contingent/Agile Teaching Clicker Strategy (Bruff, 2009b; Beatty et al., 2006; Draper &amp; Brown, 2004)</p>	<p>Considering the Contingent/Agile Teaching clicker strategy, teachers will explain how they could use the student response system to monitor the progress of student learning and idea(s) for adjusting instruction to maximize student achievement.</p> <p>Given 21<sup>st</sup>-century technology tools/software and considering Contingent/Agile Teaching, teachers will experiment with and consider how they could use the 21<sup>st</sup>-century technologies to ask questions on the fly to guide instruction.</p> <p>Considering Contingent/Agile Teaching, the teachers will continue to create a multimedia lesson that incorporates questions for collecting formative data via student response system and is aligned with the Georgia Performance Standards.</p>	<p>Model content-based application of the Contingent/Agile Teaching clicker strategy, including asking questions on the fly to guide instruction.</p> <p>Share that the literature suggests between 3-6 clicker questions for a 50-minute lesson.</p> <p>Have the teachers use a cooperative learning strategy to consider, collaborate, and explain how they could use the student response system, specifically the Contingent/Agile Teaching clicker strategy, to monitor the progress of student learning and discuss ways to adjust instruction based on formative data to maximize student achievement.</p> <p>Circulate and pose the question to teachers while they work on their multimedia lesson.</p> <p>Have the teachers modify software settings so that the charting feature will display after each engaged clicker question.</p> <p>Have the teachers experiment with engaging a clicker question in verbal mode, using the chalkboard function for writing the question, viewing the chart with class data, and identifying individual student achievement using the mobile interactive whiteboard reports. There is flexibility for the time teachers elect to spend on experimentation before working on their multimedia lesson.</p> <p>Have the teachers continue to work on their multimedia lesson and consider including an idea(s) from this session.</p>

Table 3-3. Continued

Lesson	Objectives	Activities to Meet the Objectives
<p>Lesson 3: Formative Assessment using the Discussion Warm-up/Think-Vote-Share Clicker Strategy (Bruff, 2009a, 2009b; Lyman, 1981)</p>	<p>Considering the Discussion Warm-up/Think-Vote-Share clicker strategy, teachers will explain how they could use the student response system to monitor the progress of student learning and idea(s) for adjusting instruction to maximize student achievement.</p> <p>Given 21<sup>st</sup>-century technology tools/software and considering the clicker strategies, the teachers will continue to experiment with using the technologies for formative assessment.</p> <p>Considering Discussion Warm-up/Think-Vote-Share, the teachers will continue to create a multimedia lesson that incorporates questions for collecting formative data via student response system and is aligned with the Georgia Performance Standards.</p>	<p>Model content-based application of the Discussion Warm-up/Think-Vote-Share clicker strategy.</p> <p>Ask the teachers to use a cooperative learning strategy to consider, collaborate, and explain how they could use the student response system, specifically the Discussion Warm-up/Think-Vote-Share strategy, to monitor the progress of student learning and discuss ways to adjust instruction based on formative data to maximize student achievement.</p> <p>Ask the teachers to discuss ideas for using clicker data to facilitate students' reflection about their own learning and involve them in instructional decisions to address exemplary use of formative assessment according to the Georgia Class Keys teacher evaluation instrument (2010a).</p> <p>Circulate and pose the question to teachers while they are working on their multimedia lesson.</p> <p>Have the teachers experiment with using the verbal mode for asking a question, the mobile interactive whiteboard software for writing the question for students, or any of the other previous strategies.</p> <p>There is flexibility for the time teachers elect to spend on experimentation before working on their multimedia lessons.</p> <p>The teachers continue to work on their multimedia lesson and consider including an idea(s) from this session.</p>

Table 3-3. Continued

Lesson	Objectives	Activities to Meet the Objectives
<p>Lesson 4: Formative Assessment using the Peer Instruction Clicker Strategy (Bruff, 2009a, 2009b; Mazur, 1997)</p>	<p>Considering the Peer Instruction clicker strategy, teachers will explain how they could use the student response system to monitor the progress of student learning and idea(s) for adjusting instruction to maximize student achievement.</p> <p>Given 21<sup>st</sup>-century technology tools/software and considering clicker strategies, the teachers will continue to experiment with using the technologies for formative assessment.</p> <p>Considering Peer Instruction, the teachers will continue to create a multimedia lesson that incorporates questions for collecting formative data via student response system and is aligned with the Georgia Performance Standards.</p>	<p>Model content-based application of the Peer Instruction clicker strategy.</p> <p>Discussion includes ideas for using the Peer Instruction clicker strategy for formative assessment.</p> <p>Review with IWB in the group mode. Using a cooperative learning strategy each group uses the IWB and shared document to share how they could use the student response system and/or mobile interactive whiteboard to monitor the progress of student learning and ways to adjust instruction, including student-involved decisions to maximize student achievement. Discussion of ideas allows groups to share.</p> <p>Circulate and pose the question to teachers while they are working on their multimedia lesson.</p> <p>Teachers may experiment with any of the technologies with which we have worked.</p> <p>There is flexibility for the time teachers elect to spend on experimentation before working on their multimedia lessons.</p> <p>The teachers continue to work on their multimedia lesson and consider including an idea(s) from this session.</p>



Table 3-4. Clicker Strategy Components

Clicker Strategy	Main Components for using the SRS and IWB Formative Assessment
Contingent/Agile Teaching Clicker Strategy (Bruff, 2009b; Beatty et al., 2006; Draper & Brown, 2004)	<p>Teacher asks clicker questions spread throughout content and collects real-time data.</p> <p>Students use charting feedback to monitor learning.</p> <p>Teacher uses mobile IWB screen reports to identify needs of individual students.</p> <p>Teacher changes instruction “on the fly” in response to learning needs (pacing, probing, questions on new topic, etc.).</p>
Discussion Warm-up/Think-Vote-Share Clicker Strategy (Bruff, 2009a, 2009b; Lyman, 1981)	<p>Teacher asks a clicker question, students think and record answers via the student response system.</p> <p>Teacher displays charting results for class-wide discussion.</p> <p>Teacher uses mobile IWB screen reports to identify needs of individual students.</p> <p>Students think about (Think) and commit to an answer (Vote), setting the stage for greater discussion participation (Share).</p> <p>Option: Students respond twice to difficult questions, once right after they read the question and then again after the discussion.</p>
Peer Instruction Clicker Strategy (Bruff, 2009a, 2009b; Mazur, 1997)	<p>Teacher asks a clicker question following a content segment, students vote and review charting data.</p> <p>Teacher uses mobile IWB screen reports to identify needs of individual students.</p> <p>If needed students discuss with partner (Peer Instruction) and revote, which often leads to convergence to the correct answer. (Teacher uses IWB reports to help assign partners.)</p> <p>Students may listen to mini-lecture or engage in class-wide discussion and respond/vote again if class average is still low.</p> <p>Students may find that, for particularly challenging questions, this can be an effective technique for discovering and exploring course material.</p>

Table 3-5. Alignment of the Five Evaluation Levels, Guiding Questions, and Data Collection Methods

Guskey's Five Levels of Evaluation (1998, 2000, 2002a)	Guiding Questions	Data Collection Method	Data Collection Details (What is measured and how the information is used.)
Level 1: Participants' Reactions	What are the teachers' perceptions about the professional development?	Questionnaire	Perceptions Questionnaire (Appendix C) administered during implementation of professional development to gather formative data regarding needs and program improvement.
Level 2: Participants' Learning	In what ways did the teachers acquire the intended knowledge?	Rubric	The artifact is a teacher-developed multimedia lesson to gauge the teachers' learning for improving future professional development. The Artifact Rubric (Appendix D) assesses its effectiveness.
Level 3: Organization Support and Change	In what ways does the organization help teachers implement the technologies?	Questionnaire	Organization Support Questionnaire (Appendix E) gathered data regarding the support structure provided by the professional development to improve organizational support and future professional development.

Table 3-5. Continued

Guskey's Five Levels of Evaluation (1998, 2000, 2002a)	Guiding Questions	Data Collection Method	Data Collection Details (What is measured and how the information is used.)
Level 4: Participants' Use of New Knowledge and Skills	In what ways are the teachers using the mobile interactive whiteboard and student response system?	Observation Cycle: Pre-Observation Interview and Classroom Observation	Pre-Observation Interview (Appendix F) and the Direct Observation provided data for evaluating the effectiveness of the professional development as it related to the teachers' application of knowledge gained for technology integration and effects in the classroom. Data from the observations were recorded on the Observation Field Notes Record (Appendix G) and the Observation Rubric (Appendix H).
Level 5: Student Learning Outcomes	What effect did the professional development have on student engagement?	Observation Cycle: Classroom Observation and Post-Observation Interview	The Observation Field Notes Record (Appendix G) and Post-Observation Interview (Appendix I) helped gather data about the effect the professional development had on students' level of engagement.

Table 3-6. Implementation Timeline

Study Component	Timeline (Week of Evaluation Process)
Design and Development of Instruction	Pre-Evaluation
Lesson 1: Formative Assessment using the Charting Feature and Mobile Interactive Whiteboard Screen	1
Lesson 2: Formative Assessment using the Contingent/Agile Teaching Clicker Strategy (Bruff, 2009b; Beatty et al., 2006; Draper & Brown, 2004)	2
Level 1: Perceptions Questionnaire	2-10
Lesson 3: Formative Assessment using the Discussion Warm-up/Think-Vote-Share Clicker Strategy (Bruff, 2009a, 2009b; Lyman, 1981)	4
Lesson 4: Formative Assessment using the Peer Instruction Clicker Strategy (Bruff, 2009a, 2009b; Mazur, 1997)	5
Level 2: Participants' Learning Teacher-Developed Multimedia Lesson and Post-Instruction Reflective Journal	1-5
Level 2: Participants' Learning Teacher-Developed Multimedia Lesson Artifact Rubric	5-12
Level 3: Organization Support Questionnaire	5-11
Level 4: Pre-Observation Interview and Observation Rubric	6-12
Levels 4 & 5: Observation Field Notes Record	6-12
Level 5: Post-Observation Interview	6-12
Analysis of Data Collected	1-15

## CHAPTER 4 RESULTS

This chapter reports the results of the data obtained by implementing Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a) during an evaluation of technology-based professional development conducted at two middle schools. This chapter describes the participation in the study and the findings for each Level of Guskey's Evaluation (1998, 2000, 2002a) regarding the effectiveness of the professional development.

This chapter presents the data associated with each guiding question for the study and its corresponding Level of Guskey's Evaluation (1998, 2000, 2002a). The guiding question is stated explicitly under each subheading in the chapter followed by a concise description of the data. The data for Guiding Questions 1, 2, 3, and part of 4 are represented quantitatively, as the instrumentation for the data collection was a Likert-Scale questionnaire for 1 and 3 and a rubric for 2 and 4. Additionally, I report qualitative data from the Pre-Observation Interview for Level 4, Observation Field Notes Record for Levels 4 and 5, as well as the Post-Observation Interview for Level 5.

### **Participation in the Study**

I asked the 35 teachers who attended the second professional development session to complete the Perceptions Questionnaire for Guskey's (1998) Level 2 toward the end of the session, as only attendance at some of the professional development was required for participation. Two teachers left a couple of minutes early; one completed an online version that I emailed following the session, but the other did not. One teacher who stayed for the whole session did not complete the questionnaire during the session and did not complete the online version. Teachers attending at least

two of the sessions but who were not present at the second session and who signed a consent form (n=5) were emailed an online version of the questionnaire during the last week of the professional development. Overall, 36 teachers completed the Perceptions Questionnaire (N=36).

There were more participants for the Level 1 Perceptions Questionnaire (N=36) than for the Organization Support Questionnaire (N=16) for Level 3, as the Organization Support Questionnaire was reserved for participants attending all four of the professional development sessions (Table 4-1). I administered this questionnaire via email and 11 participants completed it during the first two weeks.

I emailed both of the questionnaires weekly until the end of data collection to the participants who had not completed them. Additionally, I delivered the paper version of the Organization Support Questionnaire to four teachers participating in the Observation Cycle. Two teachers who attended all of the professional development did not complete the Organization Support Questionnaire. Twelve teachers out of the 16 who attended all four of the professional development sessions and completed the two questionnaires, which was required for participation in the Observation Cycle, volunteered (N=12). Three other teachers outside of the 12 participating in the Observation Cycle submitted an artifact for Level 2 (N=15). Table 4-1 displays the percentage of teachers who completed each part of the study and the requirements for participation in each component.

### **Guiding Questions**

The guiding questions for the study each correspond to one of Guskey's Levels of Professional Development Evaluation (1998, 2000, 2002a). This alignment of questions to the evaluation levels helped to ensure that the data collected at each level informed

the study appropriately. The following questions guided the data collection for studying the professional development I provided regarding use of the SRS and mobile IWB for formative assessment:

- Level 1: Participants' Reactions - What are the teachers' perceptions about the professional development?
- Level 2: Participants' Learning - In what ways did the teachers acquire the intended knowledge?
- Level 3: Organization Support and Change - In what ways does the organization help teachers implement the technologies?
- Level 4: Participants' Use of New Knowledge and Skills - In what ways are the teachers using the mobile interactive whiteboard and student response system?
- Level 5: Student Learning Outcomes - What effect did the professional development have on student engagement?

#### **Guiding Question for Level 1: Participants' Reactions**

I administered the Perceptions Questionnaire for Guskey's Evaluation (1998, 2000, 2002a) Level 1 to collect data for this guiding question: "What are the teachers' perceptions about the professional development?" This questionnaire consisted of 12 items using a Likert-Scale format with 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, and 4 = Strongly Agree. Number 13, an open-ended question, asked, "In what ways, if any, would you like the professional development to be modified in future sessions?" There was also a Comments section at the end of the questionnaire. Of the 36 participants completing this questionnaire, one did not answer Item 9 and another did not answer Item 10. Ten participants completed Question 13 and seven completed the Comments section.

The results from this questionnaire indicate that the participants had a positive reaction to the professional development. As noted in Table 4-2, I used descriptive

statistics to analyze the data from the Perceptions Questionnaire. The survey item with the highest mean and a rating of Strongly Agree was Item 11, The Professional Learning was Facilitated in a Professional Manner, with a mean of 3.81 and standard deviation of .40. Item 10, The Professional Development Included Discussion and/or Collaboration, had the lowest mean on the questionnaire with a mean of 3.60. The standard deviation of .55 for this item indicates that a rating of 4 (n=22) is within one standard deviation of the mean.

For Question 13, five comments indicated no need for modifications to the professional development. These comments included statements regarding the effectiveness of the professional development such as the following: “Thanks for spending encouraging time with me, meeting me at my instructional level, and easing me into what seemed scary.” Five other comments for Question 13 provided suggestions for modification or items to continue during future sessions. These comments were helpful in modifying the sessions to meet the teachers’ needs over the following two sessions. For the Comments section of the questionnaire, seven participants included comments. Six of these comments included positive remarks about the sessions.

### **Guiding Question for Level 2: Participants’ Learning**

For this level I used a Participants’ Learning Artifact Rubric and Post-Instruction Reflective Journal to address this guiding question: “In what ways did the teachers acquire the intended knowledge?” Data and information from these two instruments indicate that the teachers got ideas for developing an artifact to use during instruction for formative assessment.



## **Participants' Learning Artifact Rubric**

The Participants' Learning Artifact Rubric used to rate the teacher-developed multimedia lesson (N=15) for Guskey's (1998, 2000, 2002a) Level 2 provided data to answer this question: "In what ways did the teachers acquire the intended knowledge?" The teacher-developed multimedia artifacts were scored using this rubric aligned to the formative assessment and technology integration Georgia Class Keys (Georgia Department of Education, 2010a) for teacher evaluations.

For scoring the two individual items on this rubric, 1 = Emerging, 2 = Proficient, and 3 = Exemplary. For determining the overall score on this rubric, which was the sum of the two items on the rubric, 2-3 = Emerging, 4-5 = Proficient, and 6 = Exemplary. The data from the Participants' Learning Artifact Rubric on Table 4-3 indicate that the participants are proficient in their ability to design a technology-integrated lesson for collecting formative data.

Regarding the individualized participant data, two teachers scored a 3 in their use of technology for formative assessment and four teachers scored a 3 in their use of questions to demonstrate their exemplary ability in those areas. Only one of the teachers scored a 3 in both areas with a rating of Exemplary overall. The rest of the teachers were rated a 2 on the components of the rubric, which gave them a Proficient rating overall. None of the teachers scored Emerging in either area for this multimedia lesson rubric. With the exception of the one teacher scoring a 6 overall, each teachers' overall rating was Proficient with a score of either 4 or 5.

The descriptive statistics in Table 4-3 display the data for the individual components of the rubric as well as the total rubric score. The mean of 2.13 and standard deviation of .35 for "Planned use of Technology for Formative Assessment"

indicate an overall rating of Proficient within the sample. Similarly, the mean of 2.27 and standard deviation of .46 in the “Use of Questions” indicate that the sample population was proficient with this strategy. The mean for the total score on the rubric is 4.40 with a standard deviation of .63, indicating that scores of 4 and 5 are within one standard deviation of the mean.

### **Post-Instruction Reflective Journal**

In addition to the Participants’ Learning Artifact Rubric, I used the questions in the Post-Instruction Reflective Journal to guide my writing following each of the professional development sessions to help answer the question for Guskey’s (1998, 2000, 2002a) Level 2: “In what ways did the teachers acquire the intended knowledge?” The excerpts (Appendix K) compiled from the Reflective Journal about the lessons represent my thinking during this reflection process and focus on considering how to modify the sessions to improve the effectiveness of the professional development. I grouped my thoughts by the teachers’ response to session components, monitoring the teachers’ learning, and modification considerations for future sessions. Although not used as data for the study, the Post-Instruction Reflective Journal provided supporting information for triangulation (Denzin, 2006) of the results for Level 2 regarding the teachers’ proficiency in developing a lesson to use formatively during instruction.

### **Guiding Question for Level 3: Organization Support and Change**

I administered the Organization Support Questionnaire to collect data to answer the following question: “In what ways does the organization help teachers implement the technologies?” This questionnaire consisted of 13 items using a Likert-Scale format with 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, and 4 = Strongly Agree. All participants (N=16) answered every Likert-Scale item on the questionnaire. There was

also a Comments section at the end of the questionnaire. Of the participants completing this questionnaire, only one completed the Comments section.

Overall, the data from the Organization Support Questionnaire yielded positive results. Similar to the Perceptions Questionnaire, as noted in Table 4-4, I used descriptive statistics to analyze the data for the Organization Support Questionnaire. The means for the items on the Organization Support Questionnaire were between 2.63 and 3.81, designating Agree and Strongly Agree for the majority of outcomes.

The data for Item 8, My School's Leadership Team Representative Asked for Input on the Technology Professional Development Topics, had the lowest mean. The mean for this item was 2.63 and the standard deviation was .72. For this item, ratings of 2 and 3 were within one standard deviation of the mean.

Two items with the highest means (Table 4-4) were Item 11, Julia Helped Me When I Needed Assistance with the Technologies, and Item 12, I Felt Supported during Implementation of the Technologies. With means of 3.81 and 3.75 and standard deviations of .40 and .45 respectively, the responses to these items had little fluctuation from a rating of Strongly Agree, as a score of 4 is within one standard deviation of the mean.

### **Guiding Questions for Levels 4 and 5: Participants' Use of New Knowledge and Skills and Student Learning Outcomes**

I used the Observation Cycle, consisting of a Pre-Observation Interview, classroom observation of a technology-integrated lesson, and a Post-Observation Interview, to collect data to answer the following questions: "In what ways are the teachers using the mobile interactive whiteboard and student response system?" and "What effect did the professional development have on student engagement?" The Pre-

Observation Interview addressed the first question, the classroom observation addressed both questions, and the Post-Observation Interview addressed the latter question for Guskey's (1998, 2000, 2002a) Levels 4 and 5 respectively. The following sections describe the results of the Observation Cycle for answering these two guiding questions. The results indicate the teachers' plans for effective use, as well as actual use of the technologies for formative assessment during instruction.

### **Pre-Observation Interview**

The Pre-Observation Interview data helped answer the question for Level 4: "In what ways are the teachers using the mobile interactive whiteboard and student response system?" The Pre-Observation Interview data consisted of interview transcripts that I transcribed by typing the content of the audio recording for each of the Pre-Observation Interviews. I coded the transcripts as described in Chapter 3 of this document. This process included developing codes and sub-codes and refining codes as needed to represent the interviewees accurately (Glesne, 2006; Patten, 1987). Figure L-1 displays an example of the coding process using HyperText™ software. This software helped me refine the codes and determine themes across the Pre-Observation Interview data.

I considered the relationship among the prevalent codes to develop the Pre-Observation Interview Taxonomy (Table 4-6) that represents the themes and codes in the data. I eliminated codes unrelated to the focus of the study during development of the taxonomy. Due to the focus of the questions during the Pre-Observation Interview, several main themes developed during the coding process under which I categorized other data on the taxonomy: Planning to Use the Technologies during Instruction,

Planning to Use Formative Assessment Strategies, and Stating Thoughts about the Technologies.

The most prevalent codes that represented the theme “Planning to Use the Technologies during Instruction” included the teachers’ plans to use the technologies to present material during the lesson and their plans for using the clickers to collect anonymous data. The participants’ thoughts about using technology to present material or instructional content included use of video, digital presentations, and writing on the mobile IWB. Additionally, praise regarding the anonymity of the use of clickers to collect data was coded numerous times.

The codes appearing most frequently indicated in the Pre-Observation Interview transcripts related to the theme “Planning to Use Formative Assessment Strategies.” Three main codes overarched various sub-codes: Planning to Use Technology to Monitor Student Progress, Planning to Adjust Instruction, and Planning for Student Involvement. The technologies that the participants addressed during the interviews for monitoring student progress included general clicker data, the clicker charting data, and the mobile IWB screen. As represented by the codes, the teachers’ plans for adjusting instruction included using technology-based data for decisions about adjusting instruction. Additionally, during coding it was evident that several of the interviewees planned to have students monitor their own progress during the lesson by comparing their clicker response to the correct response signified in the charting data.

The last overarching theme in the Pre-Observation Interview data, Stating Thoughts about the Technologies, relates to the participants’ comments about the technologies. In coding the data I found that the participants were interested in using

the clickers for formative assessment. Additionally, the coded data show that at the time of the Pre-Observation Interview participants believed the clickers would provide them with immediate feedback for monitoring their students' progress during their lesson.

## **Observation**

The classroom observation data helped answer the questions for Levels 4 and 5: "In what ways are the teachers using the mobile interactive whiteboard and student response system?" and "What effect did the professional development have on student engagement?" The observation data, the second component of the Observation Cycle, consist of Field Notes Record data and results of an Observation Rubric. The next two sections describe the data and the recurring themes.

**Observation Field Notes Record.** As displayed in Figure L-1, an example of the coding process, I coded the field notes from the observations using the method described in Chapter 3, which included developing codes and sub-codes and refining codes throughout the data analysis for Levels 4 and 5 (Glesne, 2006; Patton, 1987). As I coded the Observation Field Notes Records, I developed a Classroom Observation Taxonomy of themes among the codes. I eliminated codes not related to the observation data from consideration and reworded codes to represent the observations accurately. Thinking about the relationship among the coded behaviors helped me develop the taxonomy.

Table 4-7 displays the Classroom Observation Taxonomy of the recurring observed behaviors during the classroom observations. Since there were focus points during the observations, the coding of the field notes had a distinct focus. While the observation field notes were collected and coded, themes emerged which are reflected

in the taxonomy. I categorized the themes under the following descriptive elements: Using the Technologies, Using Formative Assessment Strategies, and Directing Use of the Technologies. The observed patterns in student behaviors related to their level of engagement; therefore, I indicated the category “Engaging in Learning” on the taxonomy.

The data indicate that the participants used the mobile IWB, clickers, and digital presentation technologies for instruction. The teachers’ used these three technologies during instruction to display content or clicker data. Example common codes include: Writing on the Tablet to Explain a Concept, Using the Tablet Screen to Review Individual Student Reports, Displaying Clicker Questions, and Using Clicker Data to Chart Results. Additionally, the teachers asked for my assistance, positioning me in the role of “participant observer” (Glesne, 2006), most often to help them navigate the IWB screen reports and use the charting feature of the SRS.

The prevalent themes of the observation regarding formative assessment strategies were: Monitoring Individual Student Progress, Adjusting Instruction Based on Data, and Helping Students Monitor Their Own Progress. To monitor student progress, the teachers were displaying the chart with clicker question data and discussing the results with the class, as well as reviewing the mobile IWB screen reports of individual student data. For adjusting instruction, the teachers gave descriptive feedback in the form of rephrasing concepts, explaining correct or incorrect answers, writing on the tablet during re-teaching, and giving additional examples of the concept. The teachers often asked additional questions beyond the planned clicker questions to facilitate discussion among the students. As teachers helped the students monitor their own

progress they asked the students to take notes of important concepts, displayed and discussed clicker data in chart format, and provided descriptive feedback as they discussed reasons for a particular answer.

Periodically throughout the lessons the teachers directed the students' use of the technologies. When posing a clicker question, the teachers referred to the clickers as the method for answering the question. Teachers used various procedures for distributing the clickers at the start of the class as well.

During the observations I also recorded general student behaviors regarding their engagement during the lesson for triangulation (Denzin, 2006) of Level 5 data. Several of the codes relate to use of the technologies. The codes that indicate student engagement include: Answering the Questions with Clickers, Responding to the Charting Data, and Discussing Clicker Question with Other Students.

**Observation Rubric.** I completed the Observation Rubric following the classroom observation to answer the guiding question for Level 4: "In what ways are the teachers using the mobile interactive whiteboard and student response system?" The category with the most indicators observed during the classroom observation determined the score on the rubric for a particular participant. Whereas the rubric for the teacher-developed multimedia lesson helped me consider the teachers' planned use of the technologies for formative assessment, this Observation Rubric helped me assess the teachers' implementation of their lesson plan.

Table 4-5 displays the data for the participants' scores on the classroom Observation Rubric. One teacher scored Emerging on the Observation Rubric. Of the 12 teachers, 10 scored Proficient on the rubric. One teacher scored Exemplary on the



Observation Rubric. These frequencies indicate that 8.33%, 83.33%, and 8.33% scored Emerging, Proficient, and Exemplary, respectively.

### **Post-Observation Interview**

The Post-Observation Interview, the third component of the Observation Cycle, helped answer the question for Level 5: “What effect did the professional development have on student engagement?” Additionally, the set of questions for the Post-Observation Interviews provided data regarding the teachers’ thoughts about their students’ learning and the professional development I provided. This section focuses on the data that addressed the question for Level 5 of Guskey’s Evaluation (1998, 2000, 2002a) model.

Coding of the Post-Observation Interview transcripts resulted in the Post-Observation Interview Taxonomy (Table 4-8). One portion of the taxonomy emphasizes the points discussed by the teachers relating to student learning and engagement. All except one teacher stated that during the lesson I observed the technology helped engage or increase the focus of the students. The teacher who did not think the technologies helped engage the students mentioned that occasionally technical problems cause a slowdown in the lesson, which increases off-task behaviors.

The Post-Observation Interview Taxonomy revealed outcomes regarding the engagement level of the students and their learning to help answer the question for Level 5. The teachers mentioned that the technology helped the students to learn and reflect on their learning. During the Post-Observation Interviews the teachers talked about the usefulness of the technology for providing instant feedback to the students. As noted on the Post-Observation Interview Taxonomy, the teachers stated that the data helped reveal the students’ learning and progress throughout the lesson and

helped reveal whether the teacher needed to re-teach the content. Teachers noted that student reflection and instant feedback helped to engage learners. Additionally, as shown on Table 4-8, the Post-Observation Interview Taxonomy, the teachers indicated that the students remained engaged during the lesson. The teachers stated that the students were engaged in their use of the clickers and that the clickers helped to engage the students during learning due to the accountability involved with the collection of data tied to the individual student.

### **Summary**

The outcomes resulting from the data collection facilitated by Guskey's Evaluation (1998, 2000, 2002a) model helped evaluate the professional development focused on using the SRS and mobile IWB for formative assessment. The outcomes indicate that the professional development was effective. In the final chapter of this study, I discuss the findings and the data's implications for my work and future research.

Table 4-1. Participation in the Study

Study Component	Criteria for Participation	Number of Teachers Meeting Criteria for Participation (N)	Number of Teacher Participants Who Met Criteria (N)	Percentage of Teacher Participants Who Met Criteria
Perceptions Questionnaire for Level 1	Attended some of the professional development.	40	36	90.00%
Teacher Multimedia Artifact for Level 2	Attended all of the professional development.	18	15	83.33%
Organization Support Questionnaire for Level 3	Attended all of the professional development.	18	16	88.89%
Observation Cycle for Levels 4 and 5	Attended all of the professional development and completed the Perceptions and Organization Support Questionnaires.	16	12	75.00%

Table 4-2. Means and Standard Deviations for the Perceptions Questionnaire

Item Regarding the Professional Development	N	M	SD
1. Related to my school's improvement plan	36	3.72	0.45
2. Incorporated research-based instructional strategies	36	3.72	0.45
3. Was a positive experience	36	3.72	0.45
4. Contributed to my learning	36	3.67	0.48
5. Met my needs as a learner	36	3.61	0.49
6. Connected to my prior knowledge	36	3.67	0.48
7. Included useful and meaningful content	36	3.64	0.49
8. Allowed me to consider use of the technologies in my content area	36	3.69	0.47
9. Included segments of time for reflection and/or lesson development	35	3.66	0.48
10. Included discussion and/or collaboration	35	3.60	0.55
11. Was facilitated in a professional manner	36	3.81	0.40
12. Was conducted at a convenient time	36	3.61	0.49

Note: The ratings on the Likert-Scale were 4 = Strongly Agree, 3 = Agree, 2 = Disagree, and 1 = Strongly Disagree.

Table 4-3. Means and Standard Deviations for the Participants' Learning Artifact Rubric

Rubric Item	N	M	SD
Plan for use of Technology for Formative Assessment	15	2.13	0.35
Use of Questions	15	2.27	0.46
Total	15	4.40	0.63

Note: For each of the two components the ratings were 1 = Emerging, 2 = Proficient, and 3 = Exemplary. The sum of the two scores designated the total score for the rubric, which was applied to the following scale: 6 points = Exemplary, 4-5 points = Proficient, and 2-3 points = Emerging.

Table 4-4. Means and Standard Deviations for the Organization Support Questionnaire

Item Regarding the Professional Development	N	M	SD
1. I identified strategies for using the technologies for formative assessment.	16	3.50	0.52
2. I am able to use the technologies for formative assessment.	16	3.44	0.51
3. When I use the technologies, my students are engaged in learning.	16	3.38	0.50
4. The professional development had a positive effect.	16	3.50	0.52
5. The teachers in my school view the professional development as positive.	16	2.94	0.44
6. My administrators view the professional development as important.	16	3.50	0.52
7. Other school district leaders view the professional development as important.	16	3.31	0.60
8. My school's leadership team representative asked for input on the technology professional development topics.	16	2.63	0.72
9. The professional development helped me with my professional learning goals.	16	3.44	0.51
10. The content was connected to school improvement and student achievement.	16	3.63	0.50
11. Julia helped me when I needed assistance with the technologies.	16	3.81	0.40
12. I felt supported during implementation of the technologies.	16	3.75	0.45
13. Our teachers' successes were recognized and shared during the sessions.	16	3.13	0.81

Note: The ratings on the Likert-Scale were 4 = Strongly Agree, 3 = Agree, 2 = Disagree, and 1 = Strongly Disagree.

Table 4-5. Frequency Data for the Observation Rubric

Rating	Frequency (N=12)	Percent of Observed Population
Not Evident	0	0.00%
Emerging	1	8.33%
Proficient	10	83.33%
Exemplary	1	8.33%

Table 4-6. Pre-Observation Interview Taxonomy

Overarching Themes	Codes and Sub-Codes
Planning to Use the Technologies during Instruction	<ul style="list-style-type: none"> <li>Planning to use technology to present material</li> <li>Planning to use the interactive whiteboard to navigate the presentation</li> <li>Planning to use embedded clicker questions</li> <li>Planning for students to use clickers</li> <li>Planning to use the interactive whiteboard to write lesson notes</li> <li>Planning to use clickers to collect anonymous data</li> </ul>
Planning to Use Formative Assessment Strategies	<ul style="list-style-type: none"> <li>Planning to use technology to monitor student progress               <ul style="list-style-type: none"> <li>Planning to use clicker data to monitor student progress</li> <li>Planning to use charting to monitor student progress</li> <li>Planning to use the interactive whiteboard screen to monitor student progress</li> </ul> </li> <li>Planning to adjust instruction               <ul style="list-style-type: none"> <li>Planning to use technology-based data for decisions about adjusting instruction</li> <li>Planning to use the interactive whiteboard to provide descriptive feedback</li> <li>Planning to give explanation of correct or incorrect answers</li> </ul> </li> <li>Planning for student involvement               <ul style="list-style-type: none"> <li>Planning to have students monitor their own progress</li> <li>Planning to use clickers to involve students in instructional decision making</li> </ul> </li> </ul>
Stating Thoughts about the Technologies	<ul style="list-style-type: none"> <li>Stating interest in using clickers</li> <li>Stating the clickers provide immediate feedback</li> <li>Stating technology helps students learn</li> <li>Stating students are engaged with technologies less frequently used</li> <li>Stating students need more experience with technology</li> <li>Stating advantage of clickers to other forms of data collection</li> <li>Stating students are engaged when using clickers</li> <li>Stating the technology is new to them</li> </ul>

Table 4-7. Classroom Observation Taxonomy

Overarching Themes	Codes and Sub-Codes
<p>Teacher Behavior: Using the Technologies</p>	<p>Using the tablet to teach</p> <ul style="list-style-type: none"> <li>Using tablet to solve problem</li> <li>Writing on tablet to explain a concept</li> <li>Using tablet to record student response</li> <li>Using tablet to engage clicker question via verbal bar</li> <li>Using tablet to navigate the lesson</li> <li>Using tablet screen to review individual student reports</li> </ul> <p>Using digital presentation medium to teach</p> <ul style="list-style-type: none"> <li>Displaying textual content</li> <li>Displaying images</li> <li>Displaying clicker questions</li> </ul> <p>Using the clickers to teach</p> <ul style="list-style-type: none"> <li>Asking a clicker question</li> <li>Using clicker data to produce charting of results</li> </ul> <p>Asking for my assistance</p> <ul style="list-style-type: none"> <li>Asking question related to the charting</li> <li>Asking how to return to the presentation</li> <li>Asking how to navigate the tablet reports</li> <li>Asking how to engage a different type question</li> <li>Asking how to navigate the verbal question bar with the interactive tablet</li> </ul>
<p>Teacher Behavior: Using Formative Assessment Strategies</p>	<p>Monitoring individual student progress</p> <ul style="list-style-type: none"> <li>Recording student responses with tablet</li> <li>Displaying chart of clicker data</li> <li>Discussing clicker data</li> <li>Looking at tablet report screen</li> <li>Reviewing cumulative percent correct</li> <li>Embedding assessment into instruction</li> </ul> <p>Adjusting instruction based on data</p> <ul style="list-style-type: none"> <li>Providing descriptive Feedback               <ul style="list-style-type: none"> <li>Rephrasing concepts</li> <li>Giving explanation of correct or incorrect answers</li> <li>Writing on tablet during re-teaching</li> <li>Giving additional examples</li> </ul> </li> <li>Asking additional questions to facilitate discussion</li> </ul>

Table 4-7. Continued

Overarching Themes	Codes and Sub-Codes
	Pairing students to discuss content Facilitating student activity for understanding of concept Helping students monitor own progress Telling students to take notes Asking students if they understand/to express comfort level Asking students to explain answer choice Displaying chart of clicker data Giving descriptive Feedback Discussing reasons for a particular answer Discussing clicker data Discussing content with individual students based on tablet data
Teacher Behavior: Directing use of the Technologies	Involving students in decision making Telling students to get clickers Explaining use of clickers Telling students to use clickers
Student Behavior: Engaging in Learning	Answering questions with clickers Looking at presentation Responding to the charting data Looking at teacher Listening to teacher Responding to teacher's question Looking at other students Listening to other students Discussing clicker question with other students Taking notes about content



Table 4-8. Post-Observation Interview Taxonomy

Overarching Themes	Codes and Sub-Codes
Student Learning	<p>Stating that students gained knowledge</p> <p>    Stating technology helps students learn</p> <p>    Stating technology helped students to reflect on learning</p> <p>Stating that the technology provides instant feedback</p> <p>    Stating that clicker data revealed students' learning</p> <p>    Stating that data revealed students' progress throughout the lesson</p> <p>    Stating that data helped to reveal whether or not re-teaching was needed</p> <p>Stating that re-teaching occurred during lesson</p> <p>Comparing technology to other methods</p>
Student Engagement	<p>Stating that students were engaged/focused during the lesson</p> <p>    Stating that students were engaged via interaction with clickers</p> <p>    Stating that clickers helped engage students</p> <p>    Stating that clickers helped make students accountable during lesson - increasing their focus</p> <p>    Stating that students enjoy using technology</p> <p>    Stating that students were engaged during lesson via group activity</p> <p>Stating disagreement that clickers engage students due to technical problems</p>
Professional Development Session Design: Instructional Grouping Strategies	<p>Stating preference for working individually rather than with content team</p> <p>Stating preference to collaborate during sessions</p> <p>Stating that there are different levels of technology ability among the teachers</p> <p>    Stating differentiation by level/process may be beneficial</p> <p>    Stating preference for grouping by ability rather than content</p> <p>        Stating it is difficult to work with slow learners during sessions</p>

Table 4-8. Continued

Overarching Themes	Codes and Sub-Codes
Professional Development Session Design: Learning Strategies	<p>Stating that professional development sessions were helpful with learning technology</p> <p>Stating that sessions helped with design and implementation of the observed lesson</p> <p>Stating usefulness of stations/hands-on practice during sessions</p> <p>Stating preference for independent exploration</p> <p>Stating preference for help guides</p> <p>Stating preference for modeling technology use</p> <p>Stating that learning technology is difficult</p> <p>Stating preference for learning a small amount at a time</p> <p>Stating that the technology is new for them</p> <p>Stating need more practice with technology</p>
Suggestions for Professional Development	<p>Stating that applying in classroom is different than using technology during sessions</p> <p>Stating preference for personal feedback/support</p> <p>Stating preference for observing and providing feedback/support during implementation</p> <p>Stating preference for one-on-one assistance with learning technology</p> <p>Stating that having me come to the classroom would be beneficial</p> <p>Stating that individualized help may be difficult with a lot of teachers</p> <p>Stating that confidence increased following observation due to help given</p> <p>Suggesting an overview of upcoming sessions during meeting to spark interest</p>

## CHAPTER 5 DISCUSSION AND IMPLICATIONS

This final chapter of the study includes a summary of the study, a review of the findings, and conclusions presented for each guiding question in the study. Additionally, I discuss additional outcomes and the implications for my work and future research.

### **Summary of the Study**

The impetus for the study was the teachers' need for professional development focusing on using newly purchased SRS and mobile IWB technologies for formative assessment during instruction. I designed professional development for this purpose based on the assumptions of adult learning (Knowles et al., 1998) and findings from professional development literature (Desimone, 2009). Additionally, I implemented the ADDIE instructional design model to help design, develop, and implement professional development that would meet the teachers' needs regarding using the SRS and mobile IWB for formative assessment.

To determine the effectiveness of the technology-based professional development, this study used Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a) as a framework for designing the research questions and data collection. Guskey's Evaluation (1998, 2000, 2002a) model facilitated collection of data spanning the following elements that ultimately affected the teachers' classroom instruction: the teachers' perceptions of the professional development, their learning during the sessions, the support of the organization, the teachers' application of the learning in their teaching, and the effect on the students' engagement during instruction. The following questions guided the data collection for studying the professional development:

- Level 1: What are the teachers' perceptions about the professional development?
- Level 2: In what ways did the teachers acquire the intended knowledge?
- Level 3: In what ways does the organization help teachers implement the technologies?
- Level 4: In what ways are the teachers using the mobile interactive whiteboard and student response system?
- Level 5: What effect did the professional development have on student engagement?

To address each of Guskey's (1998, 2000, 2002a) Levels, I collected data by various methods including Likert-Scale questionnaires, rubrics, and field notes from an observation cycle. This data collection facilitated by Guskey's (1998, 2000, 2002a) model helped evaluate the professional development on using the SRS and mobile IWB for formative assessment. For Level 1 of the model, Participants' Reactions, I collected the data using the Participant Perceptions Questionnaire to gauge the participants' reaction to the professional development. I collected data for Level 2, Participants' Learning, using the Participants' Learning Artifact Rubric to determine the participants' proficiency in their ability to design a technology-integrated lesson for collecting formative data. I collected the data for Level 3, Organization Support and Change, using the Organization Support Questionnaire to determine the organization's support of teachers with their implementation of the SRS and mobile IWB during instruction. I collected data regarding the Participants' Use of New Knowledge and Skills for Level 4 using the Pre-Observation Interviews and classroom observations to help determine the teachers' ability to effectively plan and implement the use of the SRS and mobile IWB for formative assessment. Last, I collected Level 5, Student Learning Outcomes, during

the observations and Post-Observation Interviews to determine if the professional development had an effect on student engagement.

I conducted the study at two middle schools in Georgia. The teachers who participated in the study were from a “convenience sample” (Patton, 1987) as they worked at the schools that I serve and attended the professional development sessions (N=40). The response rate for the study components was as follows: Participant Perceptions Questionnaire (n=36), Teacher developed multimedia lesson (n=15), Organization Support Questionnaire (n=16), and Observation Cycle to include the Pre- and Post-Observation Interviews and the classroom observation allowing for completion of the Observation Rubric (n=12).

I used quantitative and qualitative methods for the study based on the type of data collected for each of Guskey’s (1998, 2000, 2002a) Levels. I designed questionnaires for the study aligned to assumptions of adult learning (Knowles et al., 1998) and findings from professional development literature (Desimone, 2009). I designed rubrics aligned to the Class Keys (Georgia Department of Education, 2010a) teacher evaluation instrument and modeled the design according to other methods and tools used for teacher evaluation (Danielson, 2007; North Carolina State Board of Education, 2007). Additionally, I used research-based techniques to collect (Dillman, 2007) and analyze the data (Fraenkel & Wallen, 2006; Glesne, 2006; Patten, 1987; Spradley, 1979; Wolcott, 1994). Use of Guskey’s Evaluation (1998, 2000, 2002a) model for this study helped develop a formalized data-collection plan for indicating the impact of my work and areas for further exploration. As noted by Dana and Yendol-Hoppey (2009), formalized inquiry improves the teaching and learning process. Data from this

evaluation of the professional development provided information for developing plans to improve my professional practice to meet the teachers' instructional needs.

### **Findings**

The outcomes resulting from the data collection facilitated by Guskey's Evaluation (1998, 2000, 2002a) model helped evaluate the professional development on using the SRS and mobile IWB for formative assessment. The outcomes indicate that the professional development was effective.

For Level 1 of the model, Participants' Reactions, the data from the Participant Perceptions Questionnaire (N=36) indicate that the study's participants had a positive reaction to the professional development. Item means on this four-item Likert-Scale questionnaire ranged between 3.60 and 3.81. These outcomes indicate that the professional development met the participants' initial needs.

The data for Level 2 of the model, Participants' Learning, from the Participants' Learning Artifact Rubric indicate that the participants are proficient in their ability to design a technology-integrated lesson for collecting data. None of the teachers earned a rating of Emerging on the rubric. All of the teachers, except one who earned an Exemplary rating, scored Proficient based on the rubric regarding their ability to design a lesson that used the technologies for formative assessment.

The Reflective Journal, although not used for data in the study, provided information for Level 2 of Guskey's Evaluation (1998, 2000, 2002a) that was helpful during triangulation (Denzin, 2006) of the results and gave me an opportunity to reflect on the components of my instruction, including what went well and what I could have done differently. The journal also helped me to keep notes throughout the process regarding the teachers' understanding of the concepts and their reactions to the lesson

activities. The reflections in a written format were a useful reference throughout the sessions I facilitated, and the reflection process gave me an opportunity to use my reflections for improving the instruction. Data collection occurs naturally in the setting of a reflective practitioner (Dana and Yendol-Hoppey, 2009). Likewise, this reflection on my teaching in written format helped me make connections between my observations and the professional development literature and consider the implications for my work.

Overall, the data from the Organization Support Questionnaire (N=16) regarding Level 3, Organization Support and Change, yielded positive results regarding the organization's support of teachers with their implementation of the SRS and mobile IWB for formative assessment. Item means on this four-item Likert-Scale questionnaire ranged between 2.63 and 3.81. These outcomes indicate that overall the teachers felt supported during their learning about using the SRS and mobile IWB.

The Participants' Use of New Knowledge and Skills addressed by Level 4 data from the Pre-Observation Interviews, Observation Field Notes Records, and classroom Observation Rubrics indicate that the teachers are able to effectively plan and implement their learning. On the Observation Rubric (N=12), 8.33% of the participants (n=1) scored Emerging, 83.33% of the participants (n=10) scored Proficient, and 8.33% of the participants (n=1) scored Exemplary. The triangulation (Denzin, 2006) of these results helped me understand the teachers' plans for using and strategies for implementing the technologies for formative assessment during their lesson. The data for Level 4 indicate that the professional development helped the teachers plan and implement a lesson that incorporates the SRS and mobile IWB for formative assessment.

Level 5 data regarding Student Learning Outcomes focused on the Observation Field Notes Records and Post-Observation Interviews, which indicate that the professional development had a positive effect on student engagement. The data specify the use of the technologies helped students with their learning and engaged students during the lessons. Based on the data for this Level, student learning and engagement resulted from the student reflection stimulated by the instant feedback from the charting data, the individualized reports on the mobile IWB screen, and the interaction with the clickers.

### **Conclusions**

I based the conclusions discussed in this section on the data from the guiding research questions for the study. To help with clarity I presented the conclusions in order of the Levels of Guskey's Evaluation (1998, 2000, 2002a) model.

#### **Guiding Question for Level 1: Participants' Reactions**

For the question, "What are the teachers' perceptions about the professional development?," the results indicate that the teachers' perceived the professional development to be effective in the areas addressed by the Perceptions Questionnaire. The Perceptions Questionnaire items related to application of adult learning assumptions (Knowles et al., 1998) and professional development literature (Desimone, 2009) during implementation of the professional development sessions. Therefore, these data show an overall agreement by the participants that the professional development design and implementation addressed the supporting literature. Additionally, these data demonstrate that the design and facilitation method of the professional development met the teachers' initial needs. I will continue to implement the adult learning assumptions (Knowles et al., 1998) and professional development



strategies (Desimone, 2009) and work to refine the instructional design of the sessions to maximize learning for the teachers.

Because the data for Item 10, Included Discussion and/or Collaboration, included one Disagree rating, I reflected on whether the sessions effectively addressed this component because the research on effective professional development indicates a need for collective participation (Ball, 1996; Georgia Department of Education, 2008; Hill, 2009; National Staff Development Council, 2001; Wilson & Ball, 1996). I think there were sufficient opportunities for the participants to collaborate or discuss ideas for using the technologies for formative assessment or implementing strategies for adjusting instruction; however, this particular participant may have perceived the discussions as somewhat hypothetical and not truly collaborative. For this reason I considered ways to incorporate collaboration into the professional development (Desimone et al., 2002; Desimone, 2009; Garet et al., 2001; Hur, & Brush, 2009; Mouza, 2003). I think more opportunities to collaborate on lesson planning would meet this need because it would help teachers complete a meaningful task for use with their students (Knowles et al., 1998). In support of this idea, when I reviewed the comments for Question 13 which asked, “In what ways, if any, would you like the professional development to be modified in future sessions?,” a recurring theme was that the participants value collaboration and time to create instructional materials.

### **Guiding Question for Level 2: Participants’ Learning**

For the question “In what ways did the teachers acquire the intended knowledge?,” the results indicate that the teachers are able to develop a lesson that uses the technologies for collecting formative assessment data, and they have ideas for modifying instruction to meet students’ individual needs as indicated in Figure 5-1.

Additionally, the results indicate that the teachers are proficient in their ability to incorporate use of clicker questions during instruction (Bruff, 2009a; Beatty & Gerace, 2009).

For example, one artifact I reviewed that met the proficiency criteria was a symmetry PowerPoint that had clicker questions directly aligned to the standards. The pacing of the questions and the planned use of technology was such that the teacher could immediately clarify misconceptions through re-teaching (Bruff, 2009b; Beatty & Gerace, 2009). The multimedia lesson had slides with content prior to a clicker question, and the teacher planned to use the mobile IWB screen and charting to identify and address weakness among individual students before moving forward with the lesson.

Another example of the teachers' learning is an artifact I reviewed that met the criteria for an Exemplary rating. This artifact identified plans for using the Peer Instruction clicker strategy (Bruff, 2009a, 2009b; Mazur, 1997) to assist struggling learners. Additionally, this lesson included a question at the end for gauging students' thoughts about the instructional strategies used in the lesson in order to involve them in future instructional decisions.

Four components in the literature that I implemented in the design of the instruction contributed to the teachers' learning. First, development of the artifact provided an active learning environment for effective professional development (Bradshaw, 2002; Desimone et al., 2002; Garet et al., 2001; Hirsh & Killion, 2009; Mouza, 2003) allowing the teachers to consider how to implement the research-based clicker strategies into a multimedia lesson. Second, the artifact gave the teachers an

opportunity to focus on the content that they teach the students in addition to the focus on using the multimedia lesson they developed for formative data collection and assessment (Desimone et al., 2002; Desimone, 2009; Garet et al., 2001; Hirsh & Killion, 2009; Hughes & Ooms, 2004; Sparks, 2002). Third, the development of a multimedia lesson gave the teachers a real-world task to accomplish that helped provide meaning to their learning (Knowles et al., 1998). Last, the teachers had time during the four professional development sessions to collaborate on strategies for formative assessment (Desimone et al., 2002; Desimone, 2009; Garet et al., 2001; Guskey, 2003b). I will continue to use these literature-based strategies in the design of professional development because of the effect on teacher learning. In addition, the evaluation of the professional development is important. As noted by Guskey and Yoon (2009), critical evaluation of professional development helps determine its effectiveness, as studies reveal a connection between student learning and professional development adequately designed and implemented.

### **Guiding Question for Level 3: Organization Support and Change**

For the question “In what ways does the organization help teachers implement the technologies?,” the data indicate that the teachers approved of the support they received from the organization. Two of the Organization Support Questionnaire items, Item 11 and Item 12, received significant approval. Item 8 had a lower rating on the scale than expected. The data pinpointed strategies to continue, as well as some to reconsider.

For example Item 11, Julia Helped Me When I Needed Assistance with the Technologies, received the highest rating on this questionnaire. I reflected on the strategies I used that could have affected the teachers’ perception on this item. I think

that the teachers felt supported because of certain strategies I implemented during the sessions. I set up stations during the sessions and helped the teachers experiment with the technologies. This helped increase their comfort level with the technologies because they had hands-on opportunities to use them and I spent time answering their questions. The stations and hands-on opportunities provided the teachers with an active learning environment for engaging in the learning process (Bradshaw, 2002; Bonwell & Eison, 1991; Desimone, 2009; Mouza, 2003), which contributed to the teachers' perception of receiving support during their learning.

Another opportunity I had to help the teachers was during the sessions when they were working on developing their multimedia lesson. While I circulated I answered the teachers' questions about incorporating the clickers and mobile IWB into their lessons to collect formative data. If the teachers asked, I also helped with the design of their lesson and provided positive feedback, which is a motivational strategy in the literature regarding adult assumptions (Knowles et al., 1998).

Item 12, I Felt Supported during Implementation of the Technologies, also received a high rating with a mean of 3.75. This indicates that not only did the teachers appreciate my help as they were developing their lesson materials as discussed above, but they also felt supported by their teammates and administrators. This support was evident to me as I observed the teachers helping each other during the sessions. Additionally, the administrators at each school made known their support of using the technologies through visits during the sessions, formation of technology committees, and discussions with the teachers. This support by the administrators was also evident in the data for Item 6, My Administrators View the Professional Development as

Important, which had a mean of 3.5. The emphasis described here on collective participation and coherence is explained in the professional development literature as contributing to effective professional development (Desimone et al., 2002; Desimone, 2009; Garet et al., 2001; Penuel et al., 2008). Collective participation and coherence contributed to the success of the professional development in this study as detailed in the findings.

Item 8, My School's Leadership Team Representative Asked for Input on the Technology Professional Development Topics, rated lower than I expected. Two ratings of Disagree and two Strongly Disagree ratings affected the item's mean of 2.63. In talking with the principals, the schools' leadership teams had asked the teachers for their input; however, some participants indicated they did not have the opportunity to provide input on the professional development topics. I think that facilitating the communication differently could help give everyone an opportunity to provide input on the professional development. There are several ways to accomplish this; however, one idea is having the leadership team administer a survey or set of group-interview questions to their colleagues and bring the data back to the group for review. This would help to formalize the needs-assessment and solidify beliefs regarding involvement in the decision making. Collaboration about the content and the process for professional development increases motivation and commitment to the learning (Katzenmeyer & Moller, 2009).

#### **Guiding Question for Level 4: Participants' Use of New Knowledge and Skills**

The Pre-Observation Interview and the classroom observation helped me collect data for answering this question: "In what ways are the teachers using the mobile interactive whiteboard and student response system?" The results indicate that the

teachers are using the technologies to collect data that will help them to monitor student progress and adjust instruction as needed to assist all learners. These results reflect positively on the effect of the professional development. The data from Guskey's (1998, 2000, 2002a) Level 4 were valuable in helping me identify behaviors that were most common among the participants regarding their use of the SRS and mobile IWB, as well as behaviors that were useful during instruction but not as prevalent. From these data I identified ways to improve the professional development I facilitate.

As I triangulated the results from the taxonomies for the Pre-Observation Interview, the Classroom Observation, and the Observation Rubric, I thought about the objectives for the lessons in comparison to the teachers' plans for using as well as implementing the SRS and mobile IWB for formative assessment. The teachers' strengths as identified from the Pre-Observation Interview Taxonomy include their ability to plan for data collection using the technologies, plan for monitoring student progress using the technologies, plan for using the data to make decisions about adjusting instruction, and plan for having students monitor their own progress during the lesson based on the data. The overarching themes established by the Classroom Observation Taxonomy when coding the field notes—Using the Technologies, Using Formative Assessment Strategies, and Directing Use of the Technologies—pinpointed the common behaviors of the teachers when using the technologies during instruction. The “Using Formative Assessment Strategies” section of the Classroom Observation Taxonomy aligned with the data from the Pre-Observation Interview Taxonomy because in general the teachers effectively implemented their plans. The data from the Observation Rubric emphasized the teachers' ability to use the technologies for

collecting formative data and adjusting their instruction based on the data to meet individual student's needs. The focal point of implementation at the Proficient or Exemplary levels of the Observation Rubric focuses not on the collection of data about student learning, but on how teachers use the findings to improve student achievement (Garrison & Ehringhaus, 2007).

Technologies can help the teachers immediately access student data and then teachers may use formative data to fine-tune instruction in real time for improving student comprehension (Miller, 2009). The data from the Observation Rubric triangulated with the data from the Pre-Observation Interview Taxonomy and the Classroom Observation Taxonomy indicate that the majority of teachers are proficient in their implementation of the technologies for individualized and immediate formative assessment during instruction. These outcomes result from the collaboration among participants focusing on student achievement (Guskey, 2003b; Hur, & Brush, 2009; Mouza, 2003). These data helped me reflect on how the professional development sessions I facilitated contributed to the teachers' proficiency in using the SRS and mobile IWB for formative assessment.

As an example of proficiency in a math classroom, I observed a teacher reviewing the concept of symmetry and then asking application questions in which the students had to apply the concept to various sets of shapes. When students missed a question, the teacher facilitated a discussion about why each of the shapes did or did not have a line of symmetry and provided additional examples, which is an example of the Contingent/Agile Teaching clicker strategy (Bruff 2009b; Beatty et al., 2006; Draper & Brown, 2004). Similarly, another way identified by the rubric as Proficient is to use the

mobile IWB screen to determine the individual students who lack conceptual understanding and adjust instruction to meet their needs. The teachers scoring Proficient demonstrated their ability to use the technologies for formative assessment according to the guidelines of the rubric.

Although the teachers were able to demonstrate their ability to adjust their instruction immediately based on data to meet individual students' needs, there was an observed weakness in the teachers' ability to use a variety of strategies for this purpose to achieve an Exemplary score on the rubric. Therefore, I reflected on how the participants' behaviors, especially the participant who scored Exemplary on the Observation Rubric, may provide information to help teachers with use of these tools to enhance student learning. For instance, in a science classroom I observed a teacher facilitating a discussion about animal adaptations. Following a series of clicker questions, the teacher noted that several students were having difficulty with the concept by reviewing the mobile IWB screen data. The teacher paired the students based on the data so that students who did not understand had a partner who did. Then the teacher asked the students to discuss the concept and answer with the clickers again. The students discussed the question with their partner and then answered the most recent clicker question again as described in the Peer Instruction clicker strategy (Bruff, 2009a, 2009b; Mazur, 1997). A follow-up discussion gave students the opportunity to explain their answer choices. Additionally, in an exemplary lesson such as this one, students are involved in helping the teacher determine successful instructional strategies or modifications preferably via use of the technologies for data collection. The science teacher exemplified this concept by



asking the students to use their clickers to identify the effectiveness of a particular component of the lesson for increasing their understanding of the topic. This teacher went beyond the Proficient rating by asking a question to involve the students in instructional decisions and using a variety of clicker strategies to maximize student achievement.

Since one teacher scored Emerging on the Observation Rubric, I considered how I might help that teacher and potentially others not involved in this study to use the technologies effectively for formative assessment. In reviewing the field notes for this one teacher, I noticed that there was no weakness in using the technologies. The main reason for the Emerging rating was inefficiency in using data to help individual students understand the concepts. This lack of ability to adjust instruction may stem from a lack of planning. Similarly, one outcome from the Pre-Observation Interview demonstrated weakness in the teachers' ability to plan specific strategies for adjusting instruction based on the data. In this study the teachers were able to adjust instruction effectively; however, a lack of planning could translate to a lack of implementation.

Although modifying instruction in a timely manner is a skill that takes practice, I can facilitate the importance of planning strategies in advance during future professional development sessions through teacher collaboration. Additionally, outcomes reveal that the majority of participants are not using the technology to involve the students in making instructional decisions for achieving an Exemplary rating on the Class Keys teacher evaluation (Georgia Department of Education, 2010a). I will address this concept again in future sessions by providing opportunities for collaboration among content-area teachers (Desimone et al., 2002; Desimone, 2009; Garet et al., 2001).

Teachers learn from each other through their collaborative interactions (Ball, 1996; Georgia Department of Education, 2008; Hill, 2009; National Staff Development Council, 2001; Wilson & Ball, 1996). Critique, analysis, and self-challenge resulting from discussions with colleagues help teachers expand their knowledge about teaching (Freedman, 2001).

Overall, the professional development was effective in that the teachers implemented the strategies for using the SRS and mobile IWB for formative assessment as indicated on the Classroom Observation Taxonomy. The literature on adult learning assumptions (Knowles et al., 1998) and professional development (Desimone, 2009) was an integral part of the design and implementation of the professional development for this study. The use of these effective strategies contributed to the participants' learning.

#### **Guiding Question for Level 5: Student Learning Outcomes**

The Observation and Post-Observation Interview collected data for answering this question: "What effect did the professional development have on student engagement?" The results indicate that the teachers' technology integration during the lessons helped engage the students as indicated in Figure 5-2, which highlights the connections among the data from the Observation Field Notes and the Post-Observation Interviews. These results reflect positively on the effect of the professional development, indicating that the teachers have learned ways to incorporate the technology for engaging learners.

The teachers' perceptions during the Post-Observation Interviews regarding the engagement of their students focused on the students' use of clickers. The teachers stated that the clickers helped to engage the students by increasing their focus during

the lesson as well as their interaction with the clickers. Using clickers throughout a lesson provides opportunities for formative assessment and helps to engage learners (Bruff, 2009a; Beatty & Gerace, 2009). The Post-Observation Interview Taxonomy revealed that teachers think the students enjoy using technology during instruction. The teachers noted that the use of the technologies makes the student accountable during the lesson. For example, when a teacher asked a question the clicker system indicated which students had not answered the question.

Similarly, during the observations when the teacher reviewed the mobile IWB screen data it was apparent which students had answered the item correctly, as well as those needing re-teaching of the concept. I observed the teachers using this data to engage their learners. The teachers used the data to monitor learning, adjusted instruction by providing descriptive feedback, asked additional clicker questions to facilitate discussion, and used the clicker strategies to promote engagement. Each of these techniques, as well as others in the Observation Taxonomy, facilitated interaction among the students, teacher, technologies, and data for helping students learn.

The reason that the professional development positively affected the engagement of the students during the lessons is the teachers' use of the research-based clicker strategies during instruction, which I observed during their lessons. The participants learned the importance of integrating clicker questions throughout the lesson (Bruff, 2009a; Beatty & Gerace, 2009) as indicated by the observation data. The teachers were also consistent in their use of the Contingent/Agile Teaching clicker strategy (Bruff, 2009b; Beatty et al., 2006; Draper & Brown, 2004), and several participants implemented the Discussion Warm-up/Think-Vote-Share clicker strategy (Bruff, 2009a,

2009b; Lyman, 1981). The professional development sessions helped the teachers work cooperatively to focus on their content, accomplish authentic tasks, consider use of the clicker strategies during their instruction, and implement the strategies successfully for the benefit of learners.

I would like to help teachers increase their strategies for engaging learners. An exemplary teacher uses a variety of strategies for formative assessment (Georgia Department of Education, 2010a). The participant who earned an Exemplary rating on the Observation Rubric implemented the Peer Instruction clicker strategy (Bruff, 2009a, 2009b; Mazur, 1997) during the lesson I observed in addition to the other clicker strategies.

The Peer Instruction strategy is effective for engaging the students in discussions with each other and providing a method for adjusting instruction. Given the benefits of this strategy, I will help the teachers in the schools in which I work to implement it during instruction. Teacher leaders can help make changes regarding student learning as they influence improvement in others' educational practice (Katzenmeyer & Moller, 2009). Capacity building with a focus on results that includes positive pressure from teacher leaders can escalate the effectiveness of the group for increased student achievement (Fullan, 2006). Therefore, I will work with this teacher leader and others to help facilitate an increase in teacher knowledge that effects student achievement.

### **Additional Outcomes**

The data collection revealed an ancillary finding not specifically related to the guiding questions in the study. During the Post-Observation Interviews the teachers indicated a need for one-on-one professional development. This outcome resulting from the data points to future research regarding implementation of an instructional

coaching model to serve teachers with their technology integration needs. This finding resulted from the data collection during Level 5 of Guskey's Evaluation (1998, 2000, 2002a), as the last interview questions addressed collecting further data to improve the professional development I provide. The following questions included in the Post-Observation Interview helped me understand the teachers' thoughts regarding the professional development:

- In what ways, if any, could I modify the professional development to help you meet your students' instructional needs?
- Are there other strategies that you would like me to use to support you in your technology integration? If so, please explain.

One predominant theme arose in 11 of the 12 interviews. The teachers expressed a need for one-on-one support while learning and implementing technology. They discussed working with me during their instruction for increasing their comfort level with new technology, or technology used differently. One teacher said, "It really helped me with you being in here, in the classroom, one-on-one. I was able to talk to you and ask you questions as they came up. In addition, once you left after the first core, I felt very confident. I can do this on my own now." Teachers expressed similar sentiments throughout the Post-Observation Interviews.

### **Implications for Future Work and Research**

There are four concerns worth considering regarding their application to my work as an ITS:

1. A weakness was noted in the teachers' ability to plan and implement a variety of strategies for adjusting their instruction immediately based on data to meet an individual student's needs.
2. The teachers' comments on the Participant Perceptions Questionnaire and interview transcripts indicate their preference to have more time to

work with the technology incorporated into the professional development sessions.

3. The results of data analysis for the additional questions in the Post-Observation Interview indicated a need for implementing an instructional coaching model of professional development.
4. No strategic method is in place for evaluating the technology professional development conducted by the ITSs in the school system.

Guskey's Evaluation (1998, 2000, 2002a) provides a systematic method for continuous improvement in the technology-based professional development in which teachers participate, which I can implement again and may be valuable to others as well. This section describes strategies regarding these concerns and ways to address them.

### **Formative Assessment to Meet Individual Needs**

I observed a weakness in the teachers' ability to use a variety of strategies to adjust their instruction immediately based on data to achieve an Exemplary score on the Observation Rubric. I will work with the teachers to develop ideas based on research for using the technology-based formative assessment data for immediately adjusting instruction to accommodate the needs of individual students.

During the upcoming school year, the District has planned a continued focus on using the technologies for formative assessment. I will facilitate professional development sessions that address using a variety of strategies for adjusting instruction. During the sessions the teachers will discuss using the technologies and associated research-based strategies. I will re-address the following literature-based strategies during the professional development for this purpose: Discussion Warm-up/Think-Vote-Share clicker strategy (Bruff, 2009a, 2009b; Lyman, 1981) and Peer Instruction clicker strategy (Bruff, 2009a, 2009b; Mazur, 1997). I will not re-address the Contingent/Agile

Teaching clicker strategy (Bruff 2009b; Beatty et al., 2006; Draper & Brown, 2004) because the teachers' sufficiently implemented this strategy during the lessons I observed. Additional time spent on these strategies will help facilitate the teachers' understanding and develop ideas for implementation in their specific content areas. One option for helping the teachers conceptualize and implement these formative assessment clicker strategies is a strategy called Assessment as Professional Learning in which teachers collaborate to design and evaluate assessments (McTighe & Emberger, 2001).

### **More Time to Work with the Technologies**

I will attend to the second concern regarding the teachers' having additional time to work with the technologies during the professional development sessions by incorporating work sessions into the instructional sequence. The work sessions will give the teachers additional time to explore the technologies, ask questions, and work on developing technology-integrated lessons for use with their students. A work session will follow a series of sessions on a particular topic, and the work session will focus on learning about and developing lessons that incorporate that particular topic and its related technologies. Adult learning assumptions (Knowles et al., 1998) and professional development literature (Desimone, 2009; Bradshaw, 2002; Mouza, 2003) support a focus on an authentic task in an active learning environment.

### **Instructional Coaching**

The teachers' interest in one-on-one professional learning that includes support during implementation of technologies and feedback during observations aligns with a professional development strategy referred to as "instructional coaching." This professional development model, initially discussed by Joyce & Showers (1980),

suggests that for professional development to be effective it should include a combination of theory, modeling, practice, feedback, and coaching. Technology integration areas suitable for instructional coaching are those that are a focus point for the teacher and observable during instruction. Content-focused coaching described by Yendol-Hoppy and Dana (2010) is a strategy that would facilitate the work of ITSs as instructional coaches as they worked with teachers to develop their technology-based content knowledge. Instructional coaching is a component of professional development that is worth further exploration based on the additional findings in this study.

A teacher involved in instructional coaching would meet with the coach and set goals related to his or her technology integration (Barkley, 2010). The teacher would attend sessions that incorporate theory, modeling, and practice related to his or her goals (Joyce & Showers, 1980). The teacher would then participate in a coaching cycle that includes a pre-observation conference, an observation, and a post-observation conference.

During the pre-observation conference the teacher would share his or her lesson and review his or her technology-integration goals to help define the focus of the observation (Barkley, 2010). During this conference the teacher and coach would define the level of participation/assistance available during the observation. The coach would document strategies related to the instructional goals that were useful, document questions about the strategies, and document ideas or suggestions for future lessons during the classroom observation. At the post-observation conference the coach and teacher would discuss the focus point of the observation and the coach would provide feedback (Barkley, 2010). Additionally, a coaching model would require an atmosphere



in which the instructional coach is viewed as an expert, while continuing to maintain trust among the teachers (Mangin & Stoelinga, 2011). Downplaying expert status by an instructional coach causes difficulty in providing the type of feedback that facilitates instructional improvement (Mangin & Stoelinga, 2011). Instructional coaching would provide one-on-one opportunities for collaboration, as well as goal setting and reflection, which are critical for successful professional development (Orrill, 2001). It is important to recognize that there will not be a change in teachers' instructional strategies unless professional development includes follow-up coaching and support (Katzenmeyer & Moller, 2009).

### **Future Use of Guskey's Evaluation**

The systematic nature of Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a) provides a framework for future implementation. Since it is flexible regarding the professional development topic that is evaluated, this model is applicable in a variety of technology-related professional development venues. This model provided valuable data in this study; therefore, I plan to use it again as a framework for evaluating the professional development I conduct. On the next occasion I will consider ways to streamline the data-collection methods if the evaluation is conducted independently; if conducted by a team, I think it would be helpful to divide the data collection and analysis among the group to facilitate efficiency in completing the evaluation. For example, next time I will not code the data for the last question on the Pre-Observation Interview that asks the participant about any help needed before the lesson because this question did not effectively contribute to the data collection.

## **Recommendations for Implementation of Guskey's Evaluation**

It is apparent that professional development needs to incorporate adult learning assumptions, professional development and technology-based literature, as well as ISD to be effective. Albeit consistent efforts to integrate the literature into the professional development may be apparent, indeterminate weaknesses in the design could affect its success. This study demonstrates that Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a) model is a comprehensive approach for identifying areas in the professional development strategies for enhancement and informing future initiatives for teacher growth and student improvement (Guskey, 2002a).

For school systems or other organizations interested in evaluating the impact of their professional development, I recommend a segmented approach that includes reviewing the current professional development plan and implementing Guskey's Evaluation (1998, 2000, 2002a) in phases over two or more years. This method will provide an opportunity to address any apparent weaknesses in advance and confront the evaluation systematically to ensure the effectiveness of the professional development at each of the evaluation levels.

First, overview your current professional development plans for any apparent weaknesses in the design or implementation. Use the proposed framework in Figure 2-2 as a guide for assessing the design of the professional development prior to the evaluation. As discussed herein, it is important to consider the literature during instructional design of professional development. Review the system and school improvement goals and appropriate needs assessments to ensure alignment with any

long-term professional development initiatives. Make any needed modifications prior to the evaluation.

Next, implement Guskey's Evaluation (1998, 2000, 2002a) model in phases. Since most professional development initiatives take place over several years, it is feasible to ensure success at the early levels of the evaluation prior to implementing the later levels. Based on implementation of Guskey's Evaluation (1998, 2000, 2002a) for this study, I recommend completing Levels 1-3 consecutively during the first year of the evaluation. Avoid moving to the next level of the evaluation until effectiveness is established at the current level. This is important because Guskey (1998) notes that the preceding levels must be successful for the following levels to be successful. Once the first three Levels—Participants' Reactions, Participants' Learning, and Organization Support and Change—demonstrate that the professional development is effective, proceed with Levels 4 and 5 of the evaluation in succeeding years to measure the teachers' application of learning and the professional development's effect on student achievement.

In conclusion, this study found Guskey's Five Levels of Professional Development Evaluation (1998, 2000, 2002a) to be useful in assessing the value of the technology-based professional development I provided to the middle school teachers in my school system on using the SRS and mobile IWB for formative assessment. The results of the study support the literature regarding consideration of adult learning assumptions, core features for effective professional development, and ISD during the design and implementation of professional development. The data also indicated areas for growth to promote continuous improvement and identified a need for implementation of an

instructional coaching model. Finally, a segmented approach to Guskey's Evaluation (1998, 2000, 2002a) model can benefit organizations interested in evaluating their professional development.

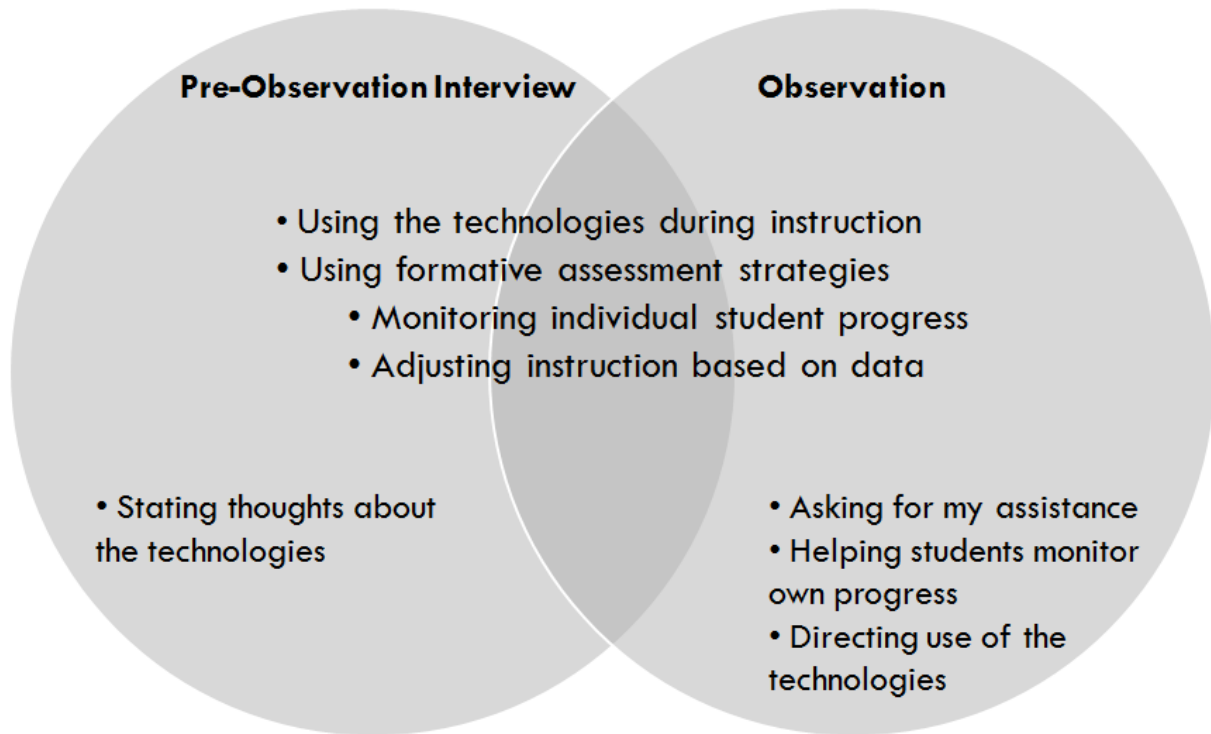


Figure 5-1. Venn Diagram Highlighting Similarities Among the Pre-Observation Interview and Observation Data

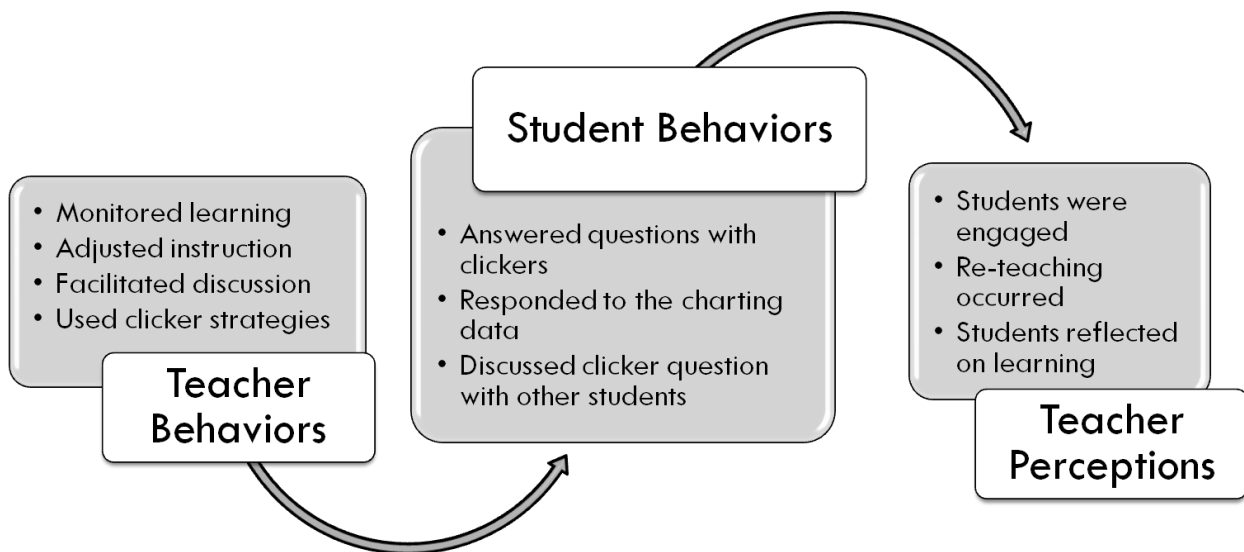


Figure 5-2. Connections Among the Data From the Observation Field Notes and the Post-Observation Interviews

APPENDIX A  
SESSION HANDOUT

<p><b>SBI. 1.5</b> The teacher uses accessible technology effectively to enhance student learning.</p> <p><b>AL 1.2</b> The teacher uses formative assessment strategies to monitor student progress and to adjust instruction in order to maximize student achievement on the Georgia Performance Standards (GPS).</p>					
<b>GaDOE Class Keys (2010) Continuum of Improvement</b>	<b>SBI 1.5</b>	<p><b>Not Evident</b></p> <p>The teacher does not use accessible technology to enhance student learning.</p>	<p><b>Emerging</b></p> <p>The teacher uses accessible technology; however, technology is used primarily with the whole class, select students, or as a tool for tutorials and drill.</p>	<p><b>Proficient</b></p> <p>The teacher routinely uses accessible technology to enhance student learning and support their achievement.</p>	<p><b>Exemplary</b></p> <p>The teacher develops, implements, and evaluates a comprehensive approach for using accessible technology to enhance learning and achievement for all students.</p>
	<b>AL 1.2</b>	<p>The teacher does not use formative assessment strategies either to monitor student progress or to adjust instruction to meet student needs.</p>	<p>The teacher uses some formative assessment tasks and tools to guide adjustments of whole-class instruction; however, formative assessment is rarely used at the individual level or may be inconsistently implemented.</p>	<p>The teacher consistently uses formative assessment tasks and tools to monitor student progress over the course of most units and to adjust instruction to meet students' individual learning needs relative to GPS.</p>	<p>The teacher consistently uses a variety of formative assessment tasks and tools to monitor student progress over the course of all units and adjusts instruction to maximize student achievement relative to GPS for all learners. The teacher also involves students in decisions about adjustments to instruction to enhance their learning.</p>

Note: This session handout aligns two of the standards from the Class Keys teacher evaluation instrument (Georgia Department of Education, 2010a).

APPENDIX B  
POST-INSTRUCTION REFLECTIVE JOURNAL

Lesson # \_\_\_\_\_ Participant ID #s \_\_\_\_\_

1. How did the teachers respond to the introduction material?
2. How did the teachers respond to the cooperative activities?
3. How did the teachers respond to the discussions?
4. How did the teachers respond while experimenting with the technologies?
5. What indicated that the teachers learned during this lesson?
6. What could I have done differently during this lesson?

APPENDIX C  
PERCEPTIONS QUESTIONNAIRE

ID# \_\_\_\_\_

Please answer the following questions regarding the professional development on the use of the interactive tablet and/or student response system for formative assessment.

<b>The professional learning provided by Julia Fuller on integrating the interactive whiteboard and clickers for formative assessment:</b>	<b>Strongly Agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
1. Related to my school's improvement plan				
2. Incorporated research-based instructional strategies				
3. Was a positive experience				
4. Contributed to my learning				
5. Met my needs as a learner				
6. Connected to my prior knowledge				
7. Included useful and meaningful content				
8. Allowed me to consider use of the technologies in my content area				
9. Included segments of time for reflection and/or lesson development				
10. Included discussion and/or collaboration				
11. Was facilitated in a professional manner				
12. Was conducted at a convenient time				

13. In what ways, if any, would you like the professional development to be modified in future sessions?

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Comments:

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APPENDIX D  
PARTICIPANTS' LEARNING ARTIFACT RUBRIC

ID#(s) \_\_\_\_\_

**Rubric for Evaluating the Teacher Developed Multimedia Lesson**

	<b>Emerging (1)</b>	<b>Proficient (2)</b>	<b>Exemplary (3)</b>	<b>Points</b>
<b>Plan for use of Technology for Formative Assessment</b>	<ul style="list-style-type: none"> <li>○ The multimedia lesson includes a formative assessment plan.</li> <li>○ The formative assessment plan includes some use of the charting feature or other data to monitor student progress and adjust instruction.</li> </ul>	<ul style="list-style-type: none"> <li>○ The description of the formative assessment plan includes use of the charting feature and other data to monitor individual student progress or use of the mobile interactive whiteboard screen to monitor learning of individual students and the class.</li> <li>○ The plan addresses using the technologies to adjust instruction relative to the Georgia Performance Standards.</li> </ul>	<ul style="list-style-type: none"> <li>○ Addresses Proficient indicators.</li> <li>○ The description of the formative assessment plan includes use of a variety of clicker strategies.</li> <li>○ Includes an idea for using clicker data to facilitate student reflection about their own learning and involve them in instructional decisions.</li> </ul>	
<b>Use of Questions</b>	<ul style="list-style-type: none"> <li>○ The multimedia lesson includes fewer than 3 questions.</li> <li>○ The questions are not clearly aligned to lesson content.</li> <li>○ The questions are grouped together rather than spread throughout the lesson.</li> </ul>	<ul style="list-style-type: none"> <li>○ The multimedia lesson includes more than 6 questions.</li> <li>○ The questions are clearly aligned to lesson content.</li> <li>○ The questions are unobtrusively grouped together.</li> </ul>	<ul style="list-style-type: none"> <li>○ The multimedia lesson includes 3-6 questions throughout the lesson content.</li> <li>○ The questions are clearly aligned to lesson content.</li> <li>○ The pacing of the questions is such that formative assessment data may be used immediately to clarify misconceptions.</li> </ul>	
<i>Total Points</i>				

**Rating Scale**

*Exemplary – 6 points*  
*Proficient – 4-5 points*  
*Emerging – 2-3 points*

Note: Aligned to Class Keys (Georgia Department of Education, 2010a).

APPENDIX E  
ORGANIZATION SUPPORT QUESTIONNAIRE

ID# \_\_\_\_\_

Please answer the following questions regarding your use of the technologies (interactive tablet and/or clickers) for formative assessment and the associated professional development.

<b>Regarding the professional learning provided by Julia Fuller, please rate the following:</b>	<b>Strongly Agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
1. I identified strategies for using the technologies for formative assessment.				
2. I am able to use the technologies for formative assessment.				
3. When I use the technologies, my students are engaged in learning.				
4. The professional development had a positive effect.				
5. The teachers in my school view the professional development as positive.				
6. My administrators view the professional development as important.				
7. Other school district leaders view the professional development as important.				
8. My school's leadership team representative asked for input on the technology professional development topics.				
9. The professional development helped me with my professional learning goals.				
10. The content was connected to school improvement and student achievement.				
11. Julia helped me when I needed assistance with the technologies.				
12. I felt supported during implementation of the technologies.				
13. Our teachers' successes were recognized and shared during the sessions.				

Please list suggestions as well as strategies I used during the sessions that were most helpful to you: \_\_\_\_\_

\_\_\_\_\_

APPENDIX F  
PRE-OBSERVATION INTERVIEW

**Date** \_\_\_\_\_ **ID#** \_\_\_\_\_

**Beginning Time** \_\_\_\_\_ **Ending Time** \_\_\_\_\_

**Introduction:** The purpose of this interview is to help me understand your plans for the lesson and to determine if you need any assistance before the lesson.

1. What is the sequence of events for this lesson?

Probe: How do you plan to integrate technology into this lesson?

Probe: How will you or the students use the technology?

Probe: Why did you decide to use the technology in this way?

2. What is your plan for monitoring student progress?

Probe: Do you plan to use technology for monitoring the students' progress? If so, please explain.

Probe: Why did you decide to monitor student progress in this way?

3. Is there anything I can do to assist you before this lesson? If so, how may I help?

**Ending Statement:** I am looking forward to your lesson. The purpose of my observation is to study the effects of my technology-integration sessions.

APPENDIX G  
OBSERVATION FIELD NOTES RECORD

Researcher Name: Julia Fuller	Study Name: An Evaluation of Instructional Technology Professional Development in the Middle Schools of a Southeastern School District	
Protocol #:	Observation Date:	Beginning Time:
Participant ID#:	Protocol Completion Date:	Ending Time:

*Focus Points for the observation:* focus on teacher technology use, student technology use, formative assessment use of technology, and student engagement:

- In what ways is the teacher using the technologies?
- In what ways is the teacher collecting formative data?
- In what ways has the teacher directed the students to use the technologies?
- In what ways are the students engaged because of the teacher's lesson?

*Description of environment:*

*Observations:*

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

(Continue numbering until end of observation)

*Reflections/Insights:* [Brackets will indicate reflections noted during the observation. Reflections made during the observation will be noted alongside the observation field notes.]

## APPENDIX H OBSERVATION RUBRIC

SBI. 1.5 The teacher uses accessible technology effectively to enhance student learning.					
AL 1.2 The teacher uses formative assessment strategies to monitor student progress and to adjust instruction in order to maximize student achievement on the Georgia Performance Standards (GPS).					
<b>GaDOE Class Keys (2010) Continuum of Improvement</b>	<b>SBI 1.5</b>	<b>Not Evident</b> The teacher does not use accessible technology to enhance student learning.	<b>Emerging</b> The teacher uses accessible technology; however, technology is used primarily with the whole class, select students, or as a tool for tutorials and drill.	<b>Proficient</b> The teacher routinely uses accessible technology to enhance student learning and support their achievement.	<b>Exemplary</b> The teacher develops, implements, and evaluates a comprehensive approach for using accessible technology to enhance learning and achievement for all students.
	<b>AL 1.2</b>	The teacher does not use formative assessment strategies either to monitor student progress or to adjust instruction to meet student needs.	The teacher uses some formative assessment tasks and tools to guide adjustments of whole-class instruction; however, formative assessment is rarely used at the individual level or may be inconsistently implemented.	The teacher consistently uses formative assessment tasks and tools to monitor student progress over the course of most units and to adjust instruction to meet students' individual learning needs relative to GPS.	The teacher consistently uses a variety of formative assessment tasks and tools to monitor student progress over the course of all units and adjusts instruction to maximize student achievement relative to GPS for all learners. The teacher also involves students in decisions about adjustments to instruction to enhance their learning.
<b>Examples of Evidence Aligned to the GaDOE Class Keys (2010)</b>		<b>Indicators:</b> The teacher... <ul style="list-style-type: none"> <li>○ does not use the provided technologies.</li> <li>○ uses clicker questions that are not guided by GPS aligned lessons.</li> </ul>	<b>Indicators:</b> The teacher... <ul style="list-style-type: none"> <li>○ employs clickers for whole class summative assessment (e.g. giving a test) or game.</li> <li>○ delivers clicker questions during direct instruction.</li> <li>○ uses some charts or other instant feedback to monitor student learning and adjust instruction.</li> </ul>	<b>Indicators:</b> The teacher... <ul style="list-style-type: none"> <li>○ delivers GPS aligned clicker questions during direct instruction.</li> <li>○ consistently uses charts or other data to monitor individual student learning and adjust instruction.</li> <li>○ or uses the mobile interactive whiteboard screen to monitor learning of individual students and the class and adjust instruction.</li> </ul>	<b>Indicators:</b> The teacher... <ul style="list-style-type: none"> <li>○ consistently implements each of the proficient indicators.</li> <li>○ uses a variety of questioning strategies with clickers.</li> <li>○ uses clicker data to facilitate student reflection about their own learning and involves them in instructional decisions.</li> </ul>

Note: Modeled after the Rubric for Evaluating North Carolina Teachers (North Carolina State Board of Education, 2007).

APPENDIX I  
POST-OBSERVATION INTERVIEW

Date \_\_\_\_\_ ID# \_\_\_\_\_

Beginning Time \_\_\_\_\_ Ending Time \_\_\_\_\_

**Introduction Statement:** Thank you for the opportunity to observe your lesson. The purpose of this interview is to help me understand your students' learning and engagement, as well as to gather information regarding the professional development I offer.

1. What are your thoughts about your students' learning during this lesson?

Probe: Did the lesson reveal information about the students' level of engagement and understanding? If so, please explain.

Probe: How do you know if the students were learning during your lesson?

Probe: What are your thoughts about the effects of the students' use of technology on learning?

Probe: Was there an opportunity for you to use data to adjust instruction during this lesson? If so, please explain.

2. In what ways, if any, could I modify the professional development to help you meet your students' instructional needs?

3. Are there other strategies that you would like me to use to support you in your technology integration? If so, please explain.

4. In what ways, if any, did you use the information from my sessions to design and/or implement this lesson?

**Ending Statement:** Thank you so much for your participation in this study. Your insight will help me to improve my practice.

APPENDIX J  
INTERVIEW CODING PROTOCOL FORM

Researcher Name: Julia Fuller	Study Name: An Evaluation of Instructional Technology Professional Development in the Middle Schools of a Southeastern School District	
Protocol #:	Interview Date:	Beginning Time:
Participant ID#:	Protocol Completion Date:	Ending Time:

Transcript	Codes and Themes
	I completed this process using HyperText™.

Note: Modeled after Fraenkel & Wallen's (2006, p. 489) Data Collection Form.

APPENDIX K  
POST-INSTRUCTION REFLECTIVE JOURNAL EXCERPTS

**Teachers' response to session components.** The various presentation tools that I used during each lesson's introduction kept the teachers' interested. Some teachers were very excited to learn about the tools and eager to create a lesson with the tools to use with their students. Additionally, in modeling the technologies, there was a general interest in learning more about the mobile IWB screen. One teacher expressed interest in just focusing on the interactive screen for now.

During the needs-assessment portion of the first session, the teachers were honest with their responses regarding their use and comfort level of the technologies. I collected information to help me know what they needed to practice over the next few weeks. They perceived themselves as less skilled than I thought they would. This activity helped me think about how to support them in their learning of the technology. I think that last year when I was teaching the basic uses of the clickers, there were so many possibilities that some of the teachers were overwhelmed. I designed these four lessons to focus on only a few strategies for using the tools formatively, which helped the teacher to not only feel more comfortable with this particular aspect of the tools but also provided some strategies for using them.

**Monitoring the teachers' learning.** After the first session I was not really sure that the teachers understood the general idea of using the technologies for formative assessment, at least in the way that I was planning to emphasize during these sessions, which was to use the charting and interactive screen data to immediately modify instruction. Based on their discussions, it seemed that they were used to referring to data after their lessons. I planned to facilitate their consideration of how they could



differentiate based on the individual mobile IWB screen reports during their lessons. I designed questions for the cooperative activities for the following sessions to meet this need.

For each cooperative activity, the majority of the teachers talked to each other about the tools and discussed ideas regarding how they were using them. They talked about possible lessons they could create to collect formative data. For one group this discussion did not specifically address the question posed to the group, but actually took it a step further to thoughts about application. One time I was not sure that they all understood the question at first, but then a participant responded in a way that I think helped to contribute to the others' understanding. Future cooperative discussions focused on figuring out how they could design a lesson for gathering formative data and application of formative assessment strategies.

During one discussion the teachers expressed an interest in the Peer Instruction (Bruff, 2009a, 2009b; Mazur, 1997) clicker strategy. The groups were actively coming up with ideas that made sense for effectively adjusting instruction and involving the students in reflection and instructional decisions. All of the groups were willing to share, and I think they learned from each other. I valued their ideas for using the technologies in their classrooms. One group was a little timid about sharing, but the other groups shared multiple ideas, which I think helped the others to conceptualize use of the tools for formative assessment. During the group discussions they also discussed their thoughts about formative assessment and shared ideas about how they might be able to use the tools. They shared their ideas willingly, and I recorded the ideas using the mobile IWB. The teachers seemed to value their discussions.

During the experimentation portion of the session, we practiced with the mobile IWB screen and navigated through the various reports. Many of the teachers grouped around the stations while others worked on lessons. One group of teachers did not use the stations, but instead worked collaboratively on lesson development. While teachers were at the stations, I worked with them on the verbal questions and the mobile IWB screen reports.

During the fourth session the cooperative activity gave the teachers an idea of how they could use multiple mobile IWBs during instruction. Additionally, their written and verbal answers to the questions demonstrated their understanding of formative assessment and student decision making using the technologies. During the activity they generated new ideas to improve their instruction. They also shared ideas about using the technologies to do things that they normally do in another way. This activity solidified the teachers' learning and provided information to validate the learning that had taken place during the sessions.

**Modification considerations for future sessions.** It seemed that I had a bit too much planned for the first session. The review of the tools' functions that are useful for gathering data, the modified KWL, and the cooperative activity were enough for one day. There was not time to start on the multimedia lesson, but rather just time to think about it. After the first session I wondered whether my focus question for the cooperative activity was too broad or not clear enough. It could be due to the participants' lack of understanding of the concept; however, I carefully phrased the cooperative discussion question for the next lesson. I planned to monitor this during the next session to see if their understanding improved based on their discussions.

During the first session I gathered information from the teachers to help me understand their needs regarding their use of the technologies. I planned to use this information to help design the upcoming sessions. They also expressed interest in some modeling and some hands-on opportunities to help them understand the concepts with which they were unfamiliar. I decided it might be helpful to have centers set up so that they could practice the technical concepts that they relayed to me as being areas of concern.

Feedback on Questionnaire 1, including “A little less theory on the front side,” caused me to consider changing the way I presented the clicker strategy. I reflected on how I could facilitate the teachers’ understanding of the strategy without delivering the information myself. For the next session I gave the teachers a strip of paper with the clicker strategy and facilitated a cooperative activity so the teachers could develop and share ideas for using the strategy in their content area. This seemed to be a more effective way to help the teachers comprehend and contemplate the information.

Over the next few sessions, certain circumstances made me consider how I could modify the strategies to better facilitate the session. To address some lack of discussion among certain groups I asked them to partner-up with their content area colleagues for the discussion rather than with someone near them. This helped certain groups to communicate more during the cooperative activities. I also decided to set the digital timer for some cooperative activities so that each teacher would have an equal chance to talk. Additionally, I decided to record the teachers’ comments during the discussion on the mobile IWB, which I think gave value to their ideas.

## APPENDIX L EXAMPLE OF CODING QUALITATIVE DATA

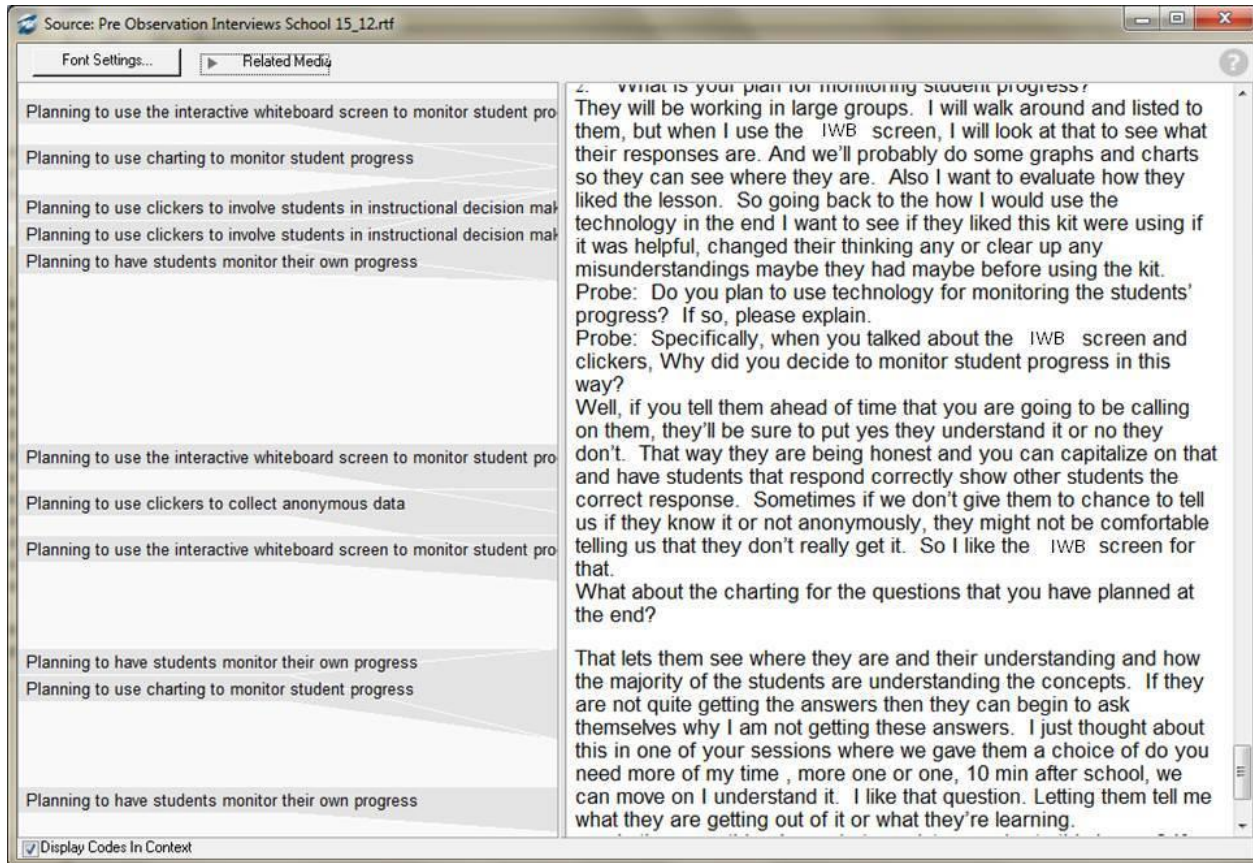


Figure L-1. Example of Coding Qualitative Data Using Hypertext™

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