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An Examination of Teacher Concerns Beyond the Initial Stages of a District's One-to-One Technology Adoption

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AN EXAMINATION OF TEACHER CONCERNS BEYOND THE INITIAL STAGES OF A DISTRICT'S ONE-TO-ONE TECHNOLOGY ADOPTION

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Approval Page

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Abstract

AN EXAMINATION OF TEACHER CONCERNS BEYOND THE INITIAL STAGES OF A DISTRICT'S ONE-TO-ONE TECHNOLOGY ADOPTION. Massengill, Elicia Ramsey, 2019: Dissertation, Gardner-Webb University.

The purpose of this study was to examine the change process teachers experience during a technology adoption in an effort to understand how effective technology implementation comes about, what obstacles must be navigated, and what resources are needed for that navigation. The convergent parallel mixed-methods design used in this study provides both qualitative and quantitative data analyzed separately in a side-by-side comparison and then merged to develop a fuller understanding of high school teachers' implementation of a one-to-one technology adoption 5 years after its inception in a rural North Carolina district. A purposive, stratified sample of 30 teachers, representing a wide range of levels of use of technology in the classroom, provided data utilizing the Concerns-Based Adoption Model. The three instruments in this model delivered data about participants' concerns, behaviors, and effectiveness of implementation. The study's data led the researcher to conclude the majority of participants continue to have personal concerns about the innovation; and while they have implemented the innovation, the implementation remains superficial. However, such holistic statements are secondary to the data informing each level of teacher use except in how they allow change facilitators to inform needs assessments. The crux, and greater value, of the study is an understanding of individual teachers at every level of implementation, obstacles they experienced, how they overcame them, and what resources they still need.

Keywords: technology, one-to-one, teacher behavior, mature implementation,

Concerns-Based Adoption Model

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Chapter 1: Introduction

Technology has been heralded as *the* boon to equalizing the educational playing field for students from varied demographics and circumstances (Friedman, 2005; Seidel, 2007); however, research suggests that access to technology alone is not enough (International Society for Technology in Education [ISTE], 2014a; Mumtaz, 2000; Royer, 2002). High-quality lessons intersecting 21st century skills with collaboration and constructive problem-solving activities from technology savvy teachers are a must in order to witness positive educational outcomes. With the increased emphasis on technology integration in the classroom, many school districts have implemented one-to-one technology initiatives, which provide each student with a web-enabled device to use in the classroom and often at home. This technology infusion follows on the heels of research proving that unless technology is provided "anytime, anywhere" (Becker, 2000; Reiser 2002), the benefits it can bring to students are minimal.

This research fueled the decision of a rural district in North Carolina to go one to one with MacBook Airs for all sixth- through 12th-grade students. Based on research, the district provided a myriad of professional development opportunities. These opportunities occurred before, during, and after the initial implementation: a technology facilitator for each school to individually assist teachers and provide ongoing professional development, a number of half and full days of county-wide collaboration on technology implementation, and county-wide professional learning communities (PLCs) purposed with creating a large database of technology-embedded lessons available to all teachers. At 5 years into the implementation, the researcher questions whether teachers have continued movement up the integration model and whether implementation has been

fully realized, and, if not, what obstacles hamper this realization and what supports are yet needed.

Statement of the Problem

Best practices for technology implementation require a marriage of technology, pedagogy, and content knowledge, better known as TPACK (Shulman, 1986). The district purchased computers along with professional development for teachers from Apple, Inc. Apple categorizes the pathway to this marriage of technology via the levels of Puentedura's (2012) SAMR (Substitution, Augmentation, Modification, Redefinition) model. This model suggests initially teachers will simply *substitute* the digital version of a printed worksheet, which does not improve the instruction students are obtaining but simply uses technology for the sake of technology. However, in the top levels of SAMR, a teacher *modifies* and *redefines* the assignment to employ the possibilities not available pre-technology; this marriage of technology, pedagogy, and content knowledge creates an educational environment that truly exposes students to 21st century skills (Puentedura, 2012).

It is also at these levels that research deserts us. While research abounds concerning the initial implementation of one-to-one initiatives, there is limited data available, other than supposition, to guide those who are on the fringes of that true marriage between technology and instruction. Without an understanding of how to complete a one-to-one technology adoption, many districts will have spent copious amounts of money, time, and effort for a less than effective program. With the large push toward one-to-one adoption, this study is both timely and needed.

Context

According to *Forbes*, the latest data from the Bureau of Labor Statistics suggests that 91% of Millennials (born between 1977-1997) *expect* to stay in a job less than 3 years, which means they will have 15-20 jobs throughout their lives (Meister, 2012). Further, Thomas Frey, Google's top-rated futurist speaker, author, and executive director of the DaVinci Institute, predicts that by 2030, just 11 years from now, over two billion of today's jobs will disappear and suggests a list of 162 possible new jobs (Frey, 2015). *Possible,* because we do not know the type jobs needed for the future. This ambiguity sounds the siren for educational reform that prepares today's students with 21st century skills instead of teaching the facts that are readily accessible because of these technology advancements. Seidel (2007) suggested, "Our traditional educational system designed to produce workers for clearly pre-defined roles cannot surmount this problem [preparing students for jobs that do not yet exist]" (p. 139) and made the following statement about a knowledge-based economy and the speed with which it is evolving:

> The removal of routine mental activity such as arithmetic calculation from human beings and its transfer to computers will be seen of equal significance as the removal of the tool from the worker's hand and its transference to the machine in the First Industrial Revolution. This freed the human mind for involvement in higher order creative tasks. Rather than devaluing the productions of the human mind, it appears that value in the 21st century will become even more dependent upon the creations of the human mind mediated by computers and data communication and processing. (p. 139)

In preparing our students for the world Seidel (2007) depicted, Friedman and

Mandelbaum (2011) cited two obstacles we must overcome: the achievement gap for students of different races and socioeconomic backgrounds and the achievement gap between American students and other nations' students (pp. 111-112). Friedman (2005) explained that the world has become "flat" because of globalization and technology and this "flattening" allows for a level playing field for everyone when, and if, technology is readily available to all students. This anytime, anywhere technology availability provides a tool wherein education systems can begin to close the aforementioned achievement gaps.

Angus King, the governor of Maine from 1995-2003, made the following comment in his foreword of the ISTE publication *Revolutionizing Education Through Technology*, "We cannot compete on wages or access to natural resources or capital … the new competition is in innovation and invention, creativity, productivity, and vision" (Greaves, Hayes, Wilson, Gielniak, & Peterson, 2012, Foreword, para. 3). King further promoted "ubiquitous" technology as one of the few methods that is creating classroom environments that champion innovation and invention, but he cautioned that the "computer is the necessary starting place, but alone is not sufficient" (Greaves et al., 2012, Foreword, para. 9). Such a classroom means teachers require students apply existing knowledge to generate new products and ideas; use models to explore complicated systems and issues; forecast possibilities; interact, collaborate, and publish with others in multiple environments and mediums; evaluate information sources; and plan and manage activities to develop solutions to authentic problems (ISTE, 2014a).

In order to accommodate both the necessity of anytime, anywhere technology and the 21st century skills needed to prepare students for today's work world, many districts

have implemented one-to-one technology initiatives which supply each student with his or her own web-enabled device. While debate over the effectiveness of one-to-one implementation continues (Hu, 2007), considerable gains occurred in many schools. The most significant academic gains transpired in writing (Bebell & Kay, 2010; Gulek & Demirtas, 2005; Sauers & McLeod, 2012), but gains also happened in problem-solving skills (Lowther, Ross, & Morrison, 2003), literacy skills (Suhr, Henandez, Grimes, & Warschauer, 2010), math achievement (Dunleavy & Heinecke, 2007), and science achievement (Berry & Wintle, 2009; Siegle & Foster, 2000). Light, McDermott, and Honey's (2002) study contended students performed significantly better than their non-laptop program peers across all tracks and subject areas. In addition to academic achievement, researchers have reviewed other areas that have shown improvement, including student engagement, attendance, behavior, and motivation (Bebell & Kay, 2010; Mouza, 2008; Shapley et al., 2006; Warschauer & Grimes, 2005; Zucker & McGhee, 2005). ISTE's Project RED book projects that such results are expected in schools where the one-to-one initiative is properly implemented as defined by the Project RED Education Success Measures and Key Implementation Factors (Greaves et al., 2012). These factors revolve around options and opportunities afforded when teachers have an effective understanding of how to implement technology in a manner to provide individualization, motivation, and customization.

Research indicates the importance of professional development for teachers when implementing a one-to-one program to provide the support needed to institute this individualization, motivation, and customization. In this study, the rural North Carolina district utilized Apple, Inc. professional development as well as county technology

facilitators within each school to provide ongoing professional development. Part of the Apple, Inc. professional development introduced Puentedura's (2012) SAMR model as both a goal and a gauge for implementation. Apple, Inc. representatives and county administration made a goal of being able to move among all levels of SAMR as dictated by each assignment's needs but to concentrate efforts in the upper tiers of SAMR, modification and redefinition, where students are truly creating, analyzing, and problem-solving. Apple and district administrators expected teachers would begin with the substitution and augmentation stages as they and their students worked to become familiar with the technology but would eventually meet the goal of moving into the upper tiers of SAMR. After 5 years of one-to-one student access, teachers have become proficient in the lower tiers of SAMR; but the progress into the top two tiers, the areas where differences in student achievement and behavior occur, become the focus of this research.

Theoretical Base

The framework provided by Hord, Rutherford, Huling-Austin, and Hall's (1987) Concerns-Based Adoption Model (CBAM) examines the one-to-one technology implementation in its current state in the traditional high schools of a North Carolina district. CBAM data determine to what extent teachers have implemented technology in the classroom; what concerns they have; what successes they have garnered; and what obstacles, if any, exist in bringing the implementation to a successful and sustainable culmination. Hord et al. (1987) came to the following conclusions after studying numerous schools instituting change: (a) Change is a process, not an event. Most implementations take 3-5 years to complete; (b) Change is a highly personal experience

involving developmental growth in feelings and skills; (c) Because change is a highly personal experience, personal concerns are legitimate and change facilitators address these concerns throughout the process in order to secure effective change; (d) Change is best understood in operational terms. People relate to change in terms of how it affects their processes, therefore analyzing effectiveness based on these terms is a more accurate indicator of teacher implementation, which allows facilitators to provide assistance that is more relevant; and (e) These conclusions lead to the understanding that the focus of facilitators must be on the "individuals, innovations, and context"—not the new program or package (pp. 5-6). Realizing the importance of the individual *and* the importance of that individual's experiences, concerns, and growth, Hord et al. (1987) developed three instruments to identify where teachers are emotionally, behaviorally, and effectively in the implementation process: the Stages of Concern Questionnaire (SoCQ), the Levels of Use (LoU) Interviews, and the Innovation Configuration (IC) Map respectively.

In order to examine the one-to-one implementation on which this study focused, the researcher used Hord et al.'s (1987) CBAM concepts and instruments to analyze, first of all, where teachers are emotionally by examining data from the SoCQ, which ranks a teacher based on his or her concerns or feelings about the technology implementation. The seven stages range from self-concerns to management concerns to student concerns. All adoptees must travel through the stages of self and management concerns as they implement; however, some teachers never leave the self or management concerns in order to seek out what is best for students. Once the SoCQ provides insight into the emotional aspect of the implementation, the LoU interviews allow a qualitative understanding of where along the six levels of use a teacher resides. The six levels of use

include nonuse, orientation, preparation, mechanical, routine, refinement, integration, and renewal in order from least amount of use to most amount of use. The final instrument involved in the CBAM is the IC, which is a quantitative or mixed methods survey developed by the researcher and tailored to the specific innovation. With these three data points, a researcher can effectively understand where a teacher is in his/her implementation process and what obstacles are impeding further implementation (Hord et al., 1987).

Hord et al.'s (1987) CBAM instruments afforded insight into obstacles currently blocking teacher progress into the top two tiers of the SAMR model. Additionally, the instruments investigate the emotions, motivations, and lack of skills and/or resources that have led to these obstacles as well as the emotions, motivations, skills, and resources that have assisted teachers who have progressed into the modification and redefinition tiers as well as the supports that are still needed.

Deficiencies in the Literature

While research abounds concerning the initial implementation of one-to-one initiatives, there is little information available, other than supposition, to guide those who are on the fringes of that true marriage between technology and instruction. Stroud's literature review found that most studies focus on the first 3 years of implementation, and 67% of the studies were concerned with only pre-implementation up to 2 years (Drayton, Falk, Stroud, Hobbs, & Hammerman, 2010). A definite gap in the research occurs after the second year of implementation. The fact that many studies indicate greater results are seen after 2 and 3 years of any implementation (Sauers & McLeod, 2012) of a new innovation would lead one to believe that much knowledge could be gained through the

study of successive implementation years. Research further substantiates this point as it suggests that full implementation cannot occur until a minimum of 3 years into the implementation process (Greaves et al., 2012). This study is both timely and needed as more and more districts are considering one-to-one initiatives. Furthermore, without an understanding of how to fully integrate a one-to-one technology adoption, many districts will have spent copious amounts of money, time, and effort for a less than effective program that may or may not demonstrate a change in student achievement or behavior.

Significance of the Study

This study investigated the process teachers experience beyond the initial stages of a one-to-one technology adoption, specifically the obstacles they face in moving into the final phases of "true" implementation as defined by the top two tiers of Puentedura's (2012) SAMR model (modification and redefinition, respectively) and the solutions that are viable in assisting their movement forward. This research sampled these concerns within a rural North Carolina district in order to understand the breadth and depth of the issues and solutions required for full technological implementation but also to provide potential one-to-one candidates with information about the process that will assist administrators and teachers in a more successful implementation.

Statement of the Purpose

This study examined the obstacles teachers face in moving into the final stages of a one-to-one technology implementation. The researcher utilized a convergent parallel mixed methods design and employed three different instruments during individual interviews to provide qualitative and quantitative data. Each instrument provides distinctly different information, which is independent of and does not inform the other

instruments; however, the aggregation of all three data types allows the researcher a more comprehensive understanding of teacher behavior from the emotional aspect, the actual use of the innovation, and the effectiveness of that use. These data may be used to inform needs assessments for professional development planning and resource attainment, along with an understanding of best practices for moving into a full technology implementation providing students high-quality lessons that intersect 21st century skills with collaboration and constructive problem-solving activities indicative of schools that promote innovation and invention.

Research Questions

This investigation into teacher behavior in a mature one-to-one technology adoption answered the following questions:

1. How have high school teachers in a rural North Carolina district implemented the one-to-one laptop initiative?
2. What obstacles are these teachers facing in moving up the implementation model to provide instruction that is more effective?
3. What methods are teachers using to overcome these obstacles?
4. What supports do teachers need in order to move into the upper tiers of the implementation model?

Definition of Terms

CBAM. An applied research framework developed at the University of Texas in the 1970s that focuses on strategies for measuring, interpreting, and facilitating effective and behavioral change as instructors make sense of educational innovations.

IC. The behavioral dimension of the CBAM, which focuses on the quality of a

teacher's use of technology.

IC Map. A rubric developed by innovation leaders to describe the range of possible implementations of an innovation. The rubric assesses the quality of the teachers' implementation of the innovation.

Levels of Use (LoU). Behavioral dimension of the CBAM, focusing on the extent to which instructors make use of an educational innovation; the construct consists of eight levels and is assessed using the LoU interview.

One-to-One technology. The provision of a web-enabled device for each student and teacher within a school setting. In the study, the district provided all sixth- through 12th-grade students and all prekindergarten through 12th-grade teachers with MacBook Airs for use at school and at home.

Stages of Concern (SoC). Affective dimension of the CBAM, focusing on the concerns of teachers involved in implementing an educational innovation. The instrument consists of seven stages and is assessed using the SoCQ.

SoCQ. Thirty-five item questionnaire, which is used to assess the relative intensity of educator concerns in each of the seven stages of concern.

SAMR. Puentedura's (2012) model for technology integration that begins with substitution, moves up to augmentation, then modification, and finally redefinition. This model evaluates the value of the integration based on the action required by students.

Organization of the Dissertation

Chapter 2 is a summary of the most relevant literature that pertains to the full integration of technology in a one-to-one environment. The focus of this literature review is the obstacles that prevent or hamper movement into the top two tiers of

Puentedura's (2012) SAMR model and the CBAM because it forms the primary theoretical framework for this study. Chapter 3 describes the methodology employed in this research, including sections concerning the instruments' validity and reliability, data collection procedures, and participants involved in the study. Chapter 4 examines the results of the study and how the data answer the researcher's questions. Chapter 5 summarizes the findings in relation to the problem and its methodological treatment and espouses the researcher's perspective by making practical and theoretical recommendations for practice, policy, and research.

Chapter 2: Literature Review

Overview

According to a survey sponsored by TIME and the Carnegie Corporation of New York, 89% of U.S. adults and 96% of senior administrators at colleges and universities say that education is in crisis, and four of 10 in both groups consider the crisis "severe" (Sanburn, 2012). Every 29 seconds, another high school student drops out, which equates to more than one million dropouts every year. In nearly 2000 high schools in the United States, the typical freshman class loses 40% of its students by senior year (Editorial Projects in Education [EPE] Research Center, 2007). Most high school dropouts report a "gradual process of disengagement" (Apple Classrooms of Tomorrow—Today, 2008, p. 6) from school as the basis for their decision to leave school. In other words, school contains little relevance or social and/or emotional connection for them. In an effort to minimize student disengagement from school and increase cohort graduation rates, many schools have adopted one-to-one technology initiatives because research indicates increased academic (Bebell & Kay, 2010; Berry & Wintle, 2009; Dunleavy & Heinecke, 2007; Gulek & Demirtas, 2005; Lowther et al., 2003; Sauers & McLeod, 2012; Siegle & Foster, 2000; Suhr et al., 2010) and behavioral improvements (Bebell & Kay, 2010; Mouza, 2008; Shapley et al., 2006; Warschauer & Grimes, 2005; Zucker & McGhee, 2005), yet simple technology integration into classroom lessons is not enough.

A classroom that fosters such success occurs when teachers require students to apply existing knowledge to generate new products and ideas; use models to explore complicated systems and issues; forecast possibilities; interact, collaborate, and publish with others in multiple environments and mediums; evaluate information sources; and

plan and manage activities to develop solutions to authentic problems (ISTE, 2014a). Such tasks are the outgrowth of the marriage of technology, pedagogy, and content knowledge, better known as TPACK (Shulman, 1986). This marriage is an abstract concept of the event that must occur in order to sustain the type of success documented in the research and desired by educators. In order to make this concept more understandable and attainable, Puentedura (2012) developed a 4-tier description of the stages of this marriage that assigns distinct, concrete traits to each level to allow for evaluation of practice and guidelines for implementation. In other words, this SAMR model may be used as a guide and gauge for how well each assignment accommodates the three areas of TPACK to allow for technology integration that culminates in educational experiences designed to maximize student potential.

Education's two major responsibilities are to transfer the culture, values, and lessons of the past to our successors and to prepare them to be successful in the future world in which they will live. These responsibilities have become more and more difficult due to a "confluence of changes" (Molnar, 1997, p. 1) that have resulted in a growing disparity between the activities in the classroom and their relevance to the real world. The interdependence of the global economy requires the education system to create a modern workforce capable of theoretical knowledge and competing internationally through competence in theoretical science (Bell, 1979). However, with the scientific information explosion that has occurred, how do we teach students to be competent in a field where the information is so vast and dynamic that knowing the necessary information is not humanly possible? Bernier (1978) estimated that a person would require 22 centuries to read the annual biomedical research literature and seven

years to read a year's worth of chemical literature. So, how does education keep from shirking its responsibilities in the face of such obstacles? Herbert Simon (1971), Nobel Laureate, suggested as far back as 1971 that we must change our definition of "to know" from meaning "having information stored in one's memory" to "the process of having access to information and knowing how to use it" (Molnar, 1997, p. 2). This movement from learning to thinking requires students to create meaningful, real world products through the process of defining problems and using problem-solving skills to solve them, thus shrinking the disparity between classroom activities and real world events. This type of learning can only happen when obtaining information becomes a by-product of the real job of education: teaching higher order thinking skills.

In the late 1960s, the National Science Foundation (NSF), recognizing how critical computers were to creating a workforce capable of the theoretical knowledge and problem-solving skills imperative to global competitiveness, "supported the development of 30 regional computing networks, which included 300 institutions of higher learning and secondary schools" (Molnar, 1975, p. 3). The NSF's action jumpstarted the steady increase in the use of technology in the classroom witnessed from that time to this. The concerns and work of the NSF have not gone unheeded: The U.S. Department of Education reported in 2009 that 97% of teachers had one or more computers located in the classroom every day, and the ratio of students to computers every day was 5.3 to 1 (Gray, Thomas, & Lewis, 2010). Despite this, prior research (Becker, 2000; Reiser, 2002) has shown that anything less than anytime, anywhere access to technology (Swan, Hooft, Kratcoski, & Schenker, 2007, p. 6), or "ubiquitous computing," acts as a barrier. Throughout the nation, school systems have taken the need for ubiquitous computing

(Weiser, Gold, & Brown, 1999) to heart through one-to-one initiatives. Papert (1980) likened anything less than supplying every student with a computer to students sharing pencils and expecting the impact of limited resources not to affect learning.

A rural North Carolina district embraced this concept with the introduction of a one-to-one technology adoption in its middle and high schools. Now, 5 years after the initial adoption, this study considers how implementation of this initiative occurred, the obstacles encountered, and the resources needed to overcome those obstacles. This literature review examines the role of technology integration in education, the role of TPACK and Puentedura's (2012) SAMR model in characterizing quality technology integration and the successes, concerns, obstacles, and resources documented in other one-to-one technology adoption studies. The literature review finishes with an examination of CBAM's instruments, which provided a framework for data collection and analysis in this study.

Technology Integration

While the mission of getting technology into the classrooms cannot be understated, Rodney S. Earle (2002, as cited in Harris & Hofer, 2011, p. 227) suggested that technology integration is about more than just the technology:

> Integrating technology is not about the technology—it is primarily about content and effective instructional practices. Technology involves the tools with which we deliver content and implement practices in better ways. Its focus must be on curriculum and learning. Integration is defined not by the amount or type of technology used, but by how and why it is used. (p. 8)

Technology innovations give students direct access to information that is organized,

indexed, affordable, and infinitely available, which, in turn, shifts control to the students, enabling them to learn both in and outside of school. While these changes are profound for students, they affect the role of educators even more dramatically. Educators must become mentors and collaborators, "leveraging the power of students, seeking new knowledge alongside students, and modeling positive habits of mind and new ways of thinking and learning" (Apple Classrooms of Tomorrow—Today, 2008, p. 8). Educators must give students an educational experience that mirrors their lives and their futures where technology infuses a mobile lifestyle that requires collaboration in physical and virtual spaces. Eliminating the disconnect between student lives and their classroom experiences through effective technology implementation is critical to creating the engagement that will keep students in school (America's Digital Schools, 2006). Today, the intention of technology-based education is not to "turn experiences into abstractions with a computer, but to turn abstractions, like the law of physics, into experiences" (DiSessa, 1986, p. 208). Through these experiences, students develop accurate and rich conceptual structures, which lead to a deep understanding of the subject. The idea of depth over breadth and the use of metacognition allow students to truly understand how their brains process information, the complexity of knowledge, and the use of that knowledge.

In an effort to lead this reconceptualization of education, two sets of national standards exist. In the first set, the Partnership for 21st Century Skills (2007) developed a vision for "student success in the new global economy" (p. 1). The Framework requires all core subjects to teach global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; and environmental literacy.

Learning and innovation skills are critical in preparation for increasingly complex life and work environments and focus on creativity and innovation, critical thinking and problem-solving, and communication and collaboration. Moreover, in today's media-driven environment, the Framework calls for a range of skills in information literacy, media literacy, and ICT (Information, Communications, and Technology) literacy. Finally, the Framework focuses on life and career skills such as flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, and leadership and responsibility (Partnership for 21st Century Skills, 2007). Further, the 21st Century Framework provides guidelines for teachers in their roles supporting students, which puts great emphasis on providing real world connections, multiple resources, choice, technology-enhanced teaching, and multiple methods of assessment (Partnership for 21st Century Skills, 2007).

ISTE (2014b) developed a second set of standards and stated they are "the standards for evaluating the skills and knowledge students need to learn effectively and live productively in an increasingly global and digital world" (p. 2). The ISTE Standards rehash the concepts contained in the 21st Century Framework and add digital citizenship and technology operations and concepts as an effort to increase student practice of legal and ethical behavior in the digital world. In alignment with the 21st Century Skills Framework, ISTE (2014c) provided standards for teachers as well and stated that "teachers must possess the skills and behaviors of digital age professionals and become comfortable being co-learners with their students and colleagues around the world" (p. 2). The ISTE teachers' framework of inspiring student learning and creativity with digital age learning experiences through effective professional development echoes the ideas of

the teachers' 21st Century Framework. However, ISTE does add digital citizenship and modeling of digital age working and learning components (ISTE, 2014c). The ISTE framework outlines the skills of both the teacher and the student, which lead to a successful and innovative educational experience grounded by a technology-rich learning environment.

Research has shown that a technology-rich learning environment can more effectively promote goals such as higher order thinking skills, learning motivation, and teamwork (Rosen, 2009; Rosen & Salomon, 2007). Rosen and Beck-Hill's (2012) study, from the Time to Know Program, on one-to-one laptop environments, found consistent and highly positive data of a one-to-one laptop initiative in an elementary school in Dallas, Texas, including improvement in math and reading scores, differentiation in teaching and learning, higher student attendance, and decreased disciplinary actions. Rosen and Beck-Hill's literary review revealed that the schools that demonstrate student improvement are the schools that have a paradigm shift where technology changes the way educators and students think about education and learning. It is precisely this need for a paradigm shift that fuels the principles guiding the TPACK Model.

TPACK (Technology-Pedagogy-Content Knowledge) Model

While the 21st Century Framework and the ISTE Standards supply teachers with an understanding of what students should be learning and what teachers should be teaching, models for how to entrench these standards are vital to the planning and execution process. In Shulman's (1986) seminal work "Those Who Understand: Knowledge Growth in Teaching," he examined the history of teacher examinations and the movement in the late 1800s when examinations focused on content knowledge to

today's current focus on pedagogical knowledge. Shulman explicated the difficulties of lacking an understanding of how to teach in the earlier model and lacking an understanding of the content in today's model. From this work, the PCK (Pedagogy-Content-Knowledge) framework was derived which argues effective teaching only occurs when a teacher has a good balance of both content and pedagogical knowledge (Shulman, 1986). Koehler and Mishra (2008) built on Shulman's concept by adding a third facet to the mix: technology (TPACK). TPACK (Figure 1) attempts to understand the complexity of relationships among students, teachers, content, technology, and practice. Koehler and Mishra believed,

> Good teaching is not simply adding technology to the existing teaching and content domain. Rather, the introduction of technology causes the representation of new concepts and requires developing a sensitivity to the dynamic, transactional relationship between all three components suggested by the TPCK framework. (p. 134)

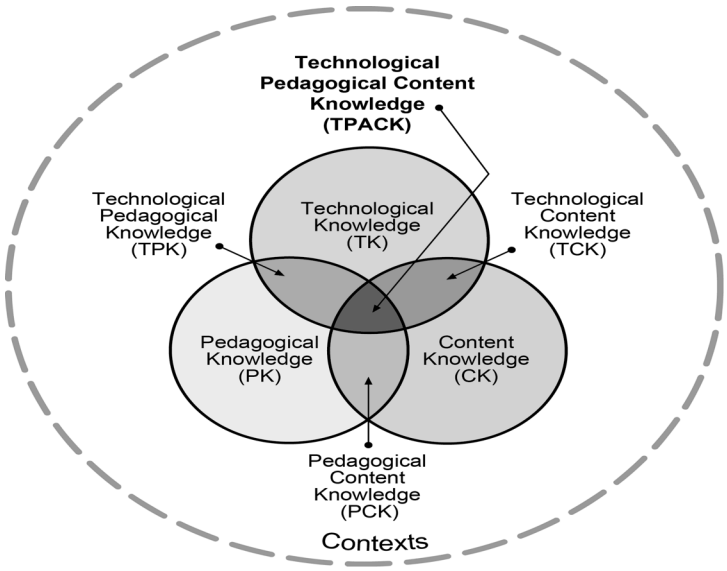

Figure 1. TPACK Model. Reproduced by permission of the publisher, © 2012 at tpack.org, by Koehler, M.J., & Mishra, P. Retrieved from http://www.tpack.org on August 6, 2015.

Niess (2005) clarified this relationship in his development of a framework for the implementation of TPACK in teacher education programs, which include the following four components: (a) a broad understanding of teaching a particular subject using technology and maximizing student learning, (b) knowledge of instructional strategies and technological resources to enhance a particular topic, (c) knowledge of student misconceptions, understandings, and abilities to learn about a particular subject and how technology may represent and/or rectify this understanding, and (d) knowledge of curriculum materials that implement technology to enhance learning. While use of the TPACK framework has become an increasingly popular tool to assist teachers with planning and evaluation of lessons, one of the drawbacks is the indistinct nature of the domains which causes difficulty in separating and measuring ability in each domain (Gess-Newsome & Lederman, 1999; McEwan & Bull, 1991). Therefore, while it is

important to understand the value of the balance among technology, content, and pedagogy underlying successful, effective implementation of technology into the curriculum, an easier framework for codifying the levels of effective implementation of technology exists.

Puentedura's (2012) SAMR Model

That framework, called the SAMR model, breaks technology levels of use into four tiers: substitution, augmentation, modification, and redefinition (Figure 2). The bottom two tiers, substitution and augmentation, are considered simply enhancements to traditional instruction, while the top two tiers, modification and redefinition, are considered transformative because they "transform" traditional learning activities into activities not possible pre-technology (Puentedura, 2011). Keane's (2012) essay, "Leading with Technology," validates, via educational psychology research, the use of the SAMR model by teachers who are implementing technology in their curricula as a research-based method of building student complexity of thought and equipping students with the "skills needed to operate in the 21st century" (p. 44).

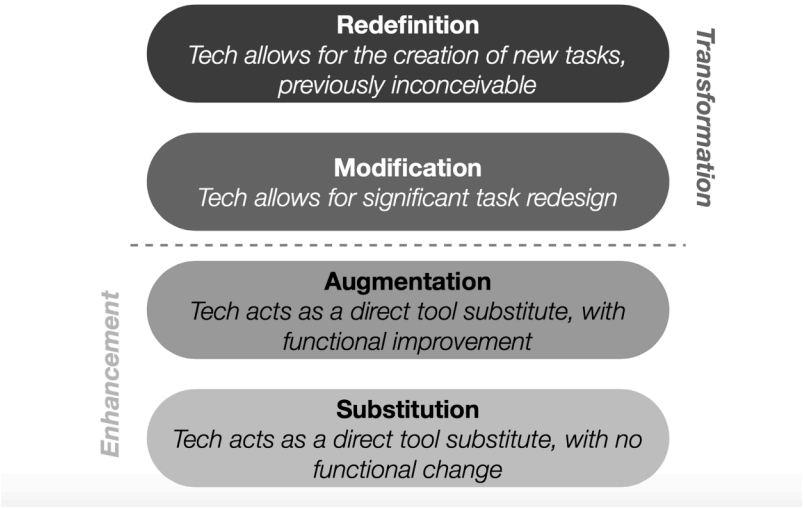

Figure 2. SAMR Model. Reprinted from Puentedura, R. R. (2010). SAMR and TPCK in action. Retrieved August 6, 2015 from http://www.hippasus.com/rrpweblog/archives/2013/04/26/SAMRBeyondTheBasics.pdf. This work is licensed under a Creative Commons Attribution-Noncommercial-Share Alike 3.0 License.

The substitution level of use qualifies technology simply as a tool to complete the same learning activities as existed pre-technology with no functional change (i.e., a worksheet previously completed with a pencil is now completed digitally). At this level, the planner must ask the question, "What will I gain by replacing the older technology with new technology?" (Puentedura, 2010). While this level is necessary to both the teacher and the student as they initially learn the new technology, basic knowledge of the software is the only benefit students receive from assignments in this tier.

At the augmentation tier, teachers use technology as a direct tool just as in substitution but with a functional improvement (i.e., the same worksheet is utilized but using cut and paste, spellcheck, a dictionary app, or a hyperlink to an online text). At this level, the planner must ask, "Have I added a feature to the task process that could not be done with the older technology?" and "How does this feature contribute to my design?" (Puentedura, 2010). Once again, while this tier is necessary to make users comfortable

with the new technology, any positive effect on learning is mitigated when technology is only used in this enhancement stage (Herrington, Herrington, Mantei, Olney, & Ferry, 2009).

Once the teacher breaks into the transformation levels of use, true integration occurs. According to Oostveen, Muirhead, and Goodman (2011), "It seems that meaningful learning is far more likely if the new technologies are recognized as providing transformative opportunities" (p. 80). For instance, in the modification level of use, teachers use technology to allow for significant task redesign, which leads to the use of multiple programs in collaboration with others to construct shared knowledge. During this stage, the planner's questions revolve around the transformation of the assignments via the new technology: "How is the original task being modified?" "Does this modification depend upon the new technology?" "How does the modification contribute to my design?" (Puentedura, 2010). It is important to notice that at this level, underlying the questions are the concepts of TPACK and their intersection, neither of which were present in the previous two tiers. For this reason, breaking the plane from enhancement to transformation is fundamental to creating high-quality, 21st century skills-based lessons.

At the pinnacle of the levels of use, redefinition utilizes technology to allow for creation of new tasks previously inconceivable, such as student creation of an iPhone application to prove mastery of the mathematical concepts involved in its function. The model aims to enable teachers to design, develop, and integrate lessons employing technology to transform learning experiences that will lead to higher levels of achievement for students (Puentedura, 2010). Planners should be asking, "What is the

new task?" "Will it replace or supplement older tasks?" "How is it uniquely made possible by the new technology?" "How does it contribute to my design?" (Puentedura, 2010). For the teacher, this level is the most difficult because it eradicates previous lessons and ideas about the efficacy of those lessons to institute assignments built on a completely different set of values, specifically the idea of student-centric learning. Hattie (2009) argued,

> It is what teachers get the students to do in the class that emerge[s] as the strongest component to accomplished teachers' repertoire, rather than what the teacher, specifically, does. Students must be actively involved in their learning, with a focus on multiple paths to problem solving. (p. 35)

While the redefinition stage is the pinnacle because balance is achieved within the domains of TPACK and, by default, institutes the 21st Century Framework and ISTE Standards, Keane (2012) admitted that redefinition "is hard to even describe as we are constantly redefining what is possible through technology" (p. 44), which creates an ever-present obstacle for teachers.

One-to-One Initiatives

Much of the current literature on technology integration that claims a very limited impact in the classroom (Cuban, 2001; Cuban, Kirkpatrick, & Peck, 2001; Newhouse, 2001) has been predicated on the inequitable accessibility of technology. However, in the mid-1990s, initiatives to provide ubiquitous computing occurred; and leading these initiatives was Microsoft's Anytime, Anywhere Learning program (Rockman et al., 2000). In the beginning, students could lease or buy computers, which may or may not have Internet connectivity. Most recently, Apple, Inc. has led the charge for one-to-one

initiatives and these initiatives have been defined as each student being provided with a mobile web-enabled device having Internet capabilities, which students are expected to use to complete academic tasks (Penuel, 2006). More widespread access to computers allows technology to infuse a "multitude of settings" (Roschelle & Pea, 2002, p. 147), allowing students to gain access to significantly more resources, inside and outside of school, regardless of economic status, race, or geography (Penuel et al., 2001).

Another positive aspect of the one-to-one initiatives is enhanced collaboration. For example, graphical displays showing an individual's contributions to solving problems can illuminate difficult concepts and help motivate others to participate more actively, while participation in simulations can assist students with difficult and/or abstract concepts (Hegedus & Kaput, 2004; Kaput & Hegedus, 2002; Stroup, 2002).

Further, many school systems cite as primary targets an improvement in student academic achievement through the use of technology's resources made more readily available to more students (reducing the digital divide); an improvement in economic competitiveness of the region by preparing students more effectively to compete in a global economy with technology-infused workplaces; and last but not least, an improvement in the quality of instruction within the school system to align with 21st Century Skills and ISTE Standards (Penuel, 2006).

While research supports great value in one-to-one programs, the research also identifies many concerns that affect the outcome and/or perception of these initiatives. The complexities and difficulties of implementing educational technology often have been a barrier to teacher implementation, sometimes because of the lack of physical materials to implement technology well, other times because policy or culture of the

school inhibits the adoption (Blumenfeld, Fishman, Krajcik, Marx, & Soloway, 2000). For this reason, critics often point out that technologies have been "oversold and underused," and that they have had minimal effect on the learning environment (Cuban, 2001). Cuban et al. (2001), in reviewing the frequency of teacher technology use in technology-abundant high schools, stated that decision makers believe that creating abundant access to technology would lead to an increased level of technology use in the classroom. However, while this is certainly a requirement, it is but an initial step. Cuban et al. found that abundant access to technology was not enough to ensure technology integration. In fact, a robust body of literature exists which describes the influences of barriers on technology integration (Anderson, Varnhagen, & Campbell, 1998; Bariso, 2003; Beaudin, 2002; Becker, 2000; Beggs, 2000; Cuban, 2001; Ertmer, 1999; Ertmer, Addison, Lane, Ross, & Woods, 1999; Hadley & Sheingold, 1993; Jacobsen, 1998; Newhouse, 1999; Pajo & Wallace, 2001; Rogers, 2000; Snoeyink & Ertmer, 2002).

Baylor and Ritchie (2002) conducted a study of 94 classrooms from four states in different geographic regions across the United States representing a wide spectrum of demographics and covering elementary, middle, and high schools. The researchers chose schools through purposive sampling that identified schools known to integrate technology consistently and effectively. Principals were then asked to create a list of teachers who integrated technology and were the primary instructors for their respective classes in the prior year. Researchers chose these 94 randomly from the principal-generated lists. The quantitative study focused on the following areas: (a) factors related to school technology (planning, leadership, curriculum alignment, professional development, technology use, teacher openness to change, and teacher non-school computer use); (b) dependent

measures in the areas of teacher skill (technology competency and technology integration); (c) teacher morale; and (d) perceived student learning (impact on student content acquisition and higher order thinking skills acquisition). Data collection took place through structured interviews with teachers and administrators, teacher surveys, and examination of school technology use plans. The researchers developed four new instruments—as no existing instruments matched the sources of the data with the identified independent and dependent variables—including administrator-structured interview, teacher-structured interview, technology use plan evaluation, and teacher survey. Each of the instruments consisted primarily of Likert items on a 5-point scale, which allowed for a process of aggregation to average the scores and provide one score ranging from 1 to 5 for each classroom. Aggregation was performed by averaging all related item values so each variable was reduced to one score per variable per class. Utilization of stepwise regression analysis identified what combination, if any, of the independent variable(s) predicted the results of the dependent variables. Baylor and Ritchie found that three variables—strength of technology leadership at the school level, teacher openness to change, and teacher non-school computer use—all seemed to predict student mastery of the curricula. As well, teacher openness to change, the amount of individual technology use in creative situations, and the level of integration attempted within the classroom, determined the amount of higher order thinking required by students. Baylor and Ritchie's research demonstrates the importance of the affective and behavioral facets working together to create a successful implementation. The most prevalent factor, teacher willingness to change, unfortunately, according to Baylor and Ritchie, is also the most difficult to influence. However, teacher feelings concerning

technology go beyond their skepticism of the value of technology integration or willingness to change to a more psychological barrier of accepting change.

Hall (2014) stated, "Change is a personal experience; it is a personal feeling; personal frustrations, moments of joy, excitement, depression, discouragement are part of change. So, if you want change to be successful, understanding that personal side becomes really important" (p. 5). Part of the change process is a sense of loss for the ideas, concepts, and values left behind, even when the person accepts the change as positive. Teacher technology beliefs are influenced by their teaching philosophies, which are based on their personal beliefs, values, feelings, and motivations (affective aspect); and their resistance to adopting new technologies stem from these beliefs (Norton, McRobbie, & Cooper, 2000). Even when teachers see this change as valuable, the psychological effect of making a change that puts into question one's beliefs becomes a barrier that must be overcome. For successful implementation, teachers must be willing to change their role in the classroom (Hardy, 1998) from leader to facilitator and allow students to become more central. Niederhauser and Stoddart (2001) noted a "consistent relationship between teachers' perspectives about the instructional uses of computers and the types of software they used with their students" (p. 27); this new mindset focuses on learner-centered teaching and constructivist teaching practices (Ertmer, Gopalakrishnan, & Ross, 2001; Rakes, Flowers, Casey, & Santana, 1999). Successful integration of technology into teaching depends on transforming teacher beliefs concerning technology and their teaching philosophy concurrently (Windschitl & Sahl, 2002).

Along with accepting a new paradigm of the classroom, teachers must also feel they are making changes that are valuable to themselves and their students. When

teachers deem expected uses of technology not closely aligned with the curriculum, they use it less often (Sarama, Clements, & Henry, 1998). Sugar, Crawley, and Fine's (2004) study discussed the fact that teachers must see the utility in using a particular software before they are willing to integrate it into their curricula; the researchers focused on the fact that teachers require documented impacts on student learning. Further, Sugar et al. stated that high school teachers have an entirely different group of concerns as compared to elementary and middle grades and are thus unwilling to invest the time necessary to integrate technology if proof of its efficacy does not exist. Good teaching practice requires teachers to implement changes that are supported by research, which makes this barrier understandable; yet as the breadth of research widens on the efficacy of technology integration in a multitude of environments and curricula, this barrier will likely be effaced over time.

Another shift in teacher perceptions must occur in their understanding of student capabilities. Case studies show teachers who believe that students are capable of complex technology-enhanced assignments are more likely to allow more collaboration, extended assignments, and flexibility and choice in the topic of assignments (Penuel, 2006). Teachers who perceive technology as a tool for accessing a wide variety of potential applications (Jaillet, 2004; Windschitl & Sahl, 2002) and who believe adequate software and Internet-based resources are available to assist their students (Lane, 2003; Trimmel & Backmann, 2004) are more likely to use laptops with students. Alternately, teachers focused on the possibility of student inappropriate behavior, such as playing games or non-academic Internet searches, are likely to implement laptops less often (Jaillet, 2004; Trimmel & Bachmann, 2004; Zucker & McGhee, 2005).

After initial implementation of technology, teacher concerns and motivations are significant and play a large role in how teachers actually utilize the technology in the classroom (behavioral aspect). Rogers (2000) conducted a K-12 study of 1,000 randomly selected art teachers from a cohort of 10,000 based on years of teaching experience, membership in at least two professional organizations, and a school address in the United States. Rogers sent each teacher an extensive survey that gathered both quantitative and qualitative data. The purpose of the survey was to determine the level at which the teacher implemented technology, characterize the teaching strategies used to implement technology, and identify barriers to technology implementation in order to propose an instruction model for technology implementation in art classrooms. Researchers analyzed data from the respondents using descriptive methods, cross-tabulations, and regressions. Parameters for each level of technology adoption, as defined by Rieber and Welliver (1989) and Hooper and Reiber's (1995) five-step hierarchical model of technology adoption, were used to set an adoption level code for each respondent. Researchers performed logic checks between the assigned adoption level and the data from other questions on teaching strategies to determine any discrepancies. They also created tables of frequencies for certain questions and cross-tabulations on selected variables. Answers to open-ended questions and spontaneous comments were keyword coded and categorized, then combined with the quantitative survey data. Rogers concluded in her two studies that external barriers (professional development, student impact, etc.) are most intense at the beginning stage of the adoption process but only after the internal barriers such as attitudes towards technology in teaching have been overcome. Additionally, Rogers concluded that a lack of technical support at an

advanced level and the need for additional in-depth stakeholder development becomes a barrier for those at the highest level of technology adoption.

Storz and Hoffman (2013) conducted a phenomenological study of a one-to-one initiative in a midwestern rural middle school to obtain the perspectives of students and teachers on the effectiveness of the program. Storz and Hoffman found these students obtained opportunities to be more creative, but the concern of loss of content for the sake of appearance surfaced. Technology created movement away from worksheets and toward more engaging research. Classrooms appeared to be quieter; but at the same time, more students were off-task. Teacher ideas were stretched, and the students did more group work; but teachers said they felt "unprepared, frustrated, and out of their comfort zone" (Storz & Hoffman, 2013, p. 14) in their own use of the technology. The findings of this study are indicative of teachers implementing technology in the technocentric approach. The founders of the Time to Know Program, Rosen and Beck-Hill (2012), suggested the problem with laptop initiatives revolves around the technocentric approach (use of technology for technology-related activities) rather than an innovative, technology-rich learning environment "conceptually designed and practically implemented" (p. 228) as a by-product of a paradigmatic change. The Time to Know Program signifies only a portion of the National Technology Plan (U.S. Department of Education, 2010), whose main goal is "leveraging learning to promote engaging and empowering learning experiences" by providing engaging environments and tools for understanding and remembering content.

Chell and Dowling (2012) further extended Rosen and Beck-Hill's (2012) argument to contend that while one-to-one initiatives demonstrate a range from simple

use of an online textbook to online collaboration, sharing, and publication, only some of these uses have the potential to truly "bring about the transformation in learning necessary to prepare students for the challenges of the 21st century workplace" (p. 227). Chell and Dowling integrated the use of the SAMR model as a guide to identifying true transformational assignments, which, in turn, identify these assignments as ones that require the critical-thinking and analysis skills necessary to being 21st century ready. Chell and Dowling contended that teachers cannot enter this phase of teaching until a minimum of 3 years into the one-to-one initiative; however, they also claimed Sharjah Higher College of Technology, for which they work, short-circuited this timetable and movement into the final two tiers of SAMR, taking only one semester, due to their faculty's willingness to teach each other. Conversely, their explanation of assignments that qualify as modification and redefinition does not parallel with other's definitions, specifically Puentedura's (2012). Therefore, while the willing attitude of the faculty has contributed to an excellent implementation process, their understanding of where they are in the SAMR model is inaccurate. Misunderstandings such as these create skewed perceptions of the implementation of innovations, hindering the evaluation process, and becoming a barrier to "true" implementation.

Penuel (2006) examined a wide range of studies and deduced students use laptops "primarily for writing, taking notes, completing homework assignments, keeping organized, communicating with peers and their teachers, and researching topics on the Internet" (p. 329). Observations reflect most teachers being in the "adaptation" stage of technology adoption (Sandholtz, Ringstaff, & Dwyer, 1997). This means they are asking students to work with productivity tools independently and in small groups, but they have

not changed their concept of teaching to be more student-centric (Davies, 2004; Davis, Garas, Hopstock, Kellum, & Stephenson, 2005; Light et al., 2002; Mitchell Institute, 2004; Newhouse & Rennie, 2001). However, change is a process (Hall, 2014) and requires time and exposure to the new technology to gain potency.

This study illuminates another obstacle technology must overcome, as many times innovation facilitators expect immediate and continuous improvement. While change cannot be immediate, continuous improvement can be realized throughout the process if teachers are supported. Much research (Dunleavy, Dexter, & Heinecke, 2007; Lee & Spires, 2009; Lei & Zhao, 2008; Oliver & Corn, 2008) verifies the importance of effective and ongoing professional development. The "nature and frequency of messages [teachers] hear in their environment" (Coburn, 2004, p. 213) influence teacher beliefs. Professional development activities should ensure teachers are obtaining consistent messages about the value of technology integration and how to teach and use technology effectively (Penuel, 2006). While teacher ability to redefine their educational belief system to include technology is the most important factor in successful implementation, teacher perception of technology is a primary factor as well and is related to the amount of professional development teachers have received as it increases their feelings of preparedness (National Center for Education Statistics [NCES], 2000). In addition to the amount of professional development received, the form of professional development and its alignment with standards and curriculum procure a pronounced effect on teacher motivation. Kanaya, Light, and Culp (2005) found that when teachers perceived technology development activities aligned with standards and curriculum, they were more likely to integrate technology into their teaching. Further, when teachers perceive

limited access to timely technical support and ongoing professional development, it can hinder their integration of technology (Molina, Sussex, & Penuel, 2005). Due to a lack of professional development and safeguarded time to explore the technology, Newhouse (1999) stated that many of the common barriers associated with the adoption of the innovation, such as poor computer literacy, lack of time, lack of confidence, and hardware malfunctions, were still present later in the implementation. Cuban (2001) echoed similar sentiments when he found that lack of time and inadequate, generic training sustained technology integration barriers in technology-rich high schools. Regardless of the barriers involved, "if teachers do not have sufficient equipment, time, training, or support, meaningful integration will be difficult, if not impossible, to achieve" (Ertmer, 1999, Obtaining Resources section, p. 47). However, Ertmer (1999) stated that by providing "teachers with knowledge of barriers, as well as effective strategies to overcome them, it is expected that they will be prepared to both initiate and sustain effective technology integration practices" (p. 61). Professional development activities that were most beneficial focused on helping teachers integrate technology into their instruction rather than how to use software (Davies, 2004; Dinnocenti, 2002; Fairman, 2004; Lane, 2003). As well, many school systems have employed instructional technology facilitators to assist teachers in finding digital resources and to provide expertise in how to integrate technology into specific content areas (Silvernail & Harris, 2003). Further, many teachers say informal collaboration with other teachers is especially important to ensuring implementation success because it creates a cohesive and involved culture (Davis et al., 2005; Gaynor & Fraser, 2003; Silvernail & Harris, 2003). Programs where teachers report a high degree of reliability for laptops often have

within-building technical support staff and ready access to outside vendors for major problems (Hill & Reeves, 2004). While the results can be rewarding for schools, it is imperative to understand the emotional and behavioral aspects of any adoption process in order to recognize where teacher concerns lie and what supports are needed to assist their movement forward.

CBAM

Fuller (1969), a counseling psychologist, conducted research on teacher concerns throughout their careers from a clinical perspective, which resulted in group counseling sessions and longitudinal in-depth interviews of student teachers. This work was initiated because of the current innovation focus in education of presenting teachers with packaged best practices and expecting teachers to implement the "packaged system" as specified, therefore creating the predicted outcomes of the innovation. Often, the actual results did not match the predicted outcomes, which led to many studies in the process of change adoption (George, Hall, & Stiegelbauer, 2006). Fuller proposed that teacher concerns corresponded to their career stages from pre, early, to late teaching status and progressed in a linear sequence from unrelated concerns as preservice teachers to self concerns as early teachers to task and impact concerns as late phase teachers. Fuller's hypotheses played heavily into the work researchers at the Research and Development Center for Teacher Education (R&DCTE) at the University of Texas in Austin completed in their investigation of how individuals change their practices in order to adopt an innovation; this work eventuated the CBAM (Hall, Wallace, & Dossett, 1973).

The need to have clear definitions, understandings, and benchmarks led many to research the process through which districts most effectively achieve implementation.

Hord et al.'s (1987) CBAM has become a hallmark method of facilitating change within education because of its sensitivity and devotion to the needs of those who are enacting the change. Several premises establish the foundation of CBAM:

1. Change is a process, not an event.
2. Change is accomplished by individuals.
3. Change is a highly personal experience.
4. Change involves developmental growth.
5. Change is best understood in operational terms. In other words, what will this change mean to me? My students?

For these reasons, facilitation of this change should focus on the individuals, innovation, and the context of the innovation (Hord et al., 1987, pp. 5-6).

In order to understand clearly these three areas, the change facilitator must understand what the program is exactly and then how teachers are actually using the program. Understanding what the program is implies the change facilitator must understand the goals of the program, but the understanding must extend to the application and visualization of those goals in the classroom (George et al., 2006). The reasoning for this process becomes apparent through Hord et al.'s (1987) SoC which demonstrates engagement in any change process will result in teachers having specific and individualistic concerns about the change and their part in that change.

Stages of Concern (SoC). As the researchers at the R&DCTE at the University of Texas in Austin accumulated a body of work regarding this concern model, they identified seven stages of concern about an innovation through which all individuals progress as they attempt to implement a new innovation (George et al., 2006).

When events heighten our emotions, we manifest *concern* about the event – the more personal the event, the more intense our concern. Our perception of the event determines the intensity of concern. For example, we often label people as optimistic or pessimistic based on their perception, and thus concern, over certain events. While the facts of the event do not change, each person perceives that event differently based on their concerns. During the change process, individuals are capable of feeling many concerns but tend to "perceive certain aspects as more important than others at any given time" (George et al., 2006, p. 7). In other words, throughout the implementation process, the individual will experience stages of concern where his or her concerns change based on his or her perceptions of the innovation. This process is developmental in that the individual must experience and resolve the present concern before moving on to a new stage of concern. The process is highly personal and requires time and effective intervention of change facilitators in order to be resolved. And, while knowledge and experience are critical to moving through the stages of concern, it does not guarantee movement. "In general," time, successful experiences, and the attainment of new skills allow an individual to progress through the stages of concern (George et al., 2006, pp. 7-9). Therefore, change facilitators must keep in mind that change is individual and forced movement into higher levels of concern will only result in moving back to the lowest levels of concern in the SoC model.

The SoC range from the beginning stages of how does this affect me (*self)* to how does this affect the *tasks* I must accomplish, and finally, to how does this *impact* my students (Figure 3)? While this may seem simplistic in nature, the movement from self to task to impact is an involved and complex process; however, it is also a fairly linear and

predictable process. That is to say, not all people will develop in a linear fashion and not all will do so in a predictable fashion; however, through the research backing the CBAM approach, it is evident that a majority will (Hord et al., 1987).

IMPACT	6	Refocusing	The individual focuses on exploring ways to reap more universal benefits from the innovation, including the possibility of making major changes to it or replacing it with a more powerful alternative.
IMPACT	5	Collaboration	The individual focuses on coordinating and cooperating with others regarding use of the innovation.
IMPACT	4	Consequence	The individual focuses on the innovation's impact on students in his or her immediate sphere of influence. Considerations include the relevance of the innovation for students; the evaluation of student outcomes, including performance and competences; and the changes needed to improve student outcomes.
TASK	3	Management	The individual focuses on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, and scheduling dominate.
SELF	2	Personal	The individual is uncertain about he demands of the innovation, his or her adequacy to meet those demands, and/or his or her role with the innovation. The individual is analyzing his or her relationship to the reward structure of the organization, determining his or her part in decision making, and considering potential conflicts with existing structures of personal commitment. Concerns also might involve the financial or status implications of the program for the individual and his or her colleagues.
SELF	1	Informational	The individual indicates a general awareness of the innovation and interest in learning more details about it. The individual does not seem to be worried about himself or herself in relation to the innovation. Any interest is in impersonal, substantive aspects of the innovation, such as its general characteristics, effects, and requirements for use.
SELF	0	Unconcerned	The individual indicates little concern about or involvement with the innovation.

Figure 3. SoC about an Innovation. George et al. (2006). *Measuring implementation in schools: The stages of concern questionnaire.* SEDL, Austin, TX, p. 8.

The concerns that make up these different stages exert a powerful influence on the

implementation of a change, and they determine the kinds of assistance teachers find useful. So, while the change facilitator cannot force movement through these stages, the intention of CBAM consists of empowering the change facilitator with the knowledge of these stages of concern and how best to support and provide the assistance needed to allow the development and growth of teachers through these stages. The researchers created a 35-item questionnaire that allows the change facilitator to determine where the implementer is in the change process (Hall, George, & Rutherford, 1979) in order to provide more effectively the needed supports to move the person from one stage to the next.

Levels of Use (LoU). Hall, Dirksen, and George (2006) stated that "a component of research methodology that has been somewhat neglected is understanding and systematically addressing the importance of documenting the extent of implementation" (p. 3). In fact, most researchers focus on the accuracy of measuring the outcomes without considering the level to which the individuals have actually implemented the innovation. Such oversight leaves many studies' conclusions with "no significant differences" when favorable differences may exist but are masked by the individual's actual level of use of the innovation, or lack thereof. At the most basic level, a researcher must know if the individual is in fact using the innovation; but for a truly effective understanding of the value of the innovation, the researcher or evaluator needs to go beyond this dichotomous evaluation to a more evolved understanding of exactly how the innovation is being implemented (Hall et al., 2006, pp. 3-4).

In order to describe the extent to which an innovation is being used, the researchers identified eight levels of use (Figure 4). The LoU are intended to go beyond

the SoC which identify where the teacher is affectively to gain a greater perspective by being cognizant of where the teacher is behaviorally in the change process (Hall, Loucks, Rutherford, & Newlove, 1975). In other words, has the teacher begun to orient him/herself to the innovation, is he/she experimenting, is he/she routinely using it in the classroom?

Because LoU is a behavioral phenomenon and is not concerned with attitudes, emotions, or the quality of the innovation, the developers were able to use operational definitions of each level. In fact, the definition of LoU—"distinct states that represent observably different types of behavior and patterns of innovation use as exhibited by individuals and groups … characterize a user's development in acquiring new skills unvarying use of the innovation" (Hall et al., 2006, p. 6)—acknowledges that each level is based on specific behaviors, is independent of the other levels, and is determined based on the behavioral indicator, or Decision Point, unique to each level (Hall et al., 2006, p. 6). These Decision Points become especially important during LoU interviews when the researcher is identifying the individual's specific level of use of the innovation.

The LoU range from 0, or nonuse of the innovation, through understanding (Level I) and preparing (Level II) to use the innovation, the mechanical (Level III) and routine (Level IV) use of the innovation in everyday activity, to refinement (Level V), integration (Level VI), and renewal (Level VII) of the innovation that signifies the individual is modifying, collaborating, and making needed changes to improve the quality of the innovation (Hall et al., 2006).

LoU 0 Nonuse: State in which the user has little or no knowledge of the innovation, has no involvement with the innovation, and is doing nothing toward becoming involved.

Decision Point A: Takes action to learn more detailed information about the innovation.

LoU I Orientation: State in which the user has acquired or is acquiring information about the innovation and /or has explored or is exploring its value orientation and its demands upon the user and the user system.

Decision Point B: Makes a decision to use the innovation by establishing a time to begin.

LoU II Preparation: State in which the user is preparing for first use of the innovation.

Decision Point C: Makes user-oriented changes.

LoU III Mechanical Use: State in which the user focuses most effort on the short-term, day-to-day use of the innovation with little time for reflection. Changes in use are made more to meet user needs than client needs. The user is primarily engaged in a stepwise attempt to master the tasks required to use the innovation, often resulting in disjointed and superficial use.

Decision Point D-1: Establishes a routine pattern of use.

LoU IVA Routine: Use of the innovation is stabilized. Few if any changes are being made in ongoing use. Little preparation or thought is being given to improving innovation use or its consequences.

Decision Point D-2: Changes use of innovation in order to increase client outcomes, based on formal or informal evaluation.

LoU IVB Refinement: State in which the user varies the use of the innovation to increase the impact on clients within immediate sphere of influence. Variations are based on knowledge of both short- and long-term consequences for clients.

Decision Point E: Initiates changes in use of the innovation for the benefit of clients, based on input from and in coordination with colleagues.

LoU Integration: State in which the user is combining own efforts to use the innovation with the related activities of colleagues to achieve a collective effect on clients within their common sphere of influence.

Decision Point F: Begins exploring alternatives or major modifications to the innovation presently in use.

LoU VI Renewal: State in which the user reevaluates the quality of use of the innovation, seeks major modifications or alternatives to present innovation to achieve increased impact on clients, examines new developments in the field, and explores new goals for self and the system.

Figure 4. LoU of the Innovation with Decision Points. Hall et al. (2006). *Measuring implementation in schools: Levels of use.* SEDL: Austin, TX, p. 7.

Hord et al. (1987) stated,

In school after school, where changes have been introduced, research has shown that there are people who do not use the innovation at all, even months or years

> after the introduction. There are others who use only parts of the innovation, while others try to use it but struggle. (p. 54)

Herein lies the reason why many innovations have been incorrectly judged and eliminated: Organizations will attempt to assess the effectiveness of the program without an understanding of how the program has been implemented (Hord et al., 1987). In order to understand and assist the change process, the change facilitator must be able to answer questions such as, To what level of use have the educators implemented the program? What concerns are plaguing them that have caused them not to implement to a higher level of use? What concerns do they have even as they have been successful to this level?

The change facilitator must guide the change process to the point of successful implementation, which means monitoring and responding with support and assistance through each of the possible eight levels of use. The levels of use provide descriptions of how the user at each level behaves – from spending most efforts in orienting themselves to the program, to managing the program, and finally to integrating the program (George et al., 2006). Successful implementations occur when the facilitators of change clearly understand the people instituting the change, where they are in the process, and what concerns they have about the innovation.

Even this knowledge, however, does not ensure a complete or effective initiative. After the first year, typically 60-70% of users will be at a Level of Use (LoU) III which means they are operating mechanically in the classroom (Hord et al., 1987, pp. 56-57). These teachers have instituted the innovation; but they are barely ahead of the students in studying the material, they cannot supplement or modify the material, and they have given very little thought to the effect the innovation has on their students. Even after the

change has been implemented for some time, the majority of users will be at Level of Use IV, which is routine, meaning they have worked out the kinks, they know how each day will go, but they have not invested any effort into improvement or consideration of the impact to their students. The movement through the LoU slows even more as few teachers will reach LoU V (integration) by collaborating with others, and even fewer will reach LoU VI (renewal) to incorporate their own ideas of how to improve the innovation. Further, Hord et al. (1987) posed that even after some innovations have been implemented for 2 or 3 years, it is not unusual to find 20-30% of the staff are nonusers of the innovation (pp. 61-66).

IC. The SoC and the LoU provide an excellent understanding of where individuals are in the change process, both emotionally and behaviorally, allowing a change facilitator to prescribe necessary interventions to assist the implementation process; however, research has revealed that almost all teachers modify innovations to suit their students and their personal belief system. The CBAM research team realized after conducting two studies to determine whether teachers and faculty were using an innovation – one study involving 400 teachers concerned with team teaching and another study of 350 university faculty members focused on the use of instructional modules – that while the majority of these teachers and faculty members said they were using the innovation, the manner in which they were using the innovation varied significantly. The differences in how innovations were being implemented led the Concerns-Based Adoption team to develop the IC Map in order to understand the different possible operational practices for the innovation and identify the most ideal (Hall et al., 1979). The IC Map enumerates the components of the innovation and the different variations the

implementation may take, moving from most desirable to least desirable (Hord, Stiegelbauer, George, & Hall, 2006, pp. 2-7).

The IC describes the innovation in action, clarifying what the innovation actually looks like along a continuum from high-quality implementation to least desirable practices. Teachers and administrators must be able to envision best practices in order to make consistently the best use of the innovation and produce the expected results. As well, change facilitators and administrators need tools that assist them in defining the components of complex initiatives to support and provide more effectively for the individuals implementing the innovation. Utilizing IC Maps provides clarification of goals, outcomes, and impacts of the innovation as well as provides data that allow program evaluation and needed modifications to improve sustainability of the reform (Hord et al., 2006, pp. 2-4).

The IC may be applied in numerous ways. In a research context, researchers can assess the extent to which the treatment is truly absent from the control group or to test the extent to which the hypothesized best practices lead to increases in outcomes. In the evaluation context, ICs can be used to answer questions such as whether an innovation has been fully implemented, what it looks like over time, and the relationship the innovation has to the outcomes. In a dissemination context, ICs can provide concrete descriptions about the range of configurations possible with a new program or practice. In the professional development context, ICs provide a record of what teachers actually do to allow for modification, complementing, or changing their current practices as well as professional development activities allowing for self-reflection, peer observations, and observations by coaches and change facilitators (Hord et al., 2006, pp. 8-11).

CBAM is a framework designed to provide measurement concepts and tools for evaluators and researchers to evaluate the effects and/or progress of implementation of an innovation. CBAM is also designed to help change facilitators identify the special needs of individuals involved in the change process and address those needs appropriately based on the data gathered through the three diagnostic tools. In the process of adopting a change, the SoC represent the *who* or the personal feelings of the individuals, the LoU represent *how* the innovation is being used, and the ICs represent *what* the innovation looks like during implementation (George et al., 2006, pp. 2-3). Utilization of these three tools completes the picture of an innovation at any given time.

Conclusion

As stated at the beginning of this chapter, the American education system is in crisis for a myriad of reasons; but one of the most significant is the lack of relevance, both perceived and actual, current school practice has for students. Those school systems recognizing the need to provide educational experiences that require higher order thinking, problem-solving, analysis, and creation through the utilization of technological resources have moved toward one-to-one technology adoptions. Although many parents and practitioners commend this move, studies suggest that providing technology in and of itself is not enough. Technology integration that does not change the paradigm of education in the school through a marriage of technology with content knowledge and pedagogy results in few positive outcomes, yet "true" implementation that results in teacher and student efficacy is fraught with obstacles that change facilitators must overcome through a profound understanding of teacher concerns—emotionally, behaviorally, and effectively. CBAM allows facilitators to monitor teacher concerns

from the vantage point of these three lenses in order to provide the best resources at the most appropriate times to sanction the intertwining of technology into a rigorous and relevant curriculum. The researcher utilized this adoption model in examining teacher concerns, behaviors, and effectiveness of implementation in a one-to-one technology initiative that began at three rural North Carolina traditional high schools in 2011.

Chapter 3 articulates the methods utilized in this study, including the use of the SoCQ, the LoU focused interviews, and the IC Map survey resulting in qualitative and quantitative data that develop a fuller understanding of the teacher technology adoption process.

Chapter 3: Methodology

Project RED (Revolutionizing Education; Greaves, Hayes, Wilson, & Gielniak, 2010) conducted a survey of nearly 1,000 school principals and technology coordinators and found that 80% report their schools underutilize the technology they have already purchased. Further, 43% of students reported they felt unprepared to use technology in college or the workplace (Greaves et al., 2010). The explosion of one-to-one technology initiatives and the current focus on technology integration has attempted to rectify these situations; however, the simple existence of technology, even ubiquitous technology, does not ensure use, or effective use, of that technology within the classroom. It is with this understanding that this study examined the obstacles high school teachers in a rural North Carolina district face in moving into the final stages of a one-to-one technology implementation, 5 years after the initial adoption, in an effort to understand how effective use comes about, what obstacles must be navigated, and what resources are needed for that navigation. Findings may be used to inform needs assessments for professional development planning and resource attainment and to provide an understanding of best practices for moving into a full technology implementation delivering high-quality lessons to students that intersect 21st century skills with collaboration and constructive problem-solving activities indicative of schools that promote innovation and invention.

This investigation into teacher behavior in a mature one-to-one technology adoption sought to answer the following questions:

1. How have high school teachers in a rural North Carolina district implemented the one-to-one laptop initiative?
2. What obstacles are these teachers facing in moving up the implementation

model to provide instruction that is more effective?

3. What methods are teachers using to overcome these obstacles?
4. What supports do teachers need in order to move into the upper tiers of the implementation model?

Description of Participants

Participants for this study were 30 high school teachers chosen from three traditional high schools in a rural district in North Carolina. In 2011, the district decided to implement a one-to-one laptop initiative, which supplied all students from Grades 6-12 and every Pre-K through 12th-grade teacher with a laptop to use at school and home. The county hired a technology coordinator, technology facilitators for all middle and high schools, elementary instructional coaches, and AIG specialists to provide professional development and instructional support. During the 5 years since teachers received their laptops, the school-based technology facilitators conducted over 400 professional development sessions. Additionally, during the first 2 years, Apple, Inc. experts provided over 80 training sessions to assist teachers in implementing Apple tools. The Apple Education Specialist worked with the technology facilitators to develop goals and strategies for implementation based on Puentedura's (2012) SAMR model. Teachers in this district received ongoing professional development during the initial stages before students obtained laptops as well as throughout the implementation process.

Technology facilitators for the district chose 10 teachers from each of three high schools based on their own observations of teachers. This purposive, stratified sample allowed specific participants to be chosen in order to obtain representation in different subgroups and to facilitate comparisons among those subgroups. The technology

facilitator from each high school chose 10 teachers who represented all levels of use of the technology (as defined by Hall et al.'s, 2006, LoU instrument) based on previous observations over the last 5 years of the adoption process. Because this study is not a program evaluation, it is unnecessary to have an understanding of how many teachers within the district are performing at each of the specified levels. However, in order to understand the process teachers undergo at every level of implementation, it is imperative to obtain as much data from as many teachers as possible at each level. As has previously been stated, even mature implementations have users at all levels, including nonusers; therefore, a purposive, stratified sample was chosen in order to gain an understanding of what resources change facilitators will need to support teachers in all aspects of development.

Instruments/Materials Used

CBAM informs the methodology of this study and affords a reliable examination of the change adoption when all three CBAM instruments supply the data. The SoCQ furnishes data concerning teachers' feelings/emotions/concerns that lie with the adoption. The LoU focused interviews afford an understanding of how often teachers integrate technology into their lessons. The IC survey presents an understanding of how effectively teachers integrate technology into their lessons based on the SAMR model.

SoCQ. The questionnaire consists of a 2-page list of 35 items or statements, which probe the participant's feelings about the innovation (Appendix A). Such statements include, "I am concerned about students' attitudes toward the innovation," "I am concerned about not having enough time to organize myself each day," and "I would like to revise the innovation's approach." Participants respond by marking each item on

a 0-7 Likert scale according to how true the items seem to him/her presently (0=Irrelevant, 1/2=Not True of Me Now, 3/4/5=Somewhat True of Me Now, 6/7=Very True of Me Now). Typically, participants take 10-15 minutes to complete the questionnaire. This study utilizes data from the electronic version of the SoC questionnaire, which delivers immediate feedback to the participant and researcher detailing where the participant's concerns lie within the SoC instrument (George et al., 2006).

This report details participant stage scores in each of the seven stages of concern. A sample SoCQ score report is available in Appendix B. The report consists of six areas: (a) participant's identification number; (b) question response table – places each question number into one of the seven possible stages based on the participant's response along with the raw score (Likert scale number signifying the degree of concern, 0-7); (c) raw score totals – the total in each stage score represented in the question response table; (d) raw score to percentile conversion table – table provides the percentile equivalents for the raw scores; (e) graph of stage score percentages for all stages – graph of stage score percentiles found using the raw score to percentile conversion table; and (f) SoC figure – provides a visual representation of the participant's percentile scores at each stage of concern.

Initial analysis rests with the participant's highest stage score. Participants with a high stage score of 0 indicate little concern about the innovation. Participants with informational (Stage I) or personal (Stage II) scores focus on the facts either about the implementation or about how the implementation will affect them personally. Participants with management (Stage III) scores focus on the processes and tasks

associated with the innovation. Participants with consequence (Stage IV), collaboration (Stage V), or refocusing (Stage VI) scores are concerned with the impact the innovation will have on students, collaborating with others, and exploring ways to get the most from the innovation (George et al., 2006).

George et al. (2006) detailed the three ways data from the SoCQ can be interpreted based on different levels of "detail and abstraction" (p. 31): (a) The simplest manner of interpretation is to identify the highest stage score (Peak Stage Score Interpretation); (b) a more detailed interpretation occurs with the examination of the highest and second highest stage scores (First and Second High Stage Score Interpretation); and (c) the most sensitive interpretation occurs by analyzing the complete profile of all stage scores (Profile Interpretation), which provides a "rich, clinical picture" (p. 31). Researchers often employ SoCQ results as comparisons over time to investigate changes in participants across a timeline; however, the researcher examined the SoCQ results in this study to provide a detailed snapshot of teacher concerns 5 years into the technology adoption. For this reason, peak stage scores and profile interpretations inform this study (an interpretation of first and second stage scores is redundant where a profile interpretation is provided).

Chapter 5 of *Measuring Implementation in Schools: The Stages of Concern Questionnaire* (George et al., 2006) supplies an analysis of each stage to inform the Peak Stage Score Interpretation. For example, a participant whose score report shows Stage II as the highest stage score indicates the participant has "intense personal concerns about the innovation and its consequences for him/her. Although these concerns reflect uneasiness regarding the innovation, they do not necessarily indicate resistance" (George

et al., 2006, p. 53).

This chapter also supplies analysis of the highest stage score in conjunction with other stage scores, or Profile Interpretation, because the highest stage score alone does not fully represent the participant's concerns. Utilizing a participant's full score report allows a fuller understanding of this participant's concerns in regard to the technology implementation. A participant's full stage score percentages—or relative intensity of concern within each stage—might be Stage II (70%), Stage VI (57%), Stage III (47%), Stage IV (38%), Stage 0 (31%), Stage V (25%), and Stage I (19%). The analysis for the combination of scores reads,

> The high Stage 2 score coupled with a low Stage 1 score indicates self-concerns. This person may be more negative toward the innovation and generally is not open to more information about it. However, the high Stage 6 score indicates that this lack of desire for more information is because the person feels that he/she already knows all about the innovation and has plenty of ideas for improving the situation. (George et al., 2006, p. 39)

The difference between the original analysis of the highest stage score only as opposed to the analysis of the combined scores is significant. For a change facilitator, it is the difference between knowing the participant has some deep-seated self-concerns and knowing how to move forward with the knowledge that he/she has some negative emotions but also has some ideas about how to modify the innovation.

The analysis of all stage scores becomes even more imperative for participants with high Stage 0 scores because users at all levels of technology implementation can attain high Stage 0 scores; this phenomenon is discussed in more detail in the Reliability

and Validity of Instrumentation section later in this chapter.

The analyses provided by the American Institute of Research (who merged with the Southwest Educational Development Laboratory [SEDL], the original owners of CBAM, in 2015) of this questionnaire allowed the researcher to understand each participant's mindset in connection with the technology adoption. These data informed the researcher's questions concerning how the participant has implemented the technology, from no use at all to collaborating, reflecting, and modifying to improve the innovation, and the emotional obstacles the participant is experiencing in advancing through the developmental stages of concern.

The Levels of Use focused interviews. Where the SoC addresses the emotional aspects of change, the LoU instrument focuses on behaviors and shows how users are acting with respect to the specific change. Taken together, these two instruments yield a powerful description of the participant's response to the innovation. A part of research methodology often neglected is understanding and addressing the importance of documenting the extent of the implementation. If teachers do not implement the innovation, the expected outcomes are unlikely to occur. Before researchers can examine the rigor and precision of the implementation, probing the levels of use of the innovation is important to measuring student outcomes.

The LoU interviews deal only with behaviors, not feelings or emotions or quality of the innovation implementation (Hall et al., 2006, p. 2). For this reason, LoU was developed using operational definitions at each level that describe the behaviors of participants in conjunction with the innovation (Figure 4).

At each of these levels, Decision Points allow the interviewer to know when the

participant has moved on to a different Level of Use. For instance, the Decision Point for moving into the Refinement stage occurs when the participant changes the innovation in order to increase positive student outcomes. These Decision Points become the primary guide to the sequence and flow of the LoU interview. The LoU focused interview (Appendix C) uses a branching technique and, depending on the interviewee's responses, the interviewer asks questions from a particular branch of the protocol based on the Decision Points (Hall et al., 2006, p. 6).

The interviewer begins by asking whether the interviewee is a user or nonuser of the innovation and then moves on to probe the interviewee using the protocol questions to determine the interviewee's level of use of the innovation (Hall et al., 2006, p. 17). Examples of such questions include "What do you see as the strengths and weaknesses of the innovation in your situation?" and "Have you made any changes recently in how you use the innovation? What? Why? How recently?"

While the LoU interviews may be used to determine how often an individual is using the innovation, the researcher has also chosen to utilize these individual interviews to understand why teachers are at specific levels and what supports are needed to move those teachers to the next level. The interview protocol allows the researcher to add questions to the end of the instrument to gain additional information; however, in an effort to protect the validity of the instrument and because the instrument presented questions aligned to the study's research questions, no additional questions were added. The intended outcome of the LoU interview is to determine at what level the participant is using the innovation. However, the researcher is also concerned with the qualitative data provided by the interviewee that describes his/her progression through the

technology adoption as it functions as a needs assessment and best practices report to guide ongoing professional development and resource attainment.

The researcher compares the participant's answers to the branching chart (reprinted below) from *Measuring Implementation in Schools: Level of Use* (Hall et al., 2006, p. 18) to determine the level of use for each participant. For example, a participant who answered that he/she is a user might have responded to the question, "What kinds of changes are you making in your use of the innovation?" by stating, "I personally have been keeping an eye on my students' email, walking around the room. I've moved my desk to the back of the room so that if I'm doing anything back there I can always see their screens. It just requires a more careful moderating of the students." Using the branching chart below, the response can be classified as user-oriented, thus identifying the participant at LoU III.

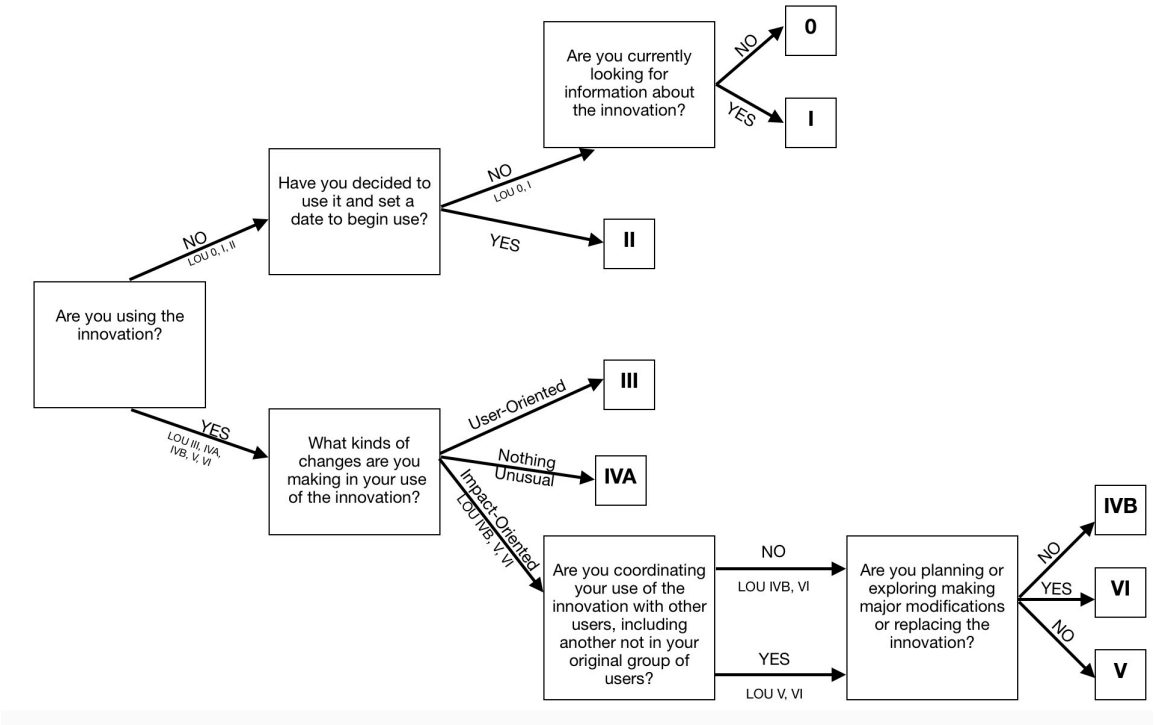

Figure 5. LoU Branching Chart. Hall et al. (2006). *Measuring implementation in schools: Levels of use.* SEDL: Austin, TX, p. 18.

The information provided by the analyses of the participants' stage scores proves valuable in understanding where the teachers' concerns lie with the innovation, but the LoU interview also provides qualitative data, which more specifically answer the research questions. For instance, when asked about the strengths of the innovation, a participant might respond, "The biggest strength for me is when I'm teaching statistics and I can use the MacBook to do applets, simulations, things I can't duplicate in my classroom just by collecting our own data or doing an activity just in class. It's very helpful to demonstrate a lot of those statistical practices." The researcher would record, transcribe, analyze, and code the participant's response for themes. One of the themes that might emerge from this response would be Access to Resources. The LoU interviews result in large amounts of qualitative data, which paint a more detailed picture

when answering the research questions than quantitative data alone.

The IC Map survey. Teachers and administrators must be able to understand what is expected of them and envision what the innovation looks like in best practice within the classroom. Even the best reforms will fail to produce results if the individual teachers do not implement the expected practices. The IC Map describes the innovation in action by clarifying what the innovation actually looks like along a continuum from high-quality implementation to least desirable practice (Hord et al., 2006, p. 2).

IC Maps emphasize the concrete and more tangible operational forms of the innovation, increasing the possibility of having reliable and valid information about the use of the innovation. The map is created by the researcher based on the critical components that must be used for the innovation to be considered successfully implemented and the variations of use of those components in actual practice from least to most desirable (Hord et al., 2006, pp. 5-6).

In an evaluation context, information about ICs can be used to answer questions such as whether the innovation has been fully implemented, what the innovation looks like after 1 or more years into the adoption, and what relationship the innovation has to student outcomes. This type of information may provide a baseline for assessing further needs, for determining bottlenecks for broader implementation, for responding to funding sources, and for creating professional development activities (Hord et al., 2006, p. 9).

The CBAM team provides researchers with questions to facilitate the creation of the IC Map by identifying the major components and their variations. Once the researcher creates a draft of the IC Map, he or she must pilot the map with a range of implementers and make needed changes to gauge accurately what implementation looks

like in each classroom. CBAM intends for the researcher to create the IC Map, as it should be specific to the innovation.

For this study, the SAMR model informed the IC Map since it identifies least to most desirable technology integration within classrooms and served as a goal and gauge of successful implementation by district change facilitators and administrators throughout the adoption process. Curriculum specialists gave the following chart to teachers during the IC Map survey. This chart delineates the four categories of substitution, augmentation, modification, and redefinition based on descriptions, characteristics, and examples.

	Substitution	Augmentation	Modification	Redefinition
Description	Technology acts as a direct tool substitute with no functional change.	Technology acts as a direct tool substitute with functional improvement.	Technology allows for significant task redesign.	Technology allows for the creation of new task that were inconceivable before technology.
Characteristics	Students use the lower levels of Bloom's Revised Taxonomy to remember, understand, and apply.	Students use the lower levels of Bloom's Revised Taxonomy to remember, understand, and apply.	Students use the upper levels of Bloom's Revised Taxonomy to analyze, evaluate, and create.	Students use the upper levels of Bloom's Revised Taxonomy to analyze, evaluate, and create.
Examples	Use Google Earth instead of an atlas to locate a place [remember].	Use Google Earth rulers to measure the distance between two places [understand].	Use Google Earth layers such as panoramio and 360 cities to research locations in order to determine the most desirable city to test the innovation you have created [analyze, evaluate].	Create a narrated Google Earth tour that synthesizes your research and explains your reasoning for choosing this city as the most desirable to test your innovation based on its features and publish this narrated tour on the Internet [synthesize, evaluate, create].

Figure 6. IC Map. Researcher generated.

The IC Map survey (Appendix D) then asks teachers to rate their comfort levels on (a) teaching students to complete assignments at each level of SAMR and (b) assigning coursework at each level of SAMR by using a Likert scale of extremely comfortable, fairly comfortable, somewhat comfortable, not very comfortable, or do not

use these type assignments. Interviewers questioned participants on how frequently they assign coursework in each level of SAMR (daily, weekly, monthly, once or twice per semester, not at all). And, finally, open-ended questions probed the obstacles encountered, the solutions found, and resources still needed at each level.

The quantitative Likert data allow an understanding of how comfortable teachers are at each level and how often they assign work at each level, while the qualitative data found in the open-ended answers give descriptions of the teachers' progress through the implementation. The researcher uses these descriptions to analyze, code, and identify themes contributing to a more detailed understanding of teachers' levels of use of the technology.

Validity and Reliability of Instrumentation

Anderson (1997) stated, CBAM is "arguably the most robust and empirically grounded theoretical model for the implementation of educational innovations to come out of educational change research in the 1970s and 1980s" (p. 331) and has been used extensively since that time throughout North America, Western Europe, and Australia in the education fields for a myriad of purposes (p. 332). Slough and Chamblee's (2000) meta-analysis of articles regarding technology in education discussed 16 different CBAM studies occurring in peer-reviewed journals from 1995-2004. George et al. (2006) further emphasized the staying power and utilitarianism of CBAM:

> CBAM tools commonly have been used in federally sponsored research projects, dissertation research, evaluations, and many change programs. Active research on CBAM tools continues, as does the use of the CBAM framework and tools along with learning from their application. Understanding teacher or individual

> change continues to be an important focus for thinking about and facilitating teacher development and school improvement. (p. 2)

The longevity of CBAM's use in education is a testament to researcher confidence in its reliability, validity, and applicability in the education context for both practitioner and researcher-oriented data collection and analysis.

Stages of Concern (SoC). As previously mentioned, the SoC instrument examines an individual's feelings or concerns in consequence of a change adoption. These concerns are segregated into seven stages that progress from unconcern, to self-focused concerns, to task concerns, and finally to concerns centered on the innovation's impact on students. The 35-item SoCQ "was tested for reliability, internal consistency, and validity with several samples and 11 innovations" (George et al., 2006, p. 11) over a 3-year period. Procedures for executing and analyzing the results of the SoCQ are well explained in the SoC text (George et al., 2006). The questionnaire (purchased through SEDL) provides an electronic system of collecting, analyzing, and reporting the results of the questionnaire for the researcher. The results are provided in graphical form and denote both individual and aggregated group results, including the peak stage score (the highest stage), the top two stages, and an analysis of the entire profile of all seven stage scores.

George et al. (2006) supplied a list of the limitations of the SoCQ that should be considered: (a) Use the tool to diagnose, not judge; (b) Do not modify the statements on the questionnaire; (c) Confirm the interpretation of the data with the respondents; (d) Expect feedback; and (e) Base any empirical critique of the SoC on adequate samples and appropriate research methodology (p. 21).

Internal reliability coefficients for the SoC reported from seven large-scale SoCQ studies proved to be lowest in Stage 0 (unconcerned), with scores from .50 to .78; but the other stages all scored above .70. To put this information in perspective, an "acceptable" reliability coefficient is dependent upon its context. According to Jordan and Hoefer (2001), it should minimally be .70; however, Smith and Glass (1987) stated that for "research purposes, moderate reliability [r > .50] is often sufficient" (p. 106). Gable (1986) explained that it is "typical for good cognitive measures to have … reliabilities in the high .80s or low .90s, where even good affective instruments frequently report reliabilities as low as .70" (p. 147). Thus, it may be maintained that the SoC instrument demonstrates internal reliability, with the possible exception of Stage 0. In fact, the most recent SoCQ manual (2006) attempted to address the validation concerns in Stage 0 by making changes to the questionnaire based on the Change Facilitator SoCQ. To sample these changes, the revised questionnaire was conducted using a group of 185 elementary to secondary teachers who were involved in the creation of PLCs. Reliability for Stage 0 was strongest among the elementary teachers (.75), followed by middle school (.68), and high school (.57). The fact that reliability was weakened at the high school level does pose a consideration to this study as the research involves high school teachers. However, in an effort to mitigate Stage 0 concerns, analyses of all stage scores in aggregate were utilized for participants with Stage 0 peak scores.

Levels of Use (LoU). Because the LoU instrument is interview driven, the procedures for establishing reliability and validity are very different. The LoU manual (Hall et al., 2006) explicates a study in which ethnographers observed a stratified sample of junior high science teachers and compared their observations to the participants' LoU

interview scores, which resulted in a .98 correlation coefficient. Hall et al. (2006) stated that the LoU concept is "valid and translates across numerous nationalities and cultures" and can be used with "confidence and the resultant data [can be] trusted" (p. 175). The LoU manual does warn against any attempts to "revise, improvise, and modify" the interview protocol as it will damage the validity of the instrument (Hall et al., 2006, p. 29).

IC. Because the IC Map was intended to be created as a tool for examining the specific innovation and the manner in which the change facilitators intended the innovation to be implemented, discussion of reliability and validity are made difficult. However, Hord et al. (2006) stated, "IC Maps emphasize the concrete and more tangible operational forms of the innovation, thereby increasing the possibility of having reliable and valid information about the use of the innovation" (p. 4).

The CBAM IC manual provides specific guidelines for creating and executing IC Map evaluations lending structure to the process and increasing reliability and validity; however, no formal research has been conducted to determine IC Map validity. It is important to understand that the purpose of IC is to provide a comprehensive overview of how well an organization has adopted the change and evaluate next steps in creating the alignment between visualized implementation and actualized implementation.

While CBAM, and specifically the SoC tool, has fallen under criticism from researchers for its validity (Bailey & Palsha, 1992; Jibaja-Rusth, Dresden, Crow, & Thompson, 1991; Rogan, Borich, & Taylor, 1992; Shotsberger & Crawford, 1996), those studies which attempt to refute CBAM's validity have failed to adhere to the limitations set forth by the CBAM committee in one or more ways, such as by focusing on

populations outside of that upon which CBAM was originally validated, modifying the CBAM instruments, or using non-CBAM instruments.

Procedures

The convergent parallel mixed methods design used in this study provided both qualitative and quantitative data which were analyzed separately in a side-by-side comparison (Creswell, 2014, pp. 219, 222) and then amalgamated to develop a fuller understanding of high school teacher behaviors 5 years after the inception of a one-to-one technology adoption in a rural North Carolina district. Based on Hord et al.'s (1987) CBAM, data were collected from (a) the SoCQ providing data on teacher emotional concerns, (b) the LoU independent focused interviews providing data on teacher behavior, and (c) the IC Map survey providing data on teacher utilization of the innovation. Each instrument provides distinctly different information, which is independent of and does not inform the other instruments; however, the aggregation of all three data types allows the researcher to "merge quantitative and qualitative data in order to provide a comprehensive analysis of the research problem" (Creswell, 2014, p. 15). This analysis is necessary to provide answers to the researcher's questions, which may be used to inform next steps in the implementation process as well as provide valuable research, where very little currently exists, for technology adopters beyond the initial stages of implementation.

In preparation for this study, the researcher obtained CITI certification and contacted the gatekeepers within the district to obtain permission to move forward with the research. Initially, the researcher contacted the district superintendent to inform her of the purpose of the study and to ask permission to use the district teachers, technology

facilitators, and curriculum specialists in this study (Appendix E). The superintendent provided permission to conduct the study in the three high schools and to contact the principals for permission to interview the teachers within their respective schools as well as access technology facilitators' knowledge of their teachers' technology use and ability and use the curriculum specialists to conduct interviews at different high schools. Each principal provided permission to move forward with the study (Appendix F).

At this point, the researcher met face-to-face with the technology facilitators, explained the purpose of the study and the role the technology facilitators were being asked to fill. All technology facilitators agreed to assist with the study (Appendix G) by creating a list of teachers stratified by levels of use. The researcher explained the LoU instrument, and technology facilitators were asked to use their knowledge of their teachers' use of technology over the last 5 years of implementation to suggest teachers who represented as many levels, preferably all levels, as possible. This stratification allows a more comprehensive understanding of the teachers' processes at all levels of implementation.

Two weeks later, each technology facilitator compiled a list of 10 teachers with varying levels of use. The researcher met face-to-face with each technology facilitator to provide him/her with 11 information sheets (Appendix H) and consent forms (Appendix I). The researcher explained to each technology facilitator that he/she should meet face-to-face with each teacher on his/her list of potential participants; provide and explain the information sheet; and if the potential participants agreed to participate, explain the consent form and obtain the participant's signature. Each participant selected a 1-hour block of time in which the questionnaires and interviews would be conducted.

Technology facilitators provided each participant with a number, so a number rather than a name identified the participant for the remainder of the study.

Three of the 30 participants declined to participate. The technology facilitators from schools represented by those who declined provided replacements who were similar to the teachers who declined in level of use of technology implementation. All three alternates agreed to participate, resulting in 10 participants from each of the three high schools. The alternates obtained information and consent sheets as well as participation numbers in lieu of their names. Technology facilitators verified all signatures, sealed the consent forms in an envelope, and returned the envelope to the researcher. The researcher obtained a list of numbers identifying the participants from each school in an effort to minimize researcher bias.

During the following 2 weeks, one of the principals from the selected high schools volunteered to complete a pilot of the SoCQ with 39 of the 50 teachers employed at the school. From this pilot, the researcher realized the word "innovation," used throughout the questionnaire, required clarification for teachers before beginning the process. The researcher directed third-party interviewers to state, "You will see the use of the word 'innovation' throughout the questionnaire. It is referring to the one-to-one technology initiative your district has adopted." The second change, made as a result of the pilot, was a clarification of the word "concerns." Many teachers stated the word "concerns" conjured feelings of worry. Again, the researcher directed the third-party interviewers to state, "The questionnaire will ask you if you have concerns about certain aspects of the technology initiative. 'Concern' here is not defined by 'worries' but rather by areas that you focus attention on and seek out solutions." These two clarifications

were valuable to the execution of the SoC questionnaire with the selected participants for this study.

The researcher worked in conjunction with the district's technology facilitators to create the IC Map based on Puentedura's (2012) SAMR model and then piloted the survey with selected nonparticipants of the study in order to gauge the clarity and effectiveness of the questions. The technology facilitators requested changes to the examples provided for each level of SAMR to align with the facilitators' knowledge of what teachers most often use in the classroom in order to aid teacher identification of each level of SAMR. Additionally, the facilitators discussed a change in language to the open-ended questions in the IC Map questionnaire to create parallelism as well as a change to the font to italicize specific words that create important differences between questions to aid in clarity. At the time of the SOCQ pilot, five volunteers not involved in the study volunteered to complete the IC Map questionnaire and provide feedback concerning the clarity of the instrument. Volunteers offered no suggestions, and all five teachers reported being able to clearly understand and respond to each question. The resultant IC Map Survey is located in Appendix D.

The researcher trained three curriculum specialists in the use of all three CBAM instruments and, specifically, the LoU interview protocol (Appendix J). Additionally, these three curriculum specialists obtained CITI certification. These three curriculum specialists served as third-party interviewers who had no affiliation with their interviewees. The researcher provided the third-party interviewers with a process guide to ensure correct use of all protocols (Appendix K). Technology facilitators supplied the third-party interviewers with a list of participants, identified by number only, and the date

and time of the participants' appointments.

At the arranged time, the participants met with a third-party interviewer in the main conference room on the school site. During this 1-hour block, the participant took the SoCQ (Appendix A) and completed the LoU interview (Appendix C) and IC survey (Appendix D) to provide a comprehensive look at how this one teacher responded to the innovation. The researcher obtained permission from AIR to use all three CBAM instruments (Appendix L).

To begin, the interviewer provided the participant with the SoCQ, a cross-sectional survey purchased from SEDL who owns the CBAM instruments' rights. The researcher used the electronic format of the survey and made no modifications in order to maintain the integrity of the instrument. The electronic version of SoCQ collected, analyzed, and returned the data to the researcher. Again, the participant's assigned number was used for identification purposes throughout the process. The survey was not anonymous because the results of all three data instruments for each participant were amalgamated, using the participant's number, to provide a comprehensive understanding of that individual at his/her specific level of concern and use. This understanding illuminated the obstacles users experienced at each level and what resources were needed to move them forward. However, the technology facilitators were the only people involved in the study to know the participants' names, excluding the researcher who was given the participants' names in an envelope that was not opened until after the study was completed and who had no interaction with the participants during the process.

Once the SoCQ was complete, the participant remained in the main conference room, and the third party trained interviewer interviewed the same participant using the

LoU protocol questions. The LoU interview protocol was performed as written with no modifications or additions made by the researcher. The curriculum specialist recorded the interview to allow for later transcription and coding of themes. The answers to the protocol questions provided the participant's level of use of the innovation in his or her classroom, but, as importantly, provided qualitative data focused on the participant's perceived weaknesses and strengths in implementing technology, the obstacles he/she faced, and the resources he/she used to navigate those obstacles. Themes emerged, through the codifying process, from this qualitative data that allowed the researcher to answer the study's research questions.

After the participant completed the LoU interview, he/she took the IC survey. The researcher created an IC survey that utilized a Likert scale questionnaire to determine how well each teacher implemented technology in his/her classroom based on Puentedura's (2012) SAMR model, which is the fusion of TPACK, 21st Century framework, and ISTE standards. The critical components of the IC Map were the four tiers of the SAMR model, which demonstrate effective technology integration from least desirable to most desirable. For each tier, descriptions, characteristics, and examples delivered reminders to teachers of the differences among the tiers. In addition to the Likert scale, three qualitative questions allowed teachers to provide a better understanding of the quantitative data by explaining what obstacles kept them from implementing more effectively, what supports they used to overcome obstacles, and what supports still are needed to continue to the next level of implementation based on the SAMR model.

Because the IC survey requests teachers identify their own comfort level within

each area of the SAMR model, the results of the survey remain completely reliable to the teachers' opinions of themselves. The IC Map does not attempt to determine the validity of these opinions in any way, as the purpose is to identify teacher beliefs about their own technology use and needs. Information from the IC survey provided the researcher with answers to the questions of what obstacles are impeding progress into a full implementation as defined by the modification and redefinition tiers of the SAMR model and how teachers have navigated those obstacles to attain integration of technology in these top two tiers.

The previously explained procedures were repeated with each of the 30 participants (10 from each high school) to provide a comprehensive understanding of how teachers at all levels of implementation feel about the innovation, how they behave in concert with the innovation, and how effective that behavior is in reaching a "true" technology implementation that provides students with educational experiences indicative of fostering innovative and analytical mindsets.

All interviews transpired within 2 weeks. The third-party interviewers downloaded all audio files to a flash drive and gave the flash drive to the researcher. An outside agency transcribed the audio files.

The researcher completed a first, or general, read to obtain an understanding of the participants' responses as a whole and to add marginal notes identifying the following themes that relate directly to the research questions: strengths, weaknesses, obstacles, solutions for obstacles, and resources needed. This process illuminated the fact that certain LoU questions pertained to certain research questions; therefore, the researcher sorted the transcription by question and grouped by the themes identified. For example,

using a spreadsheet, all questions relating to strengths were grouped together, all relating to weaknesses were grouped, etc.

The researcher completed a second read focused on identifying key phrases within participant answers. These key phrases were color-coded in order to locate key phrases easily and to confirm the accuracy of the question sorting completed during the initial read. Red signified all key phrases reporting strengths, blue signified all weaknesses, orange signified obstacles, purple signified solutions to obstacles, and green signified resources needed.

After identifying all key phrases, the researcher began the coding process by using a word or words to represent the meaning of the key phrases. Creswell (2014) defined coding as "the process of organizing the data by bracketing chunks (of text or image segments) and writing a word representing a category in the margins" (pp. 197-198). For instance, one participant's key phrase color-coded red (strength), "to have access to a wealth of information students can use to complete products," was coded "access to information." These codes were added to the spreadsheet in a column after the identified key phrases.

Through the process of coding key phrases, themes such as access to resources (emerging from key phrases such as the one identified in the previous paragraph), classroom procedures, student behavior, and balance of digital and print media emerged. These themes allowed for quantifying the qualitative data in order to make generalizations and comparisons among participant responses.

A technology facilitator completed crosschecking of the two lengthiest interviews from each school to provide intercoder agreement concerning the codes identified and

themes assigned to those codes. The only discrepancy found during this process was whether to code teacher lack of knowledge and student lack of knowledge separately, so the researcher did not request more crosschecking of codes/themes.

After the researcher completed all coding and identification of themes, the technology facilitator crosschecked the last two interviews in each school to ensure no drift in the definition of codes. No drift was identified.

The researcher replicated the process described for transcribing, reading, analyzing, and coding qualitative data from the LoU interviews for the open-ended questions within the IC Map Questionnaire as well.

Because of the sheer volume of data collected, Table 1 clarifies how each CBAM instrument informs the research questions.

Table 1

Research Questions Informed by CBAM Instrument

Research Question	SoC	LoU	IC
1: How have high school teachers in a rural NC district implemented the one-to-one laptop initiative?	X	X	X
2: What obstacles are these teachers facing in moving up the implementation model to provide instruction that is more effective?		X	X
3: What methods are teachers using to overcome these obstacles?			X
4: What supports do teachers need in order to move into the upper tiers of the implementation model?		X	X

Limitations and Delimitations

A limitation of this study was the relatively small sample of participants. As this study took place in one district, a variety of variables specific to this area, such as the district's allocation of resources to this initiative, student and teacher demographics, and

availability of technology resources prior to the innovation, may have influenced the outcomes. Ideally, this study would be more effective if it encompassed more districts with a wider range of geographic locations, demographics, finances, pre-implementation technology availability, and professional development options. However, as there are so few studies concerning mature one-to-one adoptions, its findings may contribute to the overall body of literature.

This study is not an evaluation of the one-to-one adoption. The researcher did not focus on student learning or characterizing the effectiveness of teacher development in such terms. Rather, the researcher examined how change is adopted and what obstacles and supports hinder or aid in that adoption. So, while a second limitation of this study was the researcher's role as an assistant principal in this district and the researcher's bias as a participant in the implementation of this innovation, measures were enacted to limit that bias and/or influence. Technology facilitators chose participants, informed participants of the study, obtained participant consent, and transferred participant names to numbers that were used throughout the process in lieu of participant names. The technology facilitators provided the researcher with a list of participants by their numbers, and all consent forms were sealed in an envelope which the researcher opened only after all research had been completed and analyzed. Third-party interviewers, who had no affiliation with the teachers' respective schools, conducted all data collection. Although technology facilitators informed potential participants and participants of the researcher's name when they conducted the initial information session, the researcher was not present for any part of the study in which participants were present. Technology facilitators vetted the IC Map questionnaire, made needed changes to improve its validity,

and crosschecked coding accuracy and possible definition drift during the coding process.

According to Creswell (2014), "If themes are established based on converging several sources of data or perspectives from participants, then this process can be claimed as adding to the validity of the study" (p. 201). The triangulation of all three CBAM instruments used in this study examined the emerging themes from both quantitative and qualitative data but also from different perspectives: affective, behavioral, and effective. While backyard research is a significant limitation to any study, this particular study focuses on an examination of what techniques have allowed teachers to move forward in this adoption rather than an evaluation of teacher skills or abilities. For this reason, the researcher was vested in finding answers as to how to move forward in this adoption rather than evaluating the adoption.

A delimitation of this study includes the use of a preselected group of participants intentionally chosen to provide perspectives from all levels of use of the technology implementation. The result of this selection does not reflect or even identify the number of teachers at each level within the district; therefore, understanding what percentage of teachers across the district fit into each stage of concern, level of use, or tier of SAMR is implausible. While this would be valuable information to know, these data would be collected in pursuit of a program evaluation—an excellent next step for this district but not within the scope of this study. The researcher chose to focus on this small group of preselected teachers in order to provide detailed information as to the intricacies of the interaction between the three facets of change as an avenue of better understanding the phenomena teachers experience at this stage of implementation.

A second delimitation of this study concerns the population studied. The one-to-

one implementation involved middle school teachers as well; however, the researcher chose not to study this population of teachers because, as is mentioned in the literature review, middle and high school teachers have very different concerns. Middle school teachers' concerns, efforts, obstacles, and successes in the one-to-one initiative provide excellent fodder for future research.

Conclusion

This study is an examination of the change process of this district's technology adoption that reveals understandings to inform future professional development for the district as well as to inform districts in the initial stages of one-to-one adoptions about the roadblocks and supports needed to continue the trek toward that true marriage of instruction and technology so needed by today's students. Findings from this study provide insights and opportunities for continued research in the context of mature one-to-one adoptions and add to a body of literature that is currently lacking. Chapter 4 reports the findings of the data collection process organized by research question. The data are presented by individual instrument, then collectively in a side-by-side comparison.

Chapter 4: Results

Introduction

The purpose of this study was to examine the change process teachers experience during a technology adoption in an effort to understand how effective technology implementation comes about, what obstacles must be navigated, and what resources are needed for that navigation. Research indicates most implementations take 3-5 years to reach completion (Hord et al., 1987); hence, this study observed three traditional high schools 5 years after the initial introduction of one-to-one technology. The participants in this study provided data about a mature technology implementation at this recognized milestone for completion. The scant research on mature technology adoptions benefits from the data gathered within this study. Findings may be used to inform needs assessments for professional development planning and resource attainment. Data may also afford an understanding of best practices for moving into an effective technology implementation delivering high-quality lessons to students that intersect 21st century skills with collaboration and constructive problem-solving activities indicative of schools promoting innovation and invention.

This study of a mature one-to-one technology adoption in a rural district in North Carolina sought to answer the following questions:

1. How have high school teachers in a rural North Carolina district implemented the one-to-one laptop initiative?
2. What obstacles are these teachers facing in moving up the implementation model to provide instruction that is more effective?
3. What methods are teachers using to overcome these obstacles?

4. What supports do teachers need in order to move into the upper tiers of the implementation model?

The convergent parallel mixed methods design used in this study provides both qualitative and quantitative data analyzed separately in a side-by-side comparison (Creswell, 2014, pp. 219, 222) and then merged to develop a fuller understanding of high school teacher behaviors 5 years after the inception of a one-to-one technology adoption in a rural North Carolina district. Based on Hord et al.'s (1987) CBAM, data were collected from (a) the SoCQ providing data on teacher emotional concerns, (b) the LoU independent focused interviews providing data on teacher behavior, and (c) the IC Map survey providing data on teacher utilization of the innovation. Each instrument delivers distinctly different information, which is independent of and does not inform the other instruments. While these instruments are independent of one another, the aggregation of all three data types allows the researcher to "merge quantitative and qualitative data in order to provide a comprehensive analysis of the research problem" (Creswell, 2014, p. 15). The amalgamation of these data follows the examination of the results of each of the instruments and is organized by the research questions posed in this study.

Findings

Research Question 1. How have high school teachers in a rural North Carolina district implemented the one-to-one laptop initiative? All three CBAM instruments inform this question from different perspectives: The SoCQ provides insight into participants' affective, or emotional, concerns about the innovation; the LoU focused interview identifies the behavioral aspect of teachers' level of implementation of technology; and the IC Map survey examines the comfort level of teachers moving

among the levels of Puentedura's (2012) SAMR model where the marriage of technology, content, and pedagogy occur. Data obtained from each instrument relating to Research Question 1 will be presented separately followed by an examination of all three instruments in concert.

SoCQ. The researcher tasked technology facilitators from each of the three high schools involved in this study with identifying 10 teachers from each of their respective high schools who represented as wide a spectrum as possible of teacher implementation of technology. The technology facilitators' observations of and interactions with the teachers over the first 5 years of the adoption process informed their selections of teachers with varied levels of use as defined by Hall et al.'s (2006) LoU (Figure 4).

A third party curriculum specialist, unassociated with the high school and trained in the execution of the CBAM instruments, allocated each of the teachers a computer and a link to the electronic version of the SoCQ. The 35 items in the instrument utilize a Likert scale to determine which stages of concern each teacher identifies with most closely in an effort to offer insight into the teacher's emotional concerns about the innovation. Based on participant responses to the SoCQ, SEDL generated a report detailing scores for each participant in all stages of concern. This process occurred at all three high schools.

The SoCQ results in this study deliver a detailed snapshot of teacher concerns 5 years into the technology adoption. For this reason, peak stage scores and profile interpretations inform this study (an interpretation of first and second stage scores is redundant where a profile interpretation is provided).

The purposive, stratified sample of participants intentionally selected teachers

possessing a wide range of levels of use of technology within the classroom. Table 2 offers data based on participant peak scores to determine where these participants fall within the SoC ranges.

Table 2

SoCQ: Peak Score Interpretation

Stages of Concern	Participants with Peak Scores	Percentage of the Participants
Stage 0	12	40%
Stage I	2	6.7%
Stage II	7	23.3%
Stage III	5	16.7%
Stage IV	1	3.3%
Stage V	3	10%
Stage VI	0	0%

Table 3 defines the meaning of these stages as it pertains to participant concerns about the technology. The majority of participants rank within the self-concerns category. Technology facilitators chose these participants to represent a wide range of technology use in the classroom, a measurement of behavior. The SoC measures emotion; therefore, the stratification that exists for LoU does not apply to SoC. As well, these percentages are representative of the participants in this study and do not correlate to the population as a whole.

Table 3

SoCQ: Percentage of Participants per Concerns Category

Stages of Concern	Concerns Category	Percentage of Participants
Stage 0-II	Self: unconcerned or concerned about how the innovation will/does affect them personally	73.3%
Stage III	Task: concerned about the everyday tasks involved in implementing the innovation	16.7%
Stage IV-VI	Impact: concerned about how the innovation will affect their students	13.3%

Hord et al. (1987) stated there are always participants at all levels of implementation regardless of the amount of time the innovation has been in place (p. 5). Nonetheless, given that this innovation has been realized for 5 years, it is also important to heed George et al.'s (2006) warnings against making predictions based solely on highest stage percentage (p. 31), as myriad events have occurred in 5 years that lead to varying concerns identified only through an analysis when all stage scores are taken into consideration within a SoCQ Profile Interpretation.

In Chapter 5 of *Measuring Implementation in Schools: The Stages of Concern Questionnaire* (George et al., 2006, pp. 33-54), descriptive analyses of all seven stage scores are provided to create the profile interpretation. These descriptive analyses were transferred to each participant's full stage score report, resulting in the SoCQ Profile Interpretation (Appendix M). Appending the SoCQ Profile Interpretation became necessary as the amount of detail in the interpretation compromised readability. The results of this profile interpretation inform the results discussion below.

While the majority of teachers' highest stage score was 0, the analyses of all stage scores for these teachers (Appendix M) provide wide-ranging attitudes within this stage:

nonusers who have no desire to use technology, nonusers who are open to and willing to learn about technology integration, users who are not invested in the innovation because they have uneasiness about the management aspects of the innovation, users who are neutral in their emotional responses to the innovation but do have some self concerns, and users who have implemented technology and feel they do not have anything else to learn (pp. 47-48). This wide range of teacher responses in one single stage demonstrates the sophistication of the change process and the uniqueness of each individual's reaction to change. Additionally, George et al. (2006) warned of the variance among Stage 0 scores (p. 22) as discussed in the Reliability and Validity of Instruments section in Chapter 3. This warning reinforces the need to examine all stage scores to obtain a more accurate understanding of participant concerns.

At the same time, Hord et al.'s (1987) tenants of change explained the change process as an individualized journey where no two people have the same experiences or react the same way to those experiences (p. 6). This phenomenon materializes in Stage II participants, which is second only to Stage 0 in number of participants.

Table 4

SOCQ: Profile Interpretation of Peak Stage II Scores

Participant #	Participants' Full Stage Scores	Profile Interpretation of Full Stage Scores
1301	2(70), 6(57), 3(47), 4(38), 0(31), 5(25), 1(19)	The high Stage 2 score coupled with a low Stage 1 score indicates "self" concerns. This person may be more negative toward the innovation and generally is not open to more information about it. However, the high Stage 6 score indicates that this lack of desire for more information is because the person feels that he/she already knows all about the innovation and has plenty of ideas for improving the situation.
1401	2(76), 3(73), 1(63), 6(57), 4(43), 0(40), 5(28)	High Stage 2 suggests the respondent has intense personal concerns about the innovation and its consequences for him/her. Although these concerns reflect uneasiness regarding the innovation, they do not necessarily indicate resistance. High Stage 3 scores indicate concerns about logistics, time, and management. And, high Stage 1 scores indicate a person who wants more information about the innovation.
1407	2(83), 1(80), 0(75), 5(59), 4(48), 6(30), 3(27)	The high Stage 2 score suggests that respondents have intense personal concerns about the innovation and its consequences for them. Although these concerns reflect uneasiness regarding the innovation, they do not necessity indicate resistance. The high Stage 1 score indicates a person who wants more information about the innovation.
1408	2(45), 5(28), 6(26), 1(19), 3(15), 4(13), 0(7)	Low Stage 1/high Stage 2 indicates a person who has self-concerns. These individuals may be more negative toward an innovation and generally not open to information about it. High Stage 5 suggests concerns about working with others in relation to use of the innovation. High Stage 6/low Stage 1 indicates a person who is not interested in learning more about the innovation. The person is likely to feel that he or she already knows all about the innovation and has plenty of ideas for improving the situation.

(continued)

Participant #	Participants' Full Stage Scores	Profile Interpretation of Full Stage Scores
1501	2(67), 6(65), 1(51), 5(40), 4(38), 3(27), 0(14)	The high Stage 2 score suggests that respondents who have intense concerns about the innovation and its consequences for them. Although these concerns reflect uneasiness regarding the innovation they do not necessarily indicate resistance. A high Stage 6 score Tailing Up for nonusers suggests the person has strong ideas about how to do things differently. These ideas may be positive, but are more than likely to be negative toward the innovation. The high Stage 1 score does indicate someone who wants more information about the innovation. Additionally, the low Stage 0 score suggests an intense involvement with the innovation.
1506	2(59), 1(48), 6(38), 3(34), 5(28), 4(27), 0(22)	The high Stage 2 suggests that respondents have intense personal concerns about the innovation and its consequences for them. Although these concerns reflect uneasiness regarding the innovation, they do not necessarily indicate resistance. The high Stage 1 score indicates a person who wants more information about the innovation. The high Stage 6 Tailing Up suggests the person has strong ideas about how to do things differently. These ideas may be positive, but are more likely to be negative toward the innovation. However, the low Stage 0 indicates intense involvement with the innovation.
1509	2(92), 1(90), 6(87), 4(76), 3(47), 5(40), 0(14)	The high Stage 2 score suggests that respondents have intense personal concerns about the innovation and its consequences for them. Although these concerns reflect uneasiness regarding the innovation, they do not necessarily indicate resistance. The high Stage 1 score indicates a person who wants more information about the innovation. The Stage 6 Tailing Up score suggests the person has strong ideas about how to do things differently. These ideas may be positive but are more than likely to be negative.

Generically, Stage II scores indicate an individual who is uncertain about the demands of the innovation and his/her ability to meet those demands as well as the implications the innovation has for him/herself personally (George et al., 2006, p. 8); yet

the descriptive analyses of the full stage scores for participants in Stage II, provided by George et al. (2006, pp. 33-54), demonstrate wide variations as seen in Table 4. Participants range from not being interested in learning anything else about the innovation because they feel they already know what they need to know, to being interested in learning more about the innovation because they have some concerns that are causing them frustration, to being interested in learning more about the innovation because they are frustrated with it but have ideas on how to improve it. The range of emotions participants evoke include negativity, positivity, and unease. Despite this gamut of concerns, all participants in this stage focused on how this innovation affected them personally.

A summary of themes found within the Profile Interpretation (Appendix M) allow for a condensed view of the concerns illuminated by the more detailed analysis of full stage score profiles. The number of participants within each SoC whose profile interpretation includes the respective theme is given in Table 5.

Table 5

SoCQ: Profile Interpretation Themes

Themes	Stage 0	Stage I	Stage II	Stage III	Stage IV	Stage V	Stage VI
Number of participants in stage	12	2	7	5	1	3	0
Self concerns	5	-	7	1	-	-	-
Task (management) concerns	3	1	1	4	-	-	-
Impact concerns	-	-	-	1	1	1	-
More information	4	2	5	1	-	-	-
No more information	2	-	3	-	-	-	-
Knows all about innovation	3	-	2	-	-	-	-
Concerns about collaboration	1	-	1	1	1	3	-
Collaboration	1	2	-	-	-	-	-
Not concerned with innovation	11	-	-	1	-	1	-
Involved with innovation	-	2	2	1	1	2	-
Not threatened by innovation	1	-	-	1	-	1	-
Positive	2	-	-	1	-	-	-
Uneasy	4	-	5	1	-	-	-
Negative	1	-	5	2	-	1	-
Ideas to improve	2	-	5	3	-	1	-

Holistic analyses of the themes emerging from the SoCQ profile interpretation reveal a couple of points worth considering: (a) Self-concerns and task or management concerns often overlap and were present in this study, to some degree, from Stage 0 through Stage III; (b) Concerns about collaboration or interest in collaboration occurred in every stage (except Stage VI, which is not represented); and (c) 11 of the 12 participants in Stage 0, and thus 11 of the 30 total participants, claimed no concern for the innovation. However, analyses of this stage provide a richer understanding of participant concerns within Stage 0, contradicting the label of unconcerned for some of the participants.

Stage I participants are involved in the innovation, want more information, and are interested in collaboration. Stage II participants responded in such a way as to suggest they have uneasy and/or negative feelings toward the innovation with concerns about how the innovation affects them personally, yet they are interested in obtaining

more information about the innovation. The data for participants in Stage III suggest they are most concerned with management of the innovation and have ideas about how to improve the innovation. Stage V participants are involved in the innovation and are interested in collaboration. The lack of participants represented in Stages IV and VI results in little relevant data where profile interpretation is concerned.

It is important to keep in mind that these holistic profile interpretation findings should be examined with some caution. George et al. (2006) warned that the change process is an individual journey, and profile interpretations are individualized accounts of that journey (p. 37); therefore, while obtaining holistic themes of similarity among participants within the same stage may have value, the intended value of the profile interpretation is to the individual.

Levels of Use (LoU). The researcher trained three unaffiliated curriculum specialists to conduct the LoU interview protocol, which was administered immediately after the 30 selected teachers completed the SoCQ at their prearranged appointments. Participant interviews ranged in time from 5 minutes 23 seconds to 43 minutes 5 seconds. Interviewers asked participants branching questions dependent upon their answers; and participants were allowed to expound, as they desired. As described in detail in Chapter 3, the interviews were recorded, transcribed, and coded to identify themes. A technology facilitator crosschecked the coding for intercoder agreement and to eliminate definition drift. Table 6 presents the number of participants who qualified in each LoU category, based on respondent answers.

Table 6 records three of the 30 participants as self-reported nonusers. Because these teachers were intentionally chosen by the technology facilitators for their respective

schools as being representative of this category, it stands to reason three teachers involved in this study would be nonusers; yet no correlation may be made as to the number of nonusers who exist within the district where this innovation was adopted as this is not a random sampling but a purposive sampling intended to give a clearer understanding of why they are nonusers, what obstacles they have encountered, and what resources might assist them in moving forward with the innovation.

Table 6

LoU: Number of Participants in Each Level

Level of Use	Number of Participants	Levels of Use Description
0	3	Nonuse: State in which the user has little or no knowledge of the innovation, has no involvement with the innovation, and is doing nothing toward becoming involved.
I	0	Orientation: State in which the user has acquired or is acquiring information about the innovation and/or has explored or is exploring its value orientation and its demands upon the user and the user system.
II	1	Preparation: State in which the user is preparing for first use of the innovation.
III	7	Mechanical Use: State in which the user focuses most effort on the short-term, day-to-day use of the innovation with little time for reflection. Changes in use are made more to meet user needs than client needs. The user is primarily engaged in a stepwise attempt to master the tasks required to use the innovation, often resulting in disjointed and superficial use.
IVA	4	Routine: Use of the innovation is stabilized. Few if any changes are being made in ongoing use. Little preparation or thought is being given to improving innovation use or its consequences.
IVB	4	Refinement: State in which the user varies the use of the innovation to increase the impact on clients within immediate sphere of influence. Variations are based on knowledge of both short- and long-term consequences for clients.
Vf	9	Integration: State in which the user is combining own efforts to use the innovation with the related activities of colleagues to achieve a collective effect on clients within their common sphere of influence.
VI	2	Renewal: State in which the user reevaluates the quality of use of the innovation, seeks major modifications or alternatives to present innovation to achieve increased impact on clients, examines new developments in the field, and explores new goals for self and the system.

Only one participant exists in levels I and II. With the number of years the innovation has been in place, this is understandable but, unfortunately, supplies little understanding of teacher behavioral states at these levels.

The number of participants in LoU III, IV, and V are fairly even at 7, 8, and 9 respectively. Based on Hall et al.'s (2006) definition of LoU, participants in LoU III use technology sporadically and at a superficial level, whereas participants in LoU IV have made technology use part of the daily routine. LoU IV splits into IVA and IVB because a

significant change takes place as users move from nonreflective to reflective practitioners, determining what is best for their students and making needed changes. At LoU IVB, V, and VI, participants begin to reflect upon the consequences of the innovation on their students, collaborate with colleagues, and make changes to improve the innovation (Hord et al., 2006, p. 9).

Based on LoU data, 19 of the 30 teachers (63.3%) scored within LoU IV-VI. This percentage cannot be ascribed to the population as a whole, but it does inform the results of Tables 5, 6, and 7 as the majority of themes emerging from coding participant responses came from teachers with more advanced levels of technology use.

Table 7 presents the themes that resulted from the LoU interviews pertaining to the strengths of the innovation. The table is organized by the LoU in order to understand how these characteristics are specific to each level of use. The following themes emerged through the process of coding teacher responses to the LoU interview questions. A range of participant responses defines each theme concerning strengths of the innovation.

- Access: This theme encompasses responses by teachers such as "more/easier access to student and teacher resources not available [before the innovation]," "resources that align with the curriculum standards," "apps and simulations," "more interactive and hands-on resources/activities," and "current/up-to-date resources."
- Autonomy: This theme encompasses responses by teachers such as "students may utilize tools on the computer to improve areas of weakness they are concerned with" and "students are held accountable for their own progress

with the number of programs that constantly monitor their levels of achievement."

- Choice: This theme encompasses responses by teachers such as "more options for projects and products for students to complete" and "access to more and different formats of learning outside the classroom for students to choose from."
- Communication: This theme encompasses responses by teachers such as "easier for students to submit work" and "clearer understanding of students' grades and feedback by parents because of Canvas (program that houses student assignments, grades/feedback, and communication portals)."
- Efficiency: This theme encompasses responses by teachers such as "makes grading easier" and "students receive feedback quicker and it is more individualized."
- Engagement: This theme encompasses responses by teachers such as "reaches students who were not interested in school before" and "improves student engagement."
- Equality: This theme encompasses responses by teachers such as "all students have access to the same resources" and "I don't have to worry about whether all of my students have the materials needed to complete assignments."
- Preparedness: This theme encompasses responses by teachers such as "students will be more prepared for the workplace" and "they have learned how to be more critical thinkers and how to vet resources for credibility."

Table 7

LoU: Identification of Strengths

Level	Strengths	Number of Participants Reporting
0	Access	1
	No comment	2
I	Not represented	
II	Access	2
	Communication	1
III	Access	7
	Communication	2
	Efficiency	1
	Equality	1
	Preparedness	3
IVA	Access	4
	Equality	1
	Preparedness	1
IVB	Access	2
	Autonomy	2
	Communication	1
	Efficiency	1
	Equality	1
V	Access	4
	Autonomy	2
	Choice	3
	Communication	2
	Efficiency	1
	Engagement	2
	Preparedness	6
VI	Access	2
	Communication	1
	Efficiency	1

Access, preparedness, and communication surfaced as the three most prevalent strengths of the technology implementation. Access to resources is the one strength present in every LoU and is mentioned by 20 of the 30 participants. This theme

encompasses responses by teachers such as “more/easier access to student and teacher resources not available [before the innovation],” “resources that align with the curriculum standards,” “apps and simulations,” “more interactive and hands-on resources/activities,” and “current/up-to-date resources.”

Preparedness occurs in three levels (LoU III, IVA, V) by 10 participants. This theme encompasses responses by teachers such as “students will be more prepared for the workplace” and “they have learned how to be more critical thinkers and how to vet resources for credibility.”

Communication appears in five of the seven levels represented (not LoU 0 or IVA) and is identified by seven participants. This theme encompasses responses by teachers such as “easier for students to submit work” and “clearer understanding of students’ grades and feedback by parents because of Canvas (program that houses student assignments, grades/feedback, and communication portals).”

The information provided in Table 8 pertains to the weaknesses of the innovation identified by teachers during the LoU interviews. The following themes emerged concerning the weaknesses of the one-to-one technology initiative:

- Classroom Management: This theme encompasses responses from teachers such as “difficult to keep students on task,” “increased instances of cheating,” and “I [teacher] have difficulty preparing separate lessons for students who are nonusers.”
- Learning: This theme encompasses responses from teachers such as “they [students] are using Google and not their brains,” “There should be balance. Sometimes they need to read—and feel—smell—the actual pages in a book,”

and "This class is hands-on. Students should be welding, not watching a video about welding."

- Teacher Knowledge: This theme was mentioned only once and referred to a nonuser who stated, "You just can't teach a 70 year-old dog new tricks."
- Technical Issues: This theme encompasses responses from teachers such as "the Internet is often glitchy," "technical issues," and "I have concerns about students who get home and don't have Internet or have unreliable Internet."

Table 8

LoU: Identification of Weaknesses

Level	Weaknesses	Number of Participants Reporting
0	Classroom Management	1
	No comment	1
	Teacher Knowledge	1
I	Not represented	
II	Classroom Management	1
III	Classroom Management	3
	Learning	3
	No Comment	1
	Technical Issues	1
IVA	Classroom Management	4
	Learning	1
IVB	Classroom Management	3
	Learning	2
V	Classroom Management	6
	Learning	2
	Technical Issues	2
VI	Classroom Management	1
	No Comment	1

Classroom management was the weakness identified by all LoU and comprised 19 of the 30 responses or 61% of all respondents. This theme encompasses responses from teachers such as "difficult to keep students on task," "increased instances of cheating," and "I [teacher] have difficulty preparing separate lessons for students who are nonusers."

Respondents identified the second most prevalent weakness under the theme of learning with eight responses representing all levels except nonusers and Levels I and VI. Learning encompassed responses from teachers such as "they [students] are using Google and not their brains," "problems with copying and plagiarism have increased," "There should be balance. Sometimes they need to read—and feel—smell—the actual pages in a book," and "This class is hands on. Students should be welding, not watching a video about welding."

Teachers provided 55 responses when asked to name strengths of the innovation, and teachers provided 31 responses when asked to name weaknesses of the innovation.

Table 9 depicts the successes teachers reported, during the LoU interviews, in their interactions with the one-to-one implementation. The following themes were identified after coding teachers' recorded responses:

Successes for Teachers

- Access to Resources: This theme encompasses responses from participants such as "Strengths would be that it gives students access to internet resources" and "A strength is being able to do things like journeys through the body. They can actually pull up things and be able to do podcasts and different kind of iMovies, keynote presentations, being able to add speech to it. We can do

movie gallery walkthroughs and different things like that that they can actually investigate further the information that I've taught them. I really like that."

- Alignment to Standards: This theme encompasses responses from participants such as "I have access to databases online where I can pull final typed questions for each unit in each topic we cover … and that test is directly in line with our standards that we're required to teach, and that helps a lot with preparing students for their final exams" and "lesson plans created more efficiently and better aligned to curriculum standards."
- Analytical Feedback: This theme encompasses statements from participants such as "instant feedback for the kids, the analysis and breakdown of what students know and don't know is extremely helpful and something that would have taken so much time before."
- Balance of Digital and Print: This theme encompasses statements from participants such as "A balance between technology and print is critical, so I ask my students, 'Did this work? How did it work for you? Was this something that we should try again?'" and "When I do use technology, they're [students] appreciative of being able to do that. However, I think they still see the value that I consider being able to open the book too."
- Classroom Procedures: This theme encompasses statements from participants such as "I've stepped up my own classroom procedures to … If there are any lecture based periods … I use the LanSchool programs" and "I've changed up my own classroom procedures to limit distractions, whether it's in the lunch

times [with other teachers] or just kind of talking around and discussing different topics [with other teachers], I've learned different methods to teach using the Macbooks in class."

- Collaboration: This theme encompasses statements from participants such as "Collaboration with other teachers and the ITF is critical to success" and "Peer observations and collaboration with others has been the most important professional development."
- Educational Philosophy: This theme encompasses responses from participants such as "My philosophy has changed – students are working together more and they get multiple attempts and fewer assignments are actually graded."
- Efficiency: This theme encompasses responses from participants such as "instant feedback" and "ease of grading."
- Leadership: This theme encompasses responses from participants such as "I enjoy presenting at conferences about the successes I've had with the one-to-one."
- Professional Development: This theme encompasses responses from participants such as "Our technology person [ITF], every few weeks, offers us an optional professional development about a different kind of educational technology" and "I feel that we have had a tremendous amount of professional development that has eased us into using the MacBooks to where we have tons of resources available, and we know who we can go to to find more."
- Resources: This theme encompasses responses from participants such as "I have one class where it is more of a self-paced, self-taught [class] where they

are able to use videos for the lessons, take assessments through different websites. That can help them go more in-depth and they are able to spend the time needed to focus more on that one topic" and "In virtual labs, I can present information to students via college collaborations that would never have been available to us any other way."

Successes for Students

- Access to Resources: This theme encompasses responses from participants such as "the range of innovation I've seen in students' products was not possible before [the technology implementation] because students didn't have access to the resources necessary."
- Choice: This theme encompasses responses from participants such as "I have become more structured in order to give students more options—this happens with classroom procedures, options for how to submit a product, what that product looks like."
- Collaboration: This theme encompasses responses from participants such as "students are working together more" and "It [innovation] opened up so many doors for us in terms of how we can approach teaching and the different tools that we have available to us to make learning more interactive for students, so they are collaborating with each other to solve real world problems."
- Deeper Learning: This theme encompasses responses from participants such as "The content that I have to teach to keep my students on track is so much deeper than before technology, I spend less time grading a bunch of papers and more time having the students work with the information via different

programs" and "students have learned to use the technology on a deeper level to find information to make their points during discussion."

- Engagement: This theme encompasses responses from participants such as "It seems to reach them [students] a lot better when they'll [YouTube] show things that I can't show, like reactions for example, that are too dangerous to show in the classroom" and "I can use apps and simulations to demonstrate statistical procedures and Kahoot and Flipquiz to make sure they [the students] know the material and they stay tuned in to what is happening in the classroom."
- Innovation: This theme encompasses responses from participants such as "the range of innovation I've seen in students' product has seriously improved."
- Preparation: This theme encompasses responses from participants such as "I don't have any hard data, but I do know every year it seems like the things that I've had to teach a lot more the previous year are things that they now are comfortable and familiar with" and "I see that they're more involved and they're thinking more critically. I feel I can prepare them better for life after high school."
- Student Independence/Self-Advocacy: This theme encompasses responses from participants such as "I think kids understand more that they can be their own teacher, in some ways. They have the tools" and "the technology has allowed me to meet individual students' learning needs in a way that I have never been able to before, which is huge considering our populations continue to diversify. But, not only that, I can teach students how to read the feedback

they are getting and find resources that will allow them to help themselves in ways that were never before possible.”

Table 9

LoU: Identification of Successes

Level	Successes	Number of Participants Reporting
0	No comment	3
I	Not represented	
II	Teacher: Classroom Procedures	1
	Teacher: Collaboration	1
	Student: Engagement	1
	Student: Innovation	1
III	Teacher: Access to Resources	2
	Teacher: Alignment to Standards	1
	Teacher: Classroom Procedures	3
	Teacher: Collaboration	3
	Teacher: Efficiency	1
	Student: Engagement	2
	Teacher: Professional Development	2
IVA	Teacher: Balance of Digital and Print	2
	Student: Choice	1
	Teacher: Classroom Procedures	2
	Student: Collaboration	1
	Teacher: Collaboration	2
	Student: Preparation	1
	Teacher: Professional Development	1
IVB	Teacher: Access to Resources	1
	Student: Access to Resources	1
	Teacher: Analytical Feedback	1
	Teacher: Balance of Digital and Print	1
	Teacher: Classroom Procedures	3
	Teacher: Collaboration	3
	Student: Deeper Learning	1
	Student: Engagement	1
	Student: Independence and Self-Advocacy	1
	Teacher: Professional Development	1

(continued)

Level	Successes	Number of Participants Reporting
V	Teacher: Access to Resources	2
	Student: Access to Resources	2
	Teacher: Analytical Feedback	1
	Teacher: Balance of Digital and Print	1
	Student: Choice	2
	Teacher: Classroom Procedures	3
	Student: Collaboration	1
	Teacher: Collaboration	3
	Student: Deeper Learning	3
	Teacher: Educational Philosophy	1
	Teacher: Efficiency	1
	Student: Engagement	3
	Teacher: Leadership	1
	Student: Preparation	1
	Teacher: Reflection	1
VI	Teacher: Classroom Procedures	1
	Student: Collaboration	1
	Teacher: Collaboration	1
	Teacher: Efficiency	1
	Student: Independence/Self-Advocacy	1
	Teacher: Individualization of Instruction	1

In Table 9, the successes reported during the LoU interviews are categorized into *Successes for Teachers* and *Successes for Students*. Three themes stood out based on the quantity of participant responses.

Teacher: Classroom Procedures and *Teacher: Collaboration* responses are present at all LoU with 13 of 30 and 12 of 30 teacher responses, respectively. *Teacher: Classroom Procedures* encompasses statements from participants such as “I've stepped up my own classroom procedures to … If there are any lecture-based periods or anything I use the LanSchool programs” and “I’ve changed up my own classroom procedures to limit distractions, whether it's in the lunch times [with other teachers] or just kind of talking around and discussing different topics [with other teachers]. I’ve learned

different methods to teach using the Macbooks in class." *Teacher: Collaboration* encompasses responses from participants such as "collaboration with other teachers and the ITF is critical to success" and "peer observations and collaboration with others has been the most important professional development."

Teachers identified *Student: Engagement* as a success in all but two levels (LoU IVA and VI) with seven of 30 teachers' comments. *Student: Engagement* encompasses responses from participants such as "It seems to reach them [students] a lot better when they'll [YouTube] show things that I can't show, like reactions for example, that are too dangerous to show in the classroom" and "I can use apps and simulations to demonstrate statistical procedures and Kahoot and Flipquiz to make sure they [the students] know the material and they stay tuned in to what is happening in the classroom."

IC Map. The IC Map's purpose is to describe the innovation in action, how teachers are actually using the innovation within the classroom. This school district adopted Puentedura's (2012) SAMR model as the gauge and goal for full implementation within the classroom and, thus, was utilized as the IC map for this study. The researcher and three technology facilitators for the county created the IC Map utilizing the SAMR model and providing descriptions, characteristics, and examples of each level of SAMR to assist teachers in answering six questions about each level (Appendix D):

1. How comfortable are you with teaching students how to complete assignments at the [substitution, augmentation, modification, redefinition] level?
2. How comfortable are you with asking students to complete assignments at the [substitution, augmentation, modification, redefinition] level?
3. How often do you require students to complete assignments in each category?

4. What obstacles have you encountered at the [substitution, augmentation, modification, redefinition] level?
5. Did you overcome those obstacles, and if so, how?
6. If you did not overcome the obstacles, what resources do you need to be able to do so?

Interviewers provided the IC Map to teachers after completing the LoU interviews, explained the IC map to each participant, and answered participant questions. Afterward, participants answered the IC Map survey about their comfort levels with teaching and assigning students coursework within each of Puentedura's (2012) SAMR model levels, identified any obstacles they encountered, described how they overcame them, and/or identified the resources they still needed to overcome these obstacles.

Research Question 1 is informed by participant responses to the first three questions within the IC Map survey. The remaining IC Map inquiries inform Research Questions 2-4 and are expounded upon in the sections dedicated to their respective research questions later in this chapter.

Based on IC Map survey data, Table 10 depicts the responses of each of the participants at all four SAMR levels to the question, "How comfortable are you teaching students how to complete assignments at the [substitution, augmentation, modification, redefinition] level?"

Table 10

IC: How comfortable are you with teaching students to complete assignments in each level?

SAMR Level	Extremely comfortable	Fairly comfortable	Somewhat comfortable	Not very comfortable	I do not use these types of assignments
Substitution	24	3	1	1	1
Augmentation	19	6	3	1	1
Modification	14	8	6	0	2
Redefinition	5	14	3	4	4

Based on the IC Map survey data, several observations can be made. The number of teachers who consider themselves extremely comfortable teaching students to complete assignments decrease at each successive level of SAMR. The decrease from substitution to augmentation and augmentation to modification equates to five fewer teachers being extremely comfortable at each successive level. The decrease from modification to redefinition is marked by nine fewer teachers feeling extremely comfortable.

Based on the IC Map survey data, the majority of teachers stayed extremely or fairly comfortable teaching students how to complete assignments at all levels of SAMR, with 83% at the substitution and augmentation levels, 73% at the modification level, and 63% at the redefinition level. Of the 30 teachers, one identified him/herself in the "I do not use these types of assignments" category at the substitution and augmentation levels; two teachers identified this category at the modification level; and four at the redefinition level.

Table 11 identifies participant responses to the question, "How comfortable are you with requiring students to complete assignments in each level?"

Table 11

IC: How comfortable are you with requiring students to complete assignments in each level?

SAMR Level	Extremely comfortable	Fairly comfortable	Somewhat comfortable	Not very comfortable	I do not use these types of assignments
Substitution	24	2	2	1	1
Augmentation	19	7	3	0	1
Modification	13	8	6	1	2
Redefinition	6	13	4	3	4

The results of this question echo the results of the previous question ("How comfortable are you with teaching students to complete assignments at each level?") with very small differences, suggesting teachers feel a similar level of comfort teaching students how to complete assignments as they do in assigning students coursework at each level.

Table 12 provides the frequency with which teachers require students to complete assignments in each level.

Table 12

IC: How often do you require students to complete assignments in each level?

SAMR Level	Daily	Weekly	Monthly	Once or twice per semester	Not at all
Substitution	12	12	2	1	1
Augmentation	13	9	6	1	1
Modification	3	14	5	5	3
Redefinition	1	6	12	4	7

Eighty percent of participants (24 of 30) responded that they assigned substitution level coursework on a daily and weekly basis.

In the upper tiers of SAMR, tasks were most often assigned at the modification level on a weekly basis (14 of 30 teachers assigned weekly modification assignments),

but more teachers reported assigning tasks at this level once or twice a semester (five) than in any other SAMR level. At the redefinition level, seven teachers reported not assigning tasks at this level at all, more than double any other level; however, participants reported assigning redefinition tasks at every time interval.

On a daily basis, substitution and augmentation assignments were most often used, 12 and 13 respondents, respectively. On a weekly basis, substitution and modification assignments were most often used, 12 and 14 respondents, respectively. On a monthly basis, redefinition assignments were most often used, 12 respondents. On a semester basis, modification tasks were most often used, five respondents.

CBAM. During the 1960s and 1970s, educators were often presented with "boxed" best practices, meaning teachers did not need to provide any input into the program but rather follow the program word for word in order to achieve the desired outcome. The expected outcomes did not occur. It is out of this conundrum that the researchers at the R&DCTE at The University of Texas developed the CBAM during the 1970s due to the need to understand the complex dynamic people experience when they are asked to change their practice or adopt an innovation. The CBAM, comprised of the SoC, LoU, and IC Map instruments, probes how teachers feel about the innovation, how often they use the innovation, and what the innovation looks like in their classrooms respectively, yet while these instruments consider the complex reactions of teachers to this adoption from three very distinct lenses, the amalgamation of these data should support each instrument in turn and manufacture a more complete understanding of teacher location within the innovation adoption process in addition to better understanding teacher needs of resources and interventions moving forward.

Tables 13-18 provide a snapshot of each of the 30 participants' results on all three CBAM instruments. The LoU provide the organization of the table, progressing from participants within Level 0 to participants within Level VI. Organization according to LoU occurs here (a) as the LoU is the most easily observable measure of the three instruments, allowing change facilitators to use the teachers' reporting or their own observations to decide upon teachers' LoU and the needs and/or interventions accompanying that level and (b) because the stratified sample of participants were chosen to represent the different LoU. Table 13 triangulates data from all three instruments for participants within LoU Stages 0-II.

Table 13

CBAM: Triangulation Results of SoC, LoU, and IC for LoU Stages 0-II

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Comfort Level	Successes	Weaknesses
1309	Level 0 Nonuser	Stage 0 Unconcerned	S: extremely A: somewhat M: somewhat R: fairly	No comment	Teacher knowledge
1510	Level 0 Nonuser	Stage 0 Unconcerned	S: extremely A: somewhat M: somewhat R: fairly	No comment	Classroom management
1408	Level 0 Nonuser	Stage II "Self" Concerns	S: fairly A: fairly M: fairly R: fairly	No comment	No comment
1407	Level II Preparation	Stage II "Self" Concerns	S: extremely A: extremely M: extremely R: somewhat	Teacher: Classroom Procedures Teacher: Collaboration Student: Engagement Student: Innovation	Classroom management

Conflicting data occur within the LoU 0, or nonuser level, as participants who claimed to be nonusers during the LoU interviews, which was supported by their Stage 0 and Stage II SoCQ survey results, answered the IC Map survey as if they, in fact, use the innovation. These participants provided no comment on the successes they have had with the innovation but did list teacher knowledge and classroom management as weaknesses of the innovation. Clarification concerning the indicated discrepancies is needed before proceeding with a needs assessment or resource attainment to gauge more accurately the participants' levels and needs.

For the one participant reporting at LoU II, he/she is preparing to use the technology and experiencing "self" concerns around how the technology will affect him/her personally, based on SoCQ results. According to the IC Map survey data, the participant reports comfort with teaching and assigning technology-driven assignments up to the redefinition level yet is not doing so on a routine basis. While one participant's responses to the successes and weaknesses of the innovation cannot translate to all teachers scoring within the LOU II, his/her responses do support the data gathered from the other instruments, as classroom management is the focus of both the successes and weaknesses he/she reported.

During the LoU interview, the LoU II Preparing participant also identified student engagement and innovation as a success of her/his implementation of technology. When combined with the IC results, the data suggest this teacher considers him/herself very comfortable with the technology and sees student engagement and innovation as the outcome of the technology adoption, while SoC II "Self" scores denote a pronounced focus on personal concerns with the implementation.

Table 14

CBAM: Triangulation Results of SoC, LoU, and IC for LoU Stage III

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Comfort Level	Successes	Weaknesses
1403	Level III Mechanical Use	Stage 0 Unconcerned	S: extremely A: extremely M: fairly R: fairly	Teacher: Classroom Procedures Teacher: Collaboration Teacher: Professional Development	Technical issues
1406	Level III Mechanical Use	Stage 0 Unconcerned	S: extremely A: extremely M: extremely R: fairly	Teacher: Classroom Procedures Teacher: Professional Development	Classroom management
1401	Level III Mechanical Use	Stage II "Self" Concerns	S: somewhat A: somewhat M: somewhat R: fairly	Teacher: Collaboration Teacher: Access to Resources	Learning Classroom Management
1302	Level III Mechanical Use	Stage III "Task" Concerns	S: extremely A: extremely M: extremely R: not very	Teacher: Collaboration	No comment
1304	Level III Mechanical Use	Stage III "Task" Concerns	S: extremely A: extremely M: somewhat R: somewhat	Teacher: Efficiency Teacher: Collaboration Teacher: Access to Resources Teacher: Alignment to Standards	Learning
1502	Level III Mechanical Use	Stage III "Task" Concerns	S: fairly A: fairly M: do not assign R: do not assign	Student: Engagement	Learning
1507	Level III Mechanical Use	Stage III "Task" Concerns	S: extremely A: extremely M: fairly R: do not assign	Student: Engagement Teacher: Classroom Procedures	Classroom management

According to Hall et al. (2006), teachers within the LoU III category use the innovation "mechanically," meaning the innovation is used on a frequent basis, albeit

disjointed and superficially. The teacher is barely staying ahead of the students and dedicates no time to reflection (Hall et al., 2006, p. 6). The data show the majority of teachers within the LoU III also scored in SoC II or III on the SoCQ (Table 14). Teachers still in SoC II continue to experience "self" concerns focused on how the innovation affects them personally, while SoC III respondents have moved to "task" concerns dealing with the technical aspects of how long it takes them to prepare materials and utilize the innovation (George et al., 2006, p. 4).

The participant in LoU III and SoC II rated him/herself on the IC Map survey only "somewhat comfortable" with teaching and assigning technology-embedded tasks. Participants in LoU III and SOC III rated themselves "extremely comfortable" teaching and assigning technology-embedded tasks at the substitution and augmentation levels but lacked the same amount of comfort at the modification and redefinition levels. The remainder of the respondents within LoU III scored highest within Stage 0 on the SoCQ, suggesting they are "unconcerned" about the innovation; yet these respondents rated themselves on the IC Map survey as "extremely" or "fairly comfortable" in all levels of SAMR.

During the LoU interviews, teachers within LoU III Mechanical focused on the daily tasks of technology integration and identified successes for this aspect as collaboration, professional development, access to resources, and classroom procedures.

At LoU III Mechanical, interviewee responses identified weaknesses beyond classroom management focused on a lack of student learning and issues with technology such as a lack of internet connection and faulty classroom arrays, which is supported by these participants' SoC scores in the "self" and "task" concerns.

It is appropriate at this point to recall the discussion concerning SoC Stage 0 presented in Chapter 3 as participants within Stage 0 create a significant concern for change facilitators attempting to understand the needs of teachers within LoU III discussed previously and, even more profoundly, for participants within the LoU IVA and LoU IVB.

To begin, Stage 0 does not provide information about whether the respondent is a user or nonuser; instead, Stage 0 addresses the degree of interest in and engagement with the innovation. A high score in Stage 0 means the user or nonuser is unconcerned about the innovation; it is not a priority. This may be the case if the participant does not use the innovation and is thus not concerned. This may also be the case if the participant integrates the innovation on such a routine basis that he/she no longer sees the innovation as an item to plan for or be concerned about but is simply part of what he/she does on a daily basis (George et al., 2006, p. 48).

Since the inception of the SoCQ, controversy has existed over the legitimacy of Stage 0 questions on the SoCQ as well as the validity of the Stage 0 results. Iterations of the questionnaire improved the Stage 0 reliability, and, in 2005, a revised SoCQ was utilized with a group of 185 elementary and secondary teachers and reliability coefficients were computed. Based on the entire data set, the new Stage 0 scale has an estimated reliability of .66, which is low but higher than found in the previous iterations (George et al., 2006, p. 22). For this reason, it is necessary to examine all stage scores for a given participant in order to understand fully the meaning of a participant's highest stage score being 0.

Three of the four participants in LoU IVA (Table 15) scored highest in Stage 0.

A closer look using the Profile Interpretation, reveals participant 1305's high Stage VI/low Stage I score indicates a person who is not interested in learning more about the innovation. The person feels he or she already knows all about the innovation and has plenty of ideas for improving the situation. Additionally, the high Stage II/low Stage I score indicates a person who has "self" concerns. These individuals may be more negative toward the innovation and generally are not open to information about it.

Table 15

CBAM: Triangulation Results of SoC, LoU, and IC for LoU Stage IVA

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Comfort Level	Successes	Weaknesses
1305	Level IVA Routine	Stage 0 Unconcerned	S: extremely A: extremely M: somewhat R: somewhat	Teacher: Balance of Digital and Print Teacher: Collaboration	Classroom management Learning
1307	Level IVA Routine	Stage 0 Unconcerned	S: extremely A: extremely M: extremely R: somewhat	Teacher: Classroom Procedures Student: Choice Student: Collaboration	Classroom management
1505	Level IVA Routine	Stage 0 Unconcerned	S: extremely A: fairly M: fairly R: somewhat	Teacher: Classroom Procedures Teacher: Balance of Digital and Print	Classroom management
1405	Level IVA Routine	Stage I "Self" Concerns	S: extremely A: extremely M: fairly R: fairly	Teacher: Professional Development Teacher: Collaboration Student: Preparation	Classroom management

Participant 1307's extremely low scores may reveal the respondent did not read the items but instead simply marked items along one side of the column or the other.

According to the Profile Interpretation, Participant 1505's high Stage I indicates a

person who wants more information about the innovation. The high Stage II suggests the respondent has intense personal concerns about the innovation and its consequences for them. Although these concerns reflect uneasiness regarding the innovation, they do not necessarily indicate resistance. The low Stage IV indicates the person has minimal concerns about the effects of the innovation on students.

Combine these results with the remaining participant in LoU IVA who scored in SoC I "self" concerns and several deductions evolve about participants within LoU IVA: (a) With the exception of participant 1307 (who simply marked answers on the questionnaire), all participants have personal or "self" concerns, which are creating uneasiness with the innovation; (b) The fact that all participants are at LoU IVA means they utilize the innovation on a regular basis; however, emotionally they have grown very little; and (c) The results of the IC Map survey demonstrate a proficiency in the substitution and augmentation levels and a "somewhat" or "fairly" comfortable state in the modification and redefinition levels. While these teachers need resources to allow them to be more comfortable in assigning technology-embedded tasks within the upper tiers of SAMR as well as assisting them in developing reflective practices in order to move into LoU IVB Refinement, the change facilitator must address the "self" concerns (SoCQ results) for these teachers first because "change is a process, not an event" (Hall & Hord, 2001, p. 8) and the "emergence and resolution of concerns about innovations appear to be developmental, in that earlier concerns must first be resolved before later concerns can emerge" (George et al., 2006, p. 5).

Participants who scored within LoU IVA Routine, categorized as such by the stabilization of the innovation within their classrooms (Hall et al., 2006, p. 7), reported

successes of the innovation in the mode of balancing digital and print media, advancing student collaboration, and increasing student choice and preparation. The data that show these teachers are within LoU IVA Routine and are still focused primarily on "self" concerns suggests that although these teachers recognize a need for balance and increased choice and collaboration for their students, it is on a mechanical, or superficial, level.

Table 16

CBAM: Triangulation Results of SoC, LoU, and IC for LoU Stage IVB

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Comfort Level	Successes	Weaknesses
1308	Level IVB Refinement	Stage 0 Unconcerned	S: extremely A: extremely M: extremely R: not very	Teacher: Collaboration Teacher: Analytical Feedback	Classroom management Learning
1503	Level IVB Refinement	Stage 0 Unconcerned	S: extremely A: fairly M: fairly R: fairly	Student: Deeper Learning Teacher: Access to Resources Student: Access to Resources	Classroom management
1501	Level IVB Refinement	Stage II "Self" Concerns	S: extremely A: somewhat M: somewhat R: not very	Teacher: Collaboration Teacher: Professional Development Teacher: Classroom Procedures	Classroom management
1303	Level IVB Refinement	Stage III/VI "Task" and "Impact" Concerns	S: extremely A: extremely M: somewhat R: fairly	Teacher: Balance of Digital and Print Teacher: Classroom Procedures Student: Engagement	Classroom management Learning

Hall et al. (2006) stated that participants in LoU IVB Refinement implement technology on a routine basis and reflect upon their practice in order to make changes that impact their students (p. 7). These participants reported in the IC Map surveys being extremely confident in teaching and assigning technology-embedded tasks in the lower

tiers of SAMR but gradually lost some of that comfort as they moved toward redefinition. The data for the two participants who scored in SoC 0 suggest intense personal or "self" concerns. One participant in LoU IVB received an SoC II score signifying "self" concerns as well. The final participant in this group has moved on to "task" (SoC III) and "impact" concerns (SoC VI). The data indicate teachers within the LoU IVB have begun the reflection process and are fairly adept at technology integration, especially within the lower SAMR tiers, but many continue to struggle with personal concerns.

Concern for how these changes will affect the students occurs with participants in LoU IVB Refinement evidenced by their LoU interview identification of success within the implementation as student engagement, student deeper learning, and student independence and self-advocacy, further supported by these participants' SoC "Impact" scores. These teachers still struggle with "self" and "task" concerns at times but are beginning to focus more on student impact, and they are increasing their comfort levels in all tiers of SAMR.

Teachers identified in LoU IVA Routine and IVB Refinement identified classroom management and the lack of student learning as weaknesses during the LoU interviews. Lack of student learning in both LoU III and IVA/B was defined by teachers as "cheating," "plagiarism," and "Googling answers, " which correlates to these teachers' SoC scores primarily focused in the "self" and "task" levels. IC Map scores flag for these participants as they move into the modification and redefinition tiers.

Table 17

CBAM: Triangulation Results of SoC, LoU, and IC for LoU Stage V

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Comfort Level	Successes	Weaknesses
1310	Level V Integration	Stage 0 Unconcerned	S: extremely A: extremely M: extremely R: fairly	Teacher: Classroom Procedures Teacher: Collaboration Student: Independence and Self-Advocacy	Classroom management
1404	Level V Integration	Stage 0 Unconcerned	S: extremely A: extremely M: extremely R: fairly	Teacher: Efficiency Teacher: Balance of Digital and Print Teacher: Collaboration	Classroom management
1410	Level V Integration	Stage I "Self" Concerns	S: extremely A: extremely M: fairly R: not very	Teacher: Classroom Procedures Student: Deeper Learning Student: Preparation	Classroom management
1301	Level V Integration	Stage II "Self" Concerns	S: extremely A: extremely M: extremely R: fairly	Student: Deeper Learning Student: Engagement Teacher: Access to Resources	Classroom management Technical issues
1506	Level V Integration	Stage II "Self" Concerns	S: extremely A: fairly M: somewhat R: do not assign	Teacher: Classroom Procedures Teacher: Educational Philosophy Student: Deeper Learning Student: Engagement	Technical issues

(continued)

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Comfort Level	Successes	Weaknesses
1509	Level V Integration	Stage II "Self" Concerns	S: extremely A: extremely M: fairly R: somewhat	Teacher: Classroom Procedures Student: Choice Teacher: Collaboration	Classroom management
1306	Level V Integration	Stage V "Impact" Concerns	S: extremely A: extremely M: extremely R: somewhat	Teacher: Leadership Student: Engagement Student: Choice Teacher: Reflection	Learning
1409	Level V Integration	Stage V "Impact" Concerns	S: extremely A: extremely M: extremely R: extremely	Teacher: Access to Resources Student: Access to Resources Student: Collaboration Student: Deeper Learning	Learning
1504	Level V Integration	Stage V "Impact" Concerns	S: extremely A: extremely M: extremely R: fairly	Student: Access to Resources Teacher: Analytical Feedback	Classroom management

Teachers within LoU V Integration have combined their reflective, routine use of the innovation with collaboration and report being "extremely" or "fairly" comfortable teaching and assigning technology-embedded assignments within the first three tiers of SAMR with a variety of comfort levels within the final tier of redefinition. However, the SoC results still demonstrate a significant number of teachers who continue to focus on "self" concerns—four scoring within SoC I and II—and "task" concerns—participant 1310 who scored within SoC 0. Nonetheless, over half (four of the nine participants scoring within SoC V Impact and participant 1404 [Stage 0]) have moved beyond "self" and "task" concerns to focus on the impact the innovation will have on their students and

their role in collaboration.

Table 18

CBAM: Triangulation Results of SoC, LoU, and IC for LoU Stage VI

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Comfort Level	Successes	Weaknesses
1402	Level VI Renewal	Stage 0 Unconcerned	S: extremely A: extremely M: extremely R: extremely	Teacher: Classroom Procedures Student: Collaboration Teacher: Individualization of Instruction	Classroom management
1508	Level VI Renewal	Stage IV "Impact" Concerns	S: do not assign A: do not assign M: extremely R: extremely	Teacher: Collaboration Teacher: Efficiency Student: Independence/Self-Advocacy	No comment

Participants at LoU VI Renewal have evaluated the quality use of the innovation and are seeking out major modifications to increase the positive impact on students while exploring new goals for themselves (Hall et al., 2006, p. 7). IC Map survey data suggest these participants are "extremely comfortable" at all levels of SAMR, and participant 1508 no longer assigns coursework within the bottom two tiers of SAMR. Participant 1508 scored within SoC IV "Impact" suggesting a focus on how the innovation impacts his/her students. Based on the Profile Interpretation (Appendix M), Participant 1402 scored within SOC 0, but an analysis of all stage scores confirms concerns with impacts upon students and the need to learn more.

During the LoU interviews, participants in LoU V Integration and LoU VI Renewal identified similar successes of the adoption including those identified in prior levels as well as their own changes in educational philosophy, movement into leadership roles, and integration of continual reflection. In addition, LoU VI Renewal participants

identified individualization of instruction as a success. These participants scored within the "impact" levels of the SoC and demonstrate proficiency in most, if not all, levels of SAMR.

Weaknesses identified by LoU V Integration and LoU VI Renewal pinpoint classroom management, lack of student learning, and technical issues as well. In fact, the comments made by teachers in these levels do not differ in any significant way from comments made by teachers at any other level.

Research Question 2. What obstacles are these teachers facing in moving up the implementation model to provide instruction that is more effective? Participants were asked to name obstacles hampering their ability to move forward with the technology implementation in both the LoU interviews and the IC Map surveys.

The results of the IC Map surveys concerning identified obstacles are provided in Table 19 and are specific to obstacles in moving up the SAMR tiers rather than the technology adoption as a whole.

Teachers provided responses in an open-ended text box for the question, "What obstacles did you encounter at each level?" These responses were analyzed, coded, and categorized into themes represented in Table 19. Five themes were identified and characterized by participant responses: student knowledge, teacher knowledge, student behavior, learning concerns, and technical concerns. In addition, respondents could have provided a response of *No obstacles*.

Table 19

IC: What obstacles did you encounter at each level?

SAMR Level	Student knowledge	Teacher knowledge	Student behavior	Learning concerns	Technical concerns	No obstacles
Substitution	2	0	6	7	2	8
Augmentation	2	4	3	5	2	10
Modification	3	6	2	1	3	9
Redefinition	6	10	2	0	1	6

Eight teachers responded with no obstacles at the substitution level, 10 at the augmentation level, nine at the modification level, and six at the redefinition level, signifying a majority of teachers did encounter obstacles at each level.

At the substitution level, the obstacles most often concerned student behavior (six participants reported) and learning concerns (seven participants reported). At the augmentation level, teachers seemed more concerned with obstacles focused on their own knowledge (four participants reported) and student learning (five participants reported), yet more teachers reported no obstacles (10) at the augmentation level than any other.

At the modification level, data suggest teachers were increasingly more concerned with their own knowledge (six respondents), which continued to increase in the redefinition level (10).

Overall, more teachers reported student and teacher knowledge as an obstacle with 49% of all obstacles being knowledge-focused. While teachers had obstacles to overcome around student learning, these concerns diminished as the SAMR level increased: seven learning concerns at the substitution level, five at the augmentation level, one at the modification level, and none reported at the redefinition level. Likewise, student behavior concerns diminished as the SAMR level increased: six at substitution, three at augmentation, and two each at the modification and redefinition levels.

In Table 20, the results of the LoU interviews as they pertain to the identification of obstacles are presented, providing the overall results of each of the three CBAM instruments for each respondent.

Table 20

CBAM: Obstacles

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Analysis (comfort level)	Obstacles
1309	Level 0 Nonuser	Stage 0 Unconcerned	Substitution: extremely Augmentation: somewhat Modification: somewhat Redefinition: fairly	No comment
1510	Level 0 Nonuser	Stage 0 Unconcerned	Substitution: extremely Augmentation: somewhat Modification: somewhat Redefinition: fairly	No comment
1408	Level 0 Nonuser	Stage II "Self" Concerns	Substitution: fairly Augmentation: fairly Modification: fairly Redefinition: fairly	Lack of resources
1407	Level II Preparation	Stage II "Self" Concerns	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: somewhat	Lack of knowledge Lack of resources
1403	Level III Mechanical Use	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: fairly Redefinition: fairly	Balance of digital and print Lack of knowledge
1406	Level III Mechanical Use	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: fairly	Balance of digital and print Student behavior
1401	Level III Mechanical Use	Stage II "Self" Concerns	Substitution: somewhat Augmentation: somewhat Modification: somewhat Redefinition: fairly	Lack of knowledge Overwhelm
1302	Level III Mechanical Use	Stage III "Task" Concerns	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: not very	Lack of knowledge

(continued)

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Analysis (comfort level)	Obstacles
1304	Level III Mechanical Use	Stage III "Task" Concerns	Substitution: extremely Augmentation: extremely Modification: somewhat Redefinition: somewhat	Lack of resources Time
1502	Level III Mechanical Use	Stage III "Task" Concerns	Substitution: fairly Augmentation: fairly Modification: do not assign Redefinition: do not assign	Overwhelm
1507	Level III Mechanical Use	Stage III "Task" Concerns	Substitution: extremely Augmentation: extremely Modification: fairly Redefinition: do not assign	Lack of collaboration Overwhelm
1305	Level IVA Routine	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: somewhat Redefinition: somewhat	Balance of digital and print Overwhelm
1307	Level IVA Routine	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: somewhat	Perception by community and parents Equity
1505	Level IVA Routine	Stage 0 Unconcerned	Substitution: extremely Augmentation: fairly Modification: fairly Redefinition: somewhat	Concern for students
1405	Level IVA Routine	Stage I "Self" Concerns	Substitution: extremely Augmentation: extremely Modification: fairly Redefinition: fairly	Time Lack of Resources
1308	Level IVB Refinement	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: not very	Student behavior Perception by community and parents Balance of digital and print
1503	Level IVB Refinement	Stage 0 Unconcerned	Substitution: extremely Augmentation: fairly Modification: fairly Redefinition: fairly	Concern for students

(continued)

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Analysis (comfort level)	Obstacles
1501	Level IVB Refinement	Stage II "Self" Concerns	Substitution: extremely Augmentation: somewhat Modification: somewhat Redefinition: not very	Concern for students Student behavior
1303	Level IVB Refinement	Stage III/VI "Task" and "Impact" Concerns	Substitution: extremely Augmentation: extremely Modification: somewhat Redefinition: fairly	Perception by community and parents
1310	Level V Integration	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: fairly	Overwhelm
1404	Level V Integration	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: fairly	Perception by community and parents Balance of digital and print
1410	Level V Integration	Stage I "Self" Concerns	Substitution: extremely Augmentation: extremely Modification: fairly Redefinition: not very	No comment
1301	Level V Integration	Stage II "Self" Concerns	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: fairly	Balance of digital and print Student behavior
1506	Level V Integration	Stage II "Self" Concerns	Substitution: extremely Augmentation: fairly Modification: somewhat Redefinition: do not assign	Lack of resources Time
1509	Level V Integration	Stage II "Self" Concerns	Substitution: extremely Augmentation: extremely Modification: fairly Redefinition: somewhat	Concern for students Overwhelm
1306	Level V Integration	Stage V "Impact" Concerns	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: somewhat	Balance of digital and print
1409	Level V Integration	Stage V "Impact" Concerns	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: extremely	Time Balance of digital and print

(continued)

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Analysis (comfort level)	Obstacles
1504	Level V Integration	Stage V "Impact" Concerns	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: fairly	Student behavior
1402	Level VI Renewal	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: extremely	Balance of digital and print Concern for students
1508	Level VI Renewal	Stage IV "Impact" Concerns	Substitution: do not assign Augmentation: do not assign Modification: extremely Redefinition: extremely	No comment

Obstacles identified within the LoU interviews suggest a movement from a lack of *Teacher Knowledge*, *Collaboration*, and *Resources* to a *Concern for Students*, *Lack of Time*, and *Perception of the Innovation by Community and Parents*. *Balance of Digital and Print*, *Concern for Students*, and *Student Behavior* show up as obstacles regardless of LoU level.

Participants reported *Balancing Digital and Print* as an obstacle throughout all LoU levels with the exception of LoU II, yet when combined with the data from the other instruments and specifically teacher responses to these interviews, it becomes apparent this obstacle is characterized differently at every level.

At LoU III, respondent 1406 stated, "students hate them [computers], so I struggle to make them [students] happy and also use the technology so I don't get in trouble." In LoU IVA, participant 1308 replied,

> They [computers] provide such a world of resources that I sometimes become overwhelmed and have trouble keeping the courses focused, so I have to find a

> balance of using the computer and using texts [print] that keep me on track.

In LoU V, participant 1301 said,

> In the beginning, I felt I had to use the technology for everything but I have learned balance … that's where the excitement comes in, the new and the innovative portion of it and how it can bring my students further. But then that's also where the nervousness still is there … in how much are we going to expect it to do for them, and how much is too much?

In LoU VI, participant 1402 responded,

> More and more, students do not want to use paper and pencil and I think we must still maintain a balance—be proficient in both—there are advantages to both. I have gotten to the point where print is not the primary source of my teaching. But, I have learned to evaluate constantly to determine when putting their hands on the written page, the product, the model, you know, et cetera, et cetera, is more beneficial than the online possibilities.

It is in combination with SoC and IC results that the language of each of the LoU reveals itself and supports the results of the other instruments. For example, in LoU III Mechanical, Hall et al. (2006) described the user as being focused on short-term, day-to-day use of the innovation with little time for reflection, and changes are made more to meet the user needs than client needs, often resulting in disjointed and superficial use (p. 7). This description is echoed in the respondent's LoU interview statement since he/she is concerned with students "liking" the assignments they are completing in his/her classroom (not whether it is beneficial to their learning) and the teacher not "getting into trouble" for not using the technology enough (presumably by administration).

Combining these data with the participant's SoC stage score 0 Profile Interpretation identifies this user as someone who is unconcerned about the innovation and has no desire to learn more. The IC data recorded the participant stating, "students don't understand what to do" as an obstacle in the top tiers of SAMR, suggesting a superficial use of the technology at best. This participant's data represent a multitude of concerns in providing resources to assist the user in moving forward: user's negative attitude and lack of desire to learn more, students' negative attitudes toward technology in this classroom, lack of value placed on technology use, and lack of ability to teach students to use the technology competently.

In comparison, LoU VI Renewal, defined by the user reevaluating the quality of innovation use and seeking major modifications to achieve increased impact on clients (Hall et al., 2006, p. 7), is demonstrated in participant 1402's response that he/she recognizes the value of the digital and print mediums and claims constant reflection to determine the most beneficial medium for students. In combination with the participant's SoC Stage 0 analysis of the user as competent, reflective, and willing to learn as well as his/her IC data identifying no current obstacles and a strong comfort level in all but redefinition, a change facilitator can determine the resources this participant needs. In this instance, those needs include knowledge of moving classroom assignments into the redefinition tier and collaboration with colleagues to address his/her deep level questions about how to balance the digital and print media to most effectively influence students.

Without a combination of data from all three instruments, one could easily believe the obstacle of balance between digital and print to be the same for teachers at all LoU levels when, in fact, there are great discrepancies in how teachers define this obstacle and

in the resources needed to overcome this obstacle.

Furthermore, when obstacles identified within the LoU interviews are combined with obstacles identified within the IC surveys, a unique phenomenon occurs. Participants identified *Teacher Knowledge* in LoU interviews as an obstacle within LoU II and III but dissipated in LoU IV, V, and VI; yet in the IC interviews, which asked respondents to identify obstacles moving up the SAMR hierarchy, teacher knowledge became increasingly identified as an obstacle as teachers moved up the tiers (Table 17).

The same escalation occurred as student lack of knowledge became an increasingly reported obstacle as teachers moved up the SAMR tiers, yet student knowledge was not identified as an obstacle at all within the LoU interviews. As teachers gained competency within the top levels of SAMR, the remaining obstacles of student behavior, learning concerns, and technical concerns were drastically reduced or not reported at all (Table 19). Conversely, student behavior and learning concerns were still evident in the highest levels of LoU obstacles.

Research Question 3. What methods are teachers using to overcome these obstacles? During the IC Map surveys, interviewers asked participants if they were able to overcome the obstacles they identified (Table 21).

Across all levels, 25.8% of teachers reported no obstacles. Of those who reported obstacles, 18% responded they did not overcome the obstacles, while 82% did. Specifically, at the substitution level, 87% of teachers overcame the obstacles reported. At the augmentation level, 85.7% overcame the obstacles, 81.8% at the modification level, and 73.9% at the redefinition level.

Table 21

IC: Did you overcome the obstacles at each level?

SAMR Level	Yes	No	No obstacles
Substitution	20	3	7
Augmentation	18	3	9
Modification	18	4	8
Redefinition	17	6	7

Table 22 illustrates participant responses to the question, "If you did overcome the obstacles, how?" Coding participant open-ended responses to this question developed the six themes presented in this table: *Taught Students Technology Skills, Increased Teacher Knowledge, Changed Classroom Management, Changed Teaching Methods, Sought Outside Assistance*, and *Decreased Technology Use*.

Table 22

IC: If you did overcome the obstacles, how?

SAMR Level	Taught students technology skills	Increased teacher knowledge	Changed classroom management	Changed teaching methods	Sought outside assistance	Decreased technology use
Substitution	1	0	7	7	0	0
Augmentation	1	0	2	7	3	1
Modification	2	3	2	3	1	1
Redefinition	5	3	0	1	3	1

At the substitution level, the data present a change in how teachers teach, with seven teachers reporting a change in teaching methods and seven reporting a change in classroom management. At no other level are there more teachers reporting changes. At the augmentation level, seven teachers reported a change in their teaching methods as well.

At the modification level, a similar number of teachers reported overcoming obstacles through *Teaching Students Technology Skills* (two respondents), *Increasing Teacher Knowledge* (three respondents), *Changing Classroom Management* (two respondents), and *Changing Teaching Methods* (three respondents). At the redefinition level, five teachers said teaching students technology skills allowed them to overcome obstacles, while three teachers said they increased their own knowledge.

It was at the augmentation and redefinition levels that more teachers reported seeking outside assistance (three teachers at each level). It also is important to notice that at the top three tiers of SAMR, one teacher at each level who encountered obstacles decreased his/her technology use in the classroom.

While the inclusion of a question within the LoU interview protocol concerning how teachers overcame the obstacles they faced would have proven valuable, especially

in light of the seemingly contradictory teacher responses between the IC surveys and LoU interviews when asked to identify obstacles, the IC data within the context of the LoU and SOC data provide some valuable insight.

The number of respondents who identified *Taught Students Technology Skills* and *Increased Teacher Knowledge* increased through movement up the SAMR model. This observation is supported by the IC data that suggest these teachers reported more and more competence within the higher levels of SAMR, focused more on the impact of the technology on their students (based on SoCQ scores), and were more reflective in determining value for student learning (based on LoU peak scores). Seemingly, the more teachers learned, the more important obtaining new knowledge and passing it on to their students became.

While seeking outside assistance was important to overcoming these obstacles, the data did not suggest a pattern of use.

Research Question 4. What supports do teachers need in order to move into the upper tiers of the implementation model? Data from the LoU interviews and IC Map surveys will be analyzed separately and then in concert with SoC results.

The results of the IC Map surveys are provided in Table 23 and are specific to resources needed in moving up the SAMR tiers rather than the technology adoption as a whole. In Table 23, participants responded to the question, "If you did not overcome the obstacles at each level, what resources do you need to be able to do so?" A text box was supplied for this open-ended question; however, some teachers responded with "no response," so the category of *No Response* has been added in this table. Additionally, teacher responses were coded and the following themes identified: *Professional*

Development, Time for Students to Create, Technology Resources, and *Collaboration*. This question was posed only to those teachers who were unable to overcome the obstacles at each level of SAMR; therefore, only three teachers at the substitution level, three teachers at the augmentation level, four teachers at the modification level, and six teachers at the redefinition level responded to this question.

Table 23

IC: If you did not overcome the obstacles, what resources are still needed?

SAMR Level	Professional development	Time for students to create	Technology resources	Collaboration	No response
Substitution	2	0	1	0	0
Augmentation	1	0	0	0	2
Modification	1	0	0	1	1
Redefinition	3	1	0	1	1

Professional Development was identified as a needed resource more often and at every level of SAMR. In the higher levels of SAMR, *Collaboration* and *Time for Students to Create* in the classroom were identified as needed resources.

The results of the LoU interviews regarding what teachers identified as needs for moving forward with a full implementation are combined in Table 24 to provide insight into teacher needs at each LoU.

Table 24

CBAM: Resources Needed for LoU 0-II

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Analysis (comfort level)	Resources Needed
1309	Level 0 Nonuser	Stage 0 Unconcerned	Substitution: extremely Augmentation: somewhat Modification: somewhat Redefinition: fairly	No comment
1510	Level 0 Nonuser	Stage 0 Unconcerned	Substitution: extremely Augmentation: somewhat Modification: somewhat Redefinition: fairly	No comment
1408	Level 0 Nonuser	Stage II "Self" Concerns	Substitution: fairly Augmentation: fairly Modification: fairly Redefinition: fairly	No comment
1407	Level II Preparation	Stage II "Self" Concerns	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: somewhat	PD: new/creative programs and higher level learning PD: teaching strategies

The three nonusers made no comment to the question of what resources are

needed to move forward with the technology. The LoU II Preparation participant requested professional development for both teaching strategies and new/creative/higher level learning programs indicating he/she is willing to move forward with the innovation but his/her "self" concerns (SoCQ) make professional development in teaching strategies critical.

Table 25

CBAM: Resources Needed for LoU III

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Analysis (comfort level)	Resources Needed
1403	Level III Mechanical Use	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: fairly Redefinition: fairly	PD: teaching strategies
1406	Level III Mechanical Use	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: fairly	No comment
1401	Level III Mechanical Use	Stage II "Self" Concerns	Substitution: somewhat Augmentation: somewhat Modification: somewhat Redefinition: fairly	PD: beginner
1302	Level III Mechanical Use	Stage III "Task" Concerns	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: not very	PD: new/creative programs and higher level learning
1304	Level III Mechanical Use	Stage III "Task" Concerns	Substitution: extremely Augmentation: extremely Modification: somewhat Redefinition: somewhat	PD: new/creative programs and higher level learning

(continued)

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Analysis (comfort level)	Resources Needed
1502	Level III Mechanical Use	Stage III "Task" Concerns	Substitution: fairly Augmentation: fairly Modification: do not assign Redefinition: do not assign	PD: new/creative programs and higher level learning
1507	Level III Mechanical Use	Stage III "Task" Concerns	Substitution: extremely Augmentation: extremely Modification: fairly Redefinition: do not assign	PD: new/creative programs and higher level learning

Participants within LoU III Mechanical most often identified a needed resource as professional development in new/creative programs and higher level learning. Additionally, the specific participants who chose this resource scored within "task" concerns on the SoCQ and showed high comfort levels with the levels of SAMR (IC). The participant who requested beginner level professional development obtained SoCQ scores within "self" concerns and reported medium to low degrees of comfort within SAMR levels.

Table 26

CBAM: Resources Needed LoU IV

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Analysis (comfort level)	Resources Needed
1305	Level IVA Routine	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: somewhat Redefinition: somewhat	PD: deeper knowledge about current programs
1307	Level IVA Routine	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: somewhat	PD: deeper knowledge about current programs
1505	Level IVA Routine	Stage 0 Unconcerned	Substitution: extremely Augmentation: fairly Modification: fairly Redefinition: somewhat	PD: deeper knowledge about current programs
1405	Level IVA Routine	Stage I "Self" Concerns	Substitution: extremely Augmentation: extremely Modification: fairly Redefinition: fairly	No need
1308	Level IVB Refinement	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: not very	No need

(continued)

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Analysis (comfort level)	Resources Needed
1503	Level IVB Refinement	Stage 0 Unconcerned	Substitution: extremely Augmentation: fairly Modification: fairly Redefinition: fairly	No need
1501	Level IVB Refinement	Stage II "Self" Concerns	Substitution: extremely Augmentation: somewhat Modification: somewhat Redefinition: not very	Stricter student behavior guidelines
1303	Level IVB Refinement	Stage III/VI "Task" and "Impact" Concerns	Substitution: extremely Augmentation: extremely Modification: somewhat Redefinition: fairly	Time Research

Participants within LoU IVA requested more in-depth professional development on current programs, scored in SoC 0, and demonstrated a wide range of comfort levels within SAMR.

The participant within LoU IVB with "self" concerns and a lack of comfort in the three top tiers of SAMR requested stricter student behavior guidelines. The participant within LoU IVB who held "task" and "impact" concerns, requested more time and research. The final two participants within LoU IVB and Stage 0 reported being "fairly" to "not very" confident in the redefinition level only, and claimed they had no need for additional resources.

Table 27

CBAM: Resources Needed for LoU V

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Analysis (comfort level)	Resources Needed
1310	Level V Integration	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: fairly	No need
1404	Level V Integration	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: fairly	Time PD: new/creative programs/higher level learning
1410	Level V Integration	Stage I "Self" Concerns	Substitution: extremely Augmentation: extremely Modification: fairly Redefinition: not very	PD: new/creative programs/higher level learning
1301	Level V Integration	Stage II "Self" Concerns	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: fairly	Research PD: new/creative programs/higher level learning
1506	Level V Integration	Stage II "Self" Concerns	Substitution: extremely Augmentation: fairly Modification: somewhat Redefinition: do not assign	No comment
1509	Level V Integration	Stage II "Self" Concerns	Substitution: extremely Augmentation: extremely Modification: fairly Redefinition: somewhat	PD: teaching strategies
1306	Level V Integration	Stage V "Impact" Concerns	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: somewhat	No need

(continued)

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Analysis (comfort level)	Resources Needed
1409	Level V Integration	Stage V "Impact" Concerns	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: extremely	PD: new/creative programs/higher level learning
1504	Level V Integration	Stage V "Impact" Concerns	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: fairly	PD: new/creative programs/higher level learning

In LoU V, the most requested resources were professional development in new/creative programs/higher level learning and time, respectively. The same number of participants with "self" and "impact" concerns requested professional development in new/creative programs/higher level learning programs; although, participants who scored within "self" concerns reported significantly less comfort within the SAMR tiers than their counterparts scoring within "impact" concerns.

Table 28

CBAM: Resources Needed for LoU VI

Participant Number	Levels of Use Analysis	Stages of Concern Analysis	Innovation Configuration Map Analysis (comfort level)	Resources Needed
1402	Level VI Renewal	Stage 0 Unconcerned	Substitution: extremely Augmentation: extremely Modification: extremely Redefinition: extremely	PD: new/creative programs/higher level learning
1508	Level VI Renewal	Stage IV "Impact" Concerns	Substitution: do not assign Augmentation: do not assign Modification: extremely Redefinition: extremely	No needs

Participants within LoU VI claimed either no need or professional development in new/creative/higher level learning programs. Both participants reported being extremely comfortable in the highest levels of SAMR and scored within "impact" concern stages or Stage 0.

The only theme consistent between the LoU and IC interviews is professional development. Two teachers responding to the IC protocol requested professional development at the substitution level, one at the augmentation and modification levels, and three at the redefinition level. The increase in professional development requests as the SAMR level moves higher echoes the increase as the level of use moves higher. Time for students to create and collaboration were requested in the two highest tiers of

SAMR, consistent with teachers who have moved into "impact" concerns and LoU IV-VI, as these three participants demonstrate; however, four of the 16 participants in the LoU who responded to this question gave no comment.

Summary

Data from all three CBAM instruments inform the discussion for Research Question 1 probing how teachers have implemented the one-to-one initiative within this district. Based on data gleaned from the SoCQ, the Peak Stage Score analysis places the largest majority of participants (73.3%) in the "self" concerns category (comprised of participants with peak stage scores from 0-II), 16.7% of participants have progressed to the "task" concerns category (peak stage score of III), and 13.3% of participants have obtained the "impact" concerns category (peak stage scores of IV-VI), indicative of the most effective teachers. Holistic analyses of the themes emerging from the SoCQ Profile Interpretation reveal a couple of points worth considering: (a) Self-concerns and management concerns often overlap and were present in this study, to some degree, from Stage 0 through Stage III; (b) Concerns about collaboration or interest in collaboration occurred in every stage (except Stage VI, which was not represented); and (c) 11 of the 12 participants in Stage 0, and thus 11 of the 30 total participants, claimed no concern for the innovation.

LoU interviews confirmed Hord et al.'s (1987) proposal that regardless of the maturity of the innovation, there will typically be users at all levels. All LoU levels were represented except LoU I. The majority (63.3%) of the participants' levels of use were LoU IV-VI. While this percentage cannot make a statement about teachers in general, it does inform the viewing of the LoU themes for strengths, weaknesses, and successes,

since these responses came from teachers who have reached advanced levels of use. The strengths identified for the innovation include *Access to Resources, Preparedness*, and *Communication*. The weaknesses reported for the innovation encompass *Classroom Management* and *Student Learning*. The successes acknowledged for the innovation involve *Classroom Procedures, Teacher Collaboration,* and *Student Engagement*.

Data from the IC Map surveys suggest the majority of teachers are extremely or fairly comfortable in all levels of SAMR. A majority of teachers report assigning and teaching students at all levels of SAMR, yet when asked to identify how often assignments were given at each level, the data suggest the majority of coursework still remains in the substitution and augmentation levels. In addition, the higher up the SAMR tiers, the more likely a teacher is to not assign work at that level at all. Seven of 30 teachers do not assign coursework classified as redefinition, based on IC Map survey data.

Research Question 2, regarding teacher identification of obstacles, was informed by IC Map surveys and LoU interviews. The IC Map surveys probed obstacles occurring in relationship to movement up the SAMR tiers. A majority of participants did identify obstacles at each level. Student learning and behavior were identified in the bottom tiers but disappeared within the top tiers of SAMR. Teacher and student knowledge increased as an obstacle with movement up the tiers.

Obstacles identified within the LoU interviews suggest a movement from a lack of teacher knowledge, collaboration, and resources to a concern for students, lack of time, and perception of the innovation by community and parents. Balancing digital and print media was reported as an obstacle throughout all LoU levels with the exception of LoU

II, yet when combined with the data from the other instruments and specifically teacher responses to these interviews, it becomes apparent this obstacle is characterized differently at every level.

When obstacles identified within the LoU interviews were combined with obstacles identified within the IC surveys, a unique phenomenon occurred. Teacher knowledge was identified in LoU interviews as an obstacle within LoU II and III but dissipated in levels IV, V, and VI; yet, in the IC interviews, which asked respondents to identify obstacles moving up the SAMR hierarchy, teacher knowledge became increasingly identified as an obstacle as teachers moved up the tiers.

The same escalation occurred as student lack of knowledge became an increasingly reported obstacle as teachers moved up the SAMR tiers, yet student knowledge was not identified as an obstacle at all within the LoU interviews. As teachers gained competency within the top levels of SAMR, the remaining obstacles of student behavior, learning concerns, and technical concerns were drastically reduced or not reported at all (Table 19). Conversely, student behavior and learning concerns were still evident in the highest levels of LoU obstacles.

Research Question 3 pertaining to the methods teachers identified in overcoming obstacles was directly answered by IC Map data. *No Obstacles* was reported by 25.8% of participants. Of those reporting obstacles, 82% reported overcoming those obstacles. Within the substitution and augmentation levels, participants reported overcoming obstacles by changing their teaching methods and their classroom management styles. At the modification and redefinition levels, more participants reported overcoming obstacles by obtaining knowledge for themselves and teaching their students about the technology.

While seeking outside assistance was important to overcoming these obstacles, the data did not suggest a pattern of use.

Research Question 4 examining the resources teachers need in order to move forward with the innovation was directly informed by the IC Map surveys and LoU interviews. Only participants who were unable to overcome their obstacles in moving up the SAMR tiers answered the question regarding resources that are still needed. Professional development was identified as a needed resource more often and at every level of SAMR. In the higher levels of SAMR, collaboration and time for students to create in the classroom were identified as needed resources.

Professional Development was identified most often, and at every level, in the LoU interviews. *Time* and *Research* were also identified.

The increase in professional development requests as the SAMR level moves higher echoes the increase as the LoU moves higher. Time for students to create and collaboration were requested in the two highest tiers of SAMR, consistent with teachers who have moved into "impact" concerns and LoU IV-VI.

While the data from this study were shared in this chapter, a comprehensive discussion remains. In Chapter 5, the implications of the findings presented in Chapter 4, the limitations of this study, the recommendations for further research, and conclusions are presented.

Chapter 5: Discussion

Introduction

Just in the few years since research for this dissertation began, the changes that have occurred in the vision, scope, and potential of technology in the education arena are substantial. The United States Department of Education (2017) coined the phrase "everywhere, all-the-time learning" in the 2017 version of the National Education Technology Plan Update, *Reimagining the Role of Technology in Education*. This mantra of "everywhere, all-the-time" learning may seem like a small adjustment from its predecessor, "anywhere, anytime" learning, yet a closer look reveals just how significant this evolution of language is. In fact, the metamorphosis of language that originally suggested an *opportunity* to learn via digital resources when a student *so chose* has become a *demand* that students learn with support from digital resources at *all times* and in *all environs*. In order to heed this demand, teachers must redefine the role of technology in the classroom once again. This demand underscores the value of understanding the emotional, behavioral, and reflective processes teachers undergo throughout a technology adoption. This study sought to illuminate these processes while identifying the barriers as well as the resources to navigate those barriers during a one-to-one technology implementation. The value of this particular study is its focus on a mature technology integration, 5 years into the adoption, since little research has been completed in this area to guide educators, yet it is the time period in which seeing the adoption's "full potential" is most possible, according to the research (Hord et al., 1987). Are our administrators and teachers, in fact, capable of meeting the "demand" to teach students to learn everywhere, all-the-time?

Implications of Findings

The convergent parallel mixed methods design used in this study provides both qualitative and quantitative data analyzed separately in a side-by-side comparison and then merged to develop a fuller understanding of high school teachers' behaviors 5 years after the inception of a one-to-one technology adoption in a rural North Carolina district. District technology facilitators were asked to determine teachers who represented all levels of use of technology. Thirty teachers (10 from each of three high schools within the district) volunteered to participate in this study. This purposive, stratified sample of participants who possess a wide range of levels of use of technology in the classroom inform the data contained in this study.

Research Question 1. How have high school teachers in a rural North Carolina district implemented the one-to-one laptop initiative? According to George et al. (2006), "In general, time, successful experiences and the attainment of new skills allow an individual to progress through the stages of concern" (p. 7), yet the results of the SoCQ for this study do not suggest a pattern of progress through the stages of concern. "Self" concerns and "task" concerns, which often overlap, were present in this study to some degree from Stages 0-III, making up 86.7% of participants. Hord et al. (1987) posited that movement through the stages of concern is linear; therefore, only 13.3% of the participants have moved through the initial stages of "self" and "task" concerns to be able to focus on the impact the technology is making on student learning. When examined in conjunction with the LoU, only half of the participants in LoU V and all participants in LoU VI entered into SoC "impact" concerns. In other words, the largest majority of this sample of teachers, chosen specifically to represent a large spectrum of

technology use, are still focused on how the technology affects them as teachers ("self" concerns=70%) and/or how the technology affects how they function in the classroom ("self" and "task" concerns=86.7%).

As well, other studies report that many teachers pose informal collaboration with other teachers as especially important to ensuring implementation success because it creates a cohesive and involved culture (Davis et al., 2005; Gaynor & Fraser, 2003; Silvernail & Harris, 2003). In this study, concerns about collaboration or interest in collaboration occurred in every SoC, suggesting teachers are either involved in collaborating with others or are interested in doing so.

Case studies show teachers who believe that students are capable of complex technology-enhanced assignments are more likely to allow more collaboration, extended assignments, and flexibility and choice in the topic of assignments (Penuel, 2006). Teachers who perceive technology as a tool for accessing a wide variety of potential applications (Jaillet, 2004; Windschitl & Sahl, 2002) and who believe adequate software and Internet-based resources are available to assist their students (Lane, 2003; Trimmel & Backmann, 2004) are more likely to use laptops with students. Alternately, teachers focused on the possibility of students' inappropriate behavior, such as playing games or nonacademic Internet searches, are likely to implement laptops less often (Jaillet, 2004; Trimmel & Bachmann, 2004; Zucker & McGhee, 2005). Participants reinforced these ideas with the recognition of *Access to Resources* (the one strength present in every LoU and made mention by 20 of the 30 participants) and *Student Preparedness* as the most significant strengths of the innovation. In fact, participants listed wide varieties of resources they claimed benefitted students and prepared them for the future: "journeys

through the body, podcasts and different kind of iMovies, keynote presentations, movie gallery walkthroughs, and investigations" (Participant 1405); yet they simultaneously proclaimed *Classroom Management* (the weakness identified by all LoU and comprised 19 of the 30 responses or 61% of all participants) and *Student Learning* (eight responses from all levels except nonusers, LoU I, and VI) as the most significant weaknesses. In fact, teacher responses included lists of student behavior concerns very similar to the list provided above: "increased off-task behavior, cheating, plagiarism" (Participant 1410). The research cited above seems to suggest two different teacher mindsets: (a) a teacher focused on the value of the opportunity afforded by technology or (b) a teacher focused on the potential for student misconduct; however, the data in this study suggest teachers may be capable of holding both ideas in tandem.

Teacher: Classroom Procedures and *Teacher: Collaboration* themes of success were present at all levels of use and *Student: Engagement* was identified at all but two levels (LoU IVA and VI). Additionally, the higher the LoU, the more the responses focused on student successes as opposed to teacher successes: *Teacher: Professional Development* and *Collaboration* in LoU 0-III, *Teacher Balance of Digital and Print*, *Student Choice*, and *Student Deeper Learning* in LoU IVA and IV, *Student Independence and Self-Advocacy*, *Student Collaboration*, and *Teacher Reflection* in LoU V and VI.

Where participant responses change as the LoU increases for some themes – such as *Teacher: Balance of Print and Digital Media* – to demonstrate an increasing concern for student impact, there is no distinguishable difference between participant responses across LoU concerning *Classroom Procedures*, whether reported by an LoU II or LoU VI user; yet at all levels, *Classroom Procedures* exist, and interestingly, the one weakness

present at all levels is *Classroom Management*.

The IC Map data suggest that teachers feel a similar level of comfort teaching students how to use the technology as they do in assigning students coursework at each level; therefore, the teacher must be comfortable using and teaching students how to use technology in a SAMR level before he/she will attempt to have students complete coursework at that level. At the highest level of SAMR, redefinition, teachers show significantly less comfort in teaching and assigning coursework: only six of 30 are extremely comfortable (as opposed to 13 just one tier higher at modification); and while redefinition assignments were reported at all levels, seven teachers reported not assigning tasks at this level at all, more than double any other level. When examining all instruments in concert, the data show participants did not rate themselves extremely comfortable at all levels of SAMR until LoU VI (the final level); in fact, no one claimed being extremely comfortable at the highest level of SAMR just one level down, LoU V.

While the data suggest teachers are assigning and teaching students at all levels of SAMR, the majority of coursework remains in the substitution and augmentation levels. Twenty-four of 30 participants (80%) reported assigning substitution level coursework on a daily and weekly basis, signifying the goal of this implementation has not yet been reached.

Research Question 2. What obstacles are these teachers facing in moving up the implementation model to provide instruction that is more effective? The IC Map surveys focused specifically on obstacles hampering movement at each level of SAMR. More teachers reported student and teacher knowledge as an obstacle, with 49% of all obstacles being knowledge-focused. While teachers had obstacles to overcome around

student learning, these concerns diminished as the SAMR level increased. Likewise, student behavior concerns diminished as the SAMR level increased. These data imply that the more knowledge teachers have and the more comfortable they are in the highest tiers of SAMR, the less prominent the most documented obstacles of student knowledge and behavior are.

Obstacles identified within the LoU interviews suggest a movement from a lack of teacher knowledge, collaboration, and resources to a concern for students, lack of time, and perception of the innovation by community and parents as the LoU increases. In other words, the obstacles move from being teacher and task-oriented to being student and stakeholder-oriented.

Balance of digital and print, concern for students, and student behavior show up as obstacles regardless of LoU level. Balancing digital and print media is reported as an obstacle throughout all LoU levels with the exception of LoU II, yet when combined with the data from the other instruments and specifically teacher responses to these interviews, it becomes apparent this obstacle is characterized differently at every level. Participant responses echo the SoC, moving from responses focused on the self to responses focused on the mechanics of balancing digital and print to responses focused on how that balance affects students and how well they learn.

When obstacles identified within the LoU interviews are combined with obstacles identified within the IC surveys, a unique phenomenon occurs. Teacher knowledge was identified in LoU interviews as an obstacle within LoU II and III but dissipated in levels IV, V, and VI; yet in the IC interviews, which asked respondents to identify obstacles moving up the SAMR hierarchy, teacher knowledge became increasingly identified as an

obstacle as teachers moved up the tiers.

The same escalation occurred as student lack of knowledge became an increasingly reported obstacle as teachers moved up the SAMR tiers, yet student knowledge was not identified as an obstacle at all within the LoU interviews. As teachers gained competency within the top levels of SAMR, the remaining obstacles of student behavior, learning concerns, and technical concerns were drastically reduced or not reported at all. Conversely, student behavior and learning concerns were still evident in the highest levels of LoU obstacles. These contradictions may suggest teachers who move up the IC Map and thus teach more effective technology-embedded lessons have fewer obstacles involving student behavior and knowledge; yet the same does not necessarily hold true for teachers who move up the LoU, as these obstacles with student learning and behavior are ever-present. These contradictions emphasize the autonomous nature of the instruments as LoU measure quantity of technology use, whereas IC measures quality of technology use.

For the teacher, the redefinition level is the most difficult because it eradicates previous lessons and ideas about the efficacy of those lessons to institute assignments built on a completely different set of values, specifically the idea of student-centric learning. Hattie (2009) argued,

> It is what teachers get the students to do in the class that emerge[s] as the strongest component to accomplished teachers' repertoire, rather than what the teacher, specifically, does. Students must be actively involved in their learning, with a focus on multiple paths to problem solving. (p. 35)

While the redefinition stage is the pinnacle because balance is achieved within the

domains of TPACK and, by default, institutes the 21st Century Framework and ISTE Standards, Keane (2012) admitted that redefinition "is hard to even describe as we are constantly redefining what is possible through technology" (p. 44), which creates an ever-present obstacle for teachers.

Research Question 3. What methods are teachers using to overcome these obstacles? During the IC Map surveys, participants were asked if they were able to overcome the obstacles they encountered, and if so, what methods did they use to overcome those obstacles.

Across all levels, 25.8% of teachers reported no obstacles. Of those who reported obstacles, 18% responded that they did not overcome the obstacles, while 82% did. At the substitution level, the data present a change in classroom management and teaching methods. At no other level are there more teachers reporting changes. At the augmentation level, seven teachers reported a change in their teaching methods as well. At the modification level, changes still occurred in classroom management and teaching methods, but participants also reported overcoming obstacles through teaching students technology and increasing their own knowledge. At the redefinition level, participants overcame through increasing knowledge, their own and their students.

The number of respondents who identified *Taught Students Technology Skills* and *Increased Teacher Knowledge* amplified through movement up the SAMR model, which is supported by the IC data that suggest these teachers reported more and more competence within the higher levels of SAMR, focused more on the impact of the technology on their students (based on SoCQ scores), and were more reflective in determining value for student learning (based on LoU peak scores). Seemingly, the more

teachers learned, the more important obtaining new knowledge and passing it on to their students became.

Teacher feelings concerning technology go beyond their skepticism of the value of technology integration or willingness to change to a more psychological barrier of accepting change. Hall (2014) stated, "Change is a personal experience; it is a personal feeling; personal frustrations, moments of joy, excitement, depression, discouragement are part of change. So, if you want change to be successful, understanding that personal side becomes really important" (p. 7). Part of the change process is a sense of loss for the ideas, concepts, and values left behind, even when the person accepts the change as positive. Teacher technology beliefs are influenced by their teaching philosophies, which are based on their personal beliefs, values, feelings, and motivations (affective aspect); and their resistance to adopting new technologies stem from these beliefs (Norton et al., 2000). Even when teachers see this change as valuable, the psychological effect of making a change that puts into question one's beliefs becomes a barrier that must be overcome. For successful implementation, teachers must be willing to change their role in the classroom (Hardy, 1998) from leader to facilitator and allow students to become more central. Niederhauser and Stoddart (2001) noted a "consistent relationship between teachers' perspectives about the instructional uses of computers and the types of software they used with their students" (p. 27); this new mindset focuses on learner-centered teaching and constructivist teaching practices (Ertmer et al., 2001; Rakes et al., 1999). Successful integration of technology into teaching depends on transforming teacher beliefs concerning technology and their teaching philosophy concurrently (Windschitl & Sahl, 2002).

Changing classroom procedures and teaching methods occurred most frequently at the substitution level, suggesting these obstacles were some of the first to be encountered and solved. Changing classroom procedures and teaching methods are suggestive of an educational philosophy change, yet data would suggest teachers within the first level of SAMR are dealing with "self" concerns in the lowest stages of concern and working, at best, within the mechanical levels of use, but participants did not recognize educational philosophy changes until LoU V. This may suggest teachers begin changing their educational philosophy in the initial stages to overcome the obstacles the technology adoption presents, yet they are unable to acknowledge that philosophy change until later—perhaps simply the process of accepting so great a change.

Research Question 4. What supports do teachers need in order to move into the upper tiers of the implementation model? The IC Map surveys and the LoU interviews inform this question.

During the IC Map surveys, this question was posed only to those teachers who were unable to overcome the obstacles at each level of SAMR. Professional development was identified as a needed resource more often and at every level of SAMR. In the higher levels of SAMR, collaboration and time for students to create in the classroom were identified as needed resources.

The only theme consistent between the LoU and IC interviews was professional development. The increase in professional development requests as the SAMR level moves higher echoes the increase as the level of use moves higher. Time for students to create and collaboration were requested in the two highest tiers of SAMR, consistent with teachers who have moved into "impact" concerns and LoU IV-VI.

Much research (Dunleavy et al., 2007; Lee & Spires, 2009; Lei & Zhao, 2008; Oliver & Corn, 2008) verifies the importance of effective and ongoing professional development. Teacher beliefs are influenced by the "nature and frequency of messages they hear in their environment" (Coburn, 2004, (p. 213), and professional development activities should ensure teachers are obtaining those consistent messages about the value of technology integration and how to teach and use technology effectively (Penuel, 2006). While teacher ability to redefine their educational belief system to include technology is the most important factor in successful implementation, teacher perception of technology is a primary factor as well and is related to the amount of professional development teachers have received as it increases their feelings of preparedness (NCES, 2000). In addition to the amount of professional development received, the form of professional development and its alignment with standards and curriculum procures a pronounced effect on teacher motivation.

Rogers (2000) concluded in her two studies that external barriers (professional development, student impact, etc.) are most intense at the beginning stage of the adoption process, but this is only after the internal barriers, such as attitudes towards technology in teaching, have been overcome. Additionally, Rogers concluded that a lack of technical support at an advanced level and the need for additional in-depth stakeholder development becomes a barrier for those at the highest level of technology adoption. Within this study, the most requested type of professional development was *New/Creative/Higher Level Professional Development*. This type professional development was requested at every level of use except LoU IV. Participants made statements during the LoU interviews to the importance of fewer generic professional

development sessions: “I feel like I am beyond the PD sessions. I might get one small piece of information that I can use, but usually I already know everything” (Participant 1504).

Conclusions

The founders of the Time to Know Program, Rosen and Beck-Hill (2012), suggested the problem with laptop initiatives revolves around the technocentric approach (use of technology for technology-related activities) rather than an innovative, technology-rich learning environment “conceptually designed and practically implemented” as a by-product of a paradigmatic change. The Time to Know Program signifies only a portion of the National Technology Plan (U.S. Department of Education, 2010), whose main goal is “leveraging learning to promote engaging and empowering learning experiences” (p. 9) by providing engaging environments and tools for understanding and remembering content.

Teachers must also feel they are making changes that are valuable to them and their students. When teachers deem expected uses of technology not closely aligned with the curriculum, they use it less often (Sarama et al., 1998). Sugar et al.’s (2004) study discussed the fact that teachers must see the utility in using a particular software before they are willing to integrate it into their curricula; the researchers focused on the fact that teachers require documented impacts on student learning. Further, Sugar et al. stated that high school teachers have an entirely different group of concerns as compared to elementary and middle grades and are thus unwilling to invest the time necessary to integrate technology if proof of its efficacy has not been produced.

Baylor and Ritchie (2002) found that three variables—strength of technology

leadership at the school level, teacher openness to change, and teacher non-school computer use—all seemed to predict student mastery of the curricula. As well, teacher openness to change, the amount of individual technology use in creative situations, and the level of integration attempted within the classroom determined the amount of higher order thinking required by students. Baylor and Ritchie's research demonstrates the importance of the affective and behavioral facets working together to create a successful implementation. The most prevalent factor, teacher willingness to change, unfortunately, according to Baylor and Ritchie, is also the most difficult to influence.

Taking all of the results from this study into account, it can be implied that participants in this study have not moved through the SoC as needed to create a student-centric learning environment, and they have not progressed into the upper tiers of the SAMR model as needed to create an innovative and inventive learning environment, yet movement is evident and there are some participants who demonstrated having achieved this student-centric, innovative learning environment. CBAM is predicated upon the idea that change is an individual journey that cannot be forced but can be understood. The data obtained about the obstacles, successes, and needed resources at each level of use create a roadmap for change facilitators to assist teachers in moving forward.

Limitations

There were several limitations to this study. First, the results of this study may not be generalized to other schools or districts using one-to-one technology adoptions and are only applicable to the schools in the study.

Second, due to the qualitative nature of the study and the researcher's role as an administrator in the county, it is impossible to discount researcher bias; however,

prescribed steps were taken to limit researcher bias. The researcher removed herself from the data collection process, involved an outside party to conduct intercoder agreement and eliminate definition drift, and utilized triangulation of data to add validity to the study.

Third, the LoU instrument did not specifically probe the methods teachers utilized to overcome the obstacles they identified in overall technology implementation. For this reason, Research Question 3 is informed solely by IC Map data. The creators of the LoU instrument do allow the addition of questions to the protocol, and the addition of a question concerning methods teachers used in overcoming identified obstacles would have strengthened the study.

Additionally, teacher openness to change and teacher use of technology outside of the academic setting are noted predictors of teachers' effective implementation of technology in the classroom. Obtaining responses on these two variables would have provided valuable affective (teacher openness to change) and behavioral (teacher use of technology outside the academic setting) data, with the possibility of better informing why teachers behave and use technology the way they do.

Finally, benchmarks of teachers' affective and behavioral aspects did not occur throughout the implementation process. The only understanding we have is through this study of how teachers feel about the technology adoption or how often and in what way they use the technology occurring 5 years after the initial adoption. The myriad teaching experiences, program adoptions, administrative team changes, and evolution of time create unknown forces on those results, leaving many gaps in our understanding.

Recommendations

Chell and Dowling (2012) contended that teachers cannot enter the transformative phase of technology integration, characterized by SAMR's modification and redefinition tiers, until a minimum of 3 years into a one-to-one initiative; however, they also claimed Sharjah Higher College of Technology, for which they work, short-circuited this timetable and movement into the final two tiers of SAMR, taking only one semester, due to their faculty's willingness to teach each other. Conversely, their explanation of assignments that qualify as modification and redefinition does not parallel with other's definitions, specifically Puentedura's (2012). So, while the willing attitude of the faculty has contributed to an excellent implementation process, perhaps their understanding of where they are in the SAMR model is inaccurate. It is precisely misunderstandings such as these that create skewed perceptions of the implementation of innovations, hindering the evaluation process, and becoming a barrier to "true" implementation. The purpose of this study was to examine teacher perceptions of where they are within the technology implementation; however, as with Chell and Dowling's study, false understandings of where teachers are in the process present obstacles to moving forward. A recommendation for this district is to have technology facilitators within each school observe teachers and supply their understandings to supplement teacher understandings of where they are in terms of SoC, LoU, and IC.

A second recommendation for this district is to supply professional development focused on classroom management as the data suggest this obstacle is insurmountable for many teachers at all levels of use.

A third recommendation for this district is to institute ongoing benchmarks to

create a better understanding of teacher progress and needs and to inform professional development.

A final recommendation for future research involves utilizing CBAM instruments to understand how middle school teachers have implemented the one-to-one technology adoption and what obstacles, successes, and needed resources they report.

Summary

The findings of this study suggest this technology adoption has not reached maturity at the 5-year mark. Teachers continue to be more concerned with their own internal conflicts about the adoption than how it affects student learning. Classroom management and student behavior exist as stumbling blocks regardless of the amount of technology a teacher uses in the classroom, symptomatic of a technocentric environment, yet these teachers champion the access to resources the innovation supplies and continue to seek new knowledge for themselves and their students.

The change in vision, scope, and potential of technology in the education arena as voiced by the United States Department of Education (2017) in charging educators to adopt "everywhere, all-the-time learning" waxes naïve in the face of research. While great strides have been made and continue to be made, the task applied to teachers in the face of such an educational paradigm change proves colossal. This study illuminates the tremendous process teachers must experience as they change their educational philosophies—their belief system—to enact a student-centric learning environment, seemingly pushing teachers out of the primary role. Part of the change process is a sense of loss for the ideas, concepts, and values left behind, even when the person accepts the change as positive. Hall (2014) stated, "Change is a process and requires time and

exposure to the new technology to gain potency" (p. 7).

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Appendix A

The Stages of Concern Questionnaire

Stages of Concern Questionnaire

Name (optional): _____

The purpose of this questionnaire is to determine what people who are using or thinking about using various programs are concerned about at various times during the adoption process.

The items were developed from typical responses of school and college teachers who ranged from no knowledge at all about various programs to many years' experience using them. Therefore, **many of the items on this questionnaire may appear to be of little relevance or irrelevant to you at this time.** For the completely irrelevant items, please circle "0" on the scale. Other items will represent those concerns you do have, in varying degrees of intensity, and should be marked higher on the scale.

For example:

This statement is very true of me at this time.	0	1	2	3	4	5	6	(7)
This statement is somewhat true of me now.	0	1	2	3	(4)	5	6	7
This statement is not at all true of me at this time.	0	(1)	2	3	4	5	6	7
This statement seems irrelevant to me.	(0)	1	2	3	4	5	6	7

Please respond to the items in terms of **your present concerns,** or how you feel about your involvement with **this** innovation. We do not hold to any one definition of the innovation so please think of it in terms of your own perception of what it involves. Phrases such as "this approach" and "the new system" all refer to the same innovation. Remember to respond to each item in terms of your present concerns about your involvement or potential involvement with the innovation.

Thank you for taking time to complete this task.

80 Measuring Implementation in Schools: THE STAGES OF CONCERN QUESTIONNAIRE

0	1	2	3	4	5	6	7
Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	

Circle One Number For Each Item

1. I am concerned about students' attitudes toward the innovation.	0 1 2 3 4 5 6 7
2. I now know of some other approaches that might work better.	0 1 2 3 4 5 6 7
3. I am more concerned about another innovation.	0 1 2 3 4 5 6 7
4. I am concerned about not having enough time to organize myself each day.	0 1 2 3 4 5 6 7
5. I would like to help other faculty in their use of the innovation.	0 1 2 3 4 5 6 7
6. I have a very limited knowledge of the innovation.	0 1 2 3 4 5 6 7
7. I would like to know the effect of reorganization on my professional status.	0 1 2 3 4 5 6 7
8. I am concerned about conflict between my interests and my responsibilities.	0 1 2 3 4 5 6 7
9. I am concerned about revising my use of the innovation.	0 1 2 3 4 5 6 7
10. I would like to develop working relationships with both our faculty and outside faculty using this innovation.	0 1 2 3 4 5 6 7
11. I am concerned about how the innovation affects students.	0 1 2 3 4 5 6 7
12. I am not concerned about the innovation at this time.	0 1 2 3 4 5 6 7
13. I would like to know who will make the decisions in the new system.	0 1 2 3 4 5 6 7
14. I would like to discuss the possibility of using the innovation.	0 1 2 3 4 5 6 7
15. I would like to know what resources are available if we decide to adopt the innovation	0 1 2 3 4 5 6 7
16. I am concerned about my inability to manage all that the innovation requires.	0 1 2 3 4 5 6 7
17. I would like to know how my teaching or administration is supposed to change.	0 1 2 3 4 5 6 7
18. I would like to familiarize other departments or persons with the progress of this new approach.	0 1 2 3 4 5 6 7

0	1 2	3 4 5	6 7
Irrelevant	Not true of me now	Somewhat true of me now	Very true of me now

	Circle One Number For Each Item
19. I am concerned about evaluating my impact on students.	0 1 2 3 4 5 6 7
20. I would like to revise the innovation's approach.	0 1 2 3 4 5 6 7
21. I am preoccupied with things other than the innovation.	0 1 2 3 4 5 6 7
22. I would like to modify our use of the innovation based on the experiences of our students.	0 1 2 3 4 5 6 7
23. I spend little time thinking about the innovation.	0 1 2 3 4 5 6 7
24. I would like to excite my students about their part in this approach.	0 1 2 3 4 5 6 7
25. I am concerned about time spent working with nonacademic problems related to the innovation.	0 1 2 3 4 5 6 7
26. I would like to know what the use of the innovation will require in the immediate future.	0 1 2 3 4 5 6 7
27. I would like to coordinate my efforts with others to maximize the innovation's effects.	0 1 2 3 4 5 6 7
28. I would like to have more information on time and energy commitments required by the innovation.	0 1 2 3 4 5 6 7
29. I would like to know what other faculty are doing in this area.	0 1 2 3 4 5 6 7
30. Currently, other priorities prevent me from focusing my attention on the innovation.	0 1 2 3 4 5 6 7
31. I would like to determine how to supplement, enhance, or replace the innovation.	0 1 2 3 4 5 6 7
32. I would like to use feedback from students to change the program.	0 1 2 3 4 5 6 7
33. I would like to know how my role will change when I am using the innovation.	0 1 2 3 4 5 6 7
34. Coordination of tasks and people is taking too much of my time.	0 1 2 3 4 5 6 7
35. I would like to know how the innovation is better than what we have now.	0 1 2 3 4 5 6 7

Appendix B

Sample SoCQ Score Report

Stages of Concern Scoring Device
Report for Individual SoCQ Participant (record ID: 33833)

A: Individual Participant Description (record ID: 33833)

Cohort name: Dissertation 2016
Name of Innovation: One-to-One Technology Adoption

Subgroup and Custom Prompt Responses
(Click here to Show Subgroup and Custom Prompt Responses.)

B: Question/Responses Table

Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Q3: **1**	Q6: **1**	Q7: **1**	Q4: **1**	Q1: **1**	Q5: **5**	Q2: **1**
Q12: **2**	Q14: **2**	Q13: **0**	Q8: **1**	Q11: **3**	Q10: **3**	Q9: **3**
Q21: **1**	Q15: **3**	Q17: **1**	Q16: **1**	Q19: **4**	Q18: **4**	Q20: **1**
Q23: **1**	Q26: **3**	Q28: **1**	Q25: **1**	Q24: **4**	Q27: **5**	Q22: **2**
Q30: **1**	Q35: **1**	Q33: **1**	Q34: **1**	Q32: **6**	Q29: **1**	Q31: **6**

C: Raw Score Totals

Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
6	**10**	**4**	**5**	**18**	**18**	**13**

E: Percentile Scores

Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
22%	**43%**	**21%**	**15%**	**24%**	**40%**	**34%**

D: Raw Score to Percentile Conversion Table

Five Item Raw Scale Score Total	Percentiles for stage: 0	1	2	3	4	5	6
0	0	5	5	2	1	1	1
1	1	12	12	5	1	2	2
2	2	16	14	7	1	3	3
3	4	19	17	9	2	3	5
4	7	23	21	11	2	4	6
5	14	27	25	15	3	5	9
6	22	30	28	18	3	7	11
7	31	34	31	23	4	9	14
8	40	37	35	27	5	10	17
9	48	40	39	30	5	12	20
10	55	43	41	34	7	14	22
11	61	45	45	39	8	16	26
12	69	48	48	43	9	19	30
13	75	51	52	47	11	22	34
14	81	54	55	52	13	25	38
15	87	57	57	56	16	28	42
16	91	60	59	60	19	31	47
17	94	63	63	65	21	36	52
18	96	66	67	69	24	40	57
19	97	69	70	73	27	44	60
20	98	72	72	77	30	48	65

F: Stages of Concern:

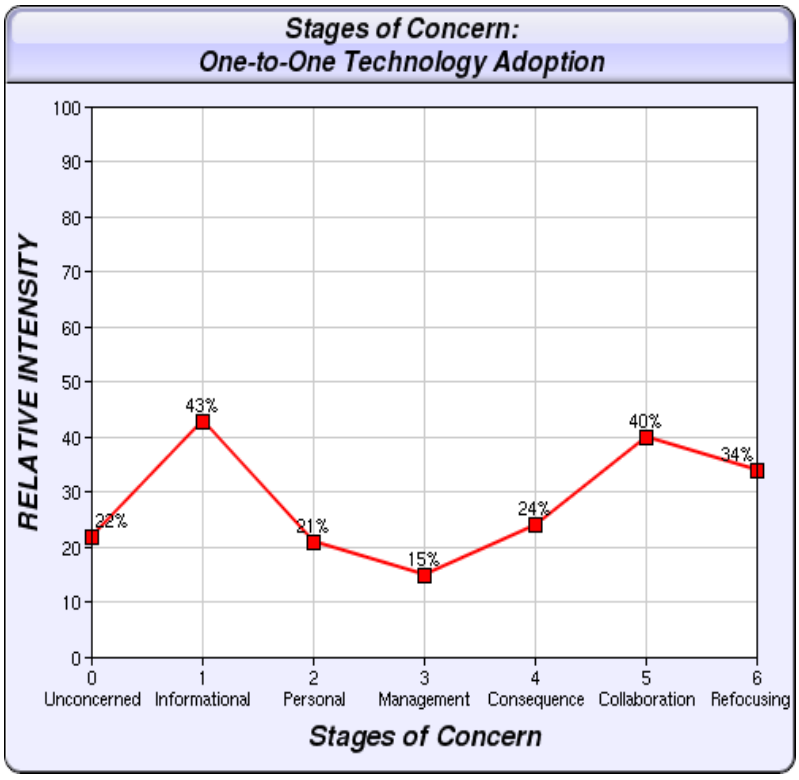

Figure 2.1: The Stages of Concern About an Innovation

Stages of Concern	Description

19	97	69	70	73	27	44	60
20	98	72	72	77	30	48	65
21	99	75	76	80	33	52	69
22	99	80	78	83	38	55	73
23	99	84	80	85	43	59	77
24	99	88	83	88	48	64	81
25	99	90	85	90	54	68	84
26	99	91	87	92	59	72	87
27	99	93	89	94	63	76	90
28	99	95	91	95	66	80	92
29	99	96	92	97	71	84	94
30	99	97	94	97	76	88	96
31	99	98	95	98	82	91	97
32	99	99	96	98	86	93	98
33	99	99	96	99	90	95	99
34	99	99	97	99	92	97	99
35	99	99	99	99	96	98	99

Figure 2.1: The Stages of Concern About an Innovation

Stages of Concern			Description
Self	0	Unconcerned	The individual indicates little concern about or involvement with the innovation.
	1	Informational	The individual indicates a general awareness of the innovation and interest in learning more details about it. The individual does not seem to be worried about him/herself in relation to the innovation. Any interest is in impersonal, substantive aspects of the innovation, such as its general characteristics, effects, and requirements for use.
	2	Personal	The individual is uncertain about the demands of the innovation, his or her adequacy to meet those demands, and/or his or her role with the innovation. The individual is analyzing his or her relationship to the reward structure of the organization, determining his or her part in decision making, and considering potential conflicts with existing structures or personal commitment. Concerns also might involve the financial or status implications of the program for the individual and his or her colleagues.
Task	3	Management	The individual focuses on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organization, managing, and scheduling dominate.
Self	4	Consequence	The individual focuses on the innovation's impact on students in his or her immediate sphere of influence. Considerations include the relevance of the innovation for students; the evaluation of student outcomes, including performance and competencies; and the changes needed to improve student outcomes.
	5	Collaboration	The individual focuses on coordinating and cooperating with others regarding use of the innovation.
	6	Refocusing	The individual focuses on exploring ways to reap more universal benefits from the innovation, including the possibility of making major changes to it or replacing it with a more powerful alternative.

Figure 2.1, The Stages of Concern About an Innovation, page 8 of *Measuring Implementation in Schools: The Stages of Concern Questionnaire*.

Appendix C

The Levels of Use Focused Interview Protocol

Appendix A
The Basic Interview Protocol

Question	Purpose
Are you using the innovation?	To distinguish between users and nonusers; to break LoU 0–II from LoU III–VI
IF YES	
What do you see as the strengths and weaknesses of the innovation in your situation? Have you made any attempt to do anything about the weaknesses?	To probe Assessing and Knowledge Categories.
Are you currently looking for any information about the innovation? What kind? For what purpose?	To probe Acquiring Information Category.
Do you ever talk with others about the innovation? What do you tell them?	To probe Sharing Category and check Decision Point E.
What do you see as being the effects of the innovation? In what way have you determined this? Are you doing any evaluating, either formally or informally, of your use of the innovation? Have you received any feedback from students? What have you done with the information you get?	To probe Assessing Category.
Have you made any changes recently in how you use the innovation? What? Why? How recently? Are you considering making any changes?	To distinguish between LoU III (user-oriented changes), LoU IVB (impact-oriented changes), and LoU IVA (no or routine changes); to probe Status Reporting and Performing Categories.
As you look ahead to later this year, what plans do you have in relation to your use of the innovation?	To probe Planning and Status Reporting Categories.

Question	Purpose
Are you working with others (outside of anyone you may have worked with from the beginning) in your use of the innovation? Have you made any changes in your use of the innovation based on this coordination?	To separate LoU V from III, IVA, and IVB. If a positive response is given, LoU V probes (below) are used.
Are you considering making or planning to make major modifications or to replace the innovation at this time?	To separate LoU VI from III, IVA, IVB, and V.
LoU V Probes	
How do you work together? How frequently?	To verify Decision Point E; to probe Performing Category.
What are the strengths and the weaknesses of this collaboration for you?	To probe Knowledge Category.
Are you looking for any particular kind of information in relation to this collaboration?	To probe Acquiring Information Category.
When you talk to others about your collaboration, what do you share with them?	To probe Sharing Category.
Have you done any formal or informal evaluation of how your collaboration is working?	To probe Assessing Category.
What plans do you have for this collaborative effort in the future?	To probe Planning Category.
Can you summarize for me where you see yourself right now in relation to the use of the innovation? (Optional Question)	To get a concise picture of the user's perception of his/her use or nonuse.

Question	Purpose
IF NO	
Have you made a decision to use the innovation in the future? If so, when?	To separate LoU 0 from I; to probe Status Reporting, Planning, and Performing Categories; to separate LoU I from II.
Can you describe the innovation for me as you see it?	To probe Knowledge Category.
Are you currently looking for any information about the innovation? What kinds? For what purposes?	To probe Acquiring Information Category.
What are the strengths and weaknesses of the innovation for your situation?	To probe Assessing Category.
At this point in time, what kinds of questions are you asking about the innovation? Give examples if possible.	To probe Assessing, Sharing, and Status Reporting Categories.
Do you ever talk with others and share information about the innovation? What do you share?	To probe Sharing Category.
What are you planning with respect to the innovation? Can you tell me about any preparation or plans you have been making for the use of the innovation?	To probe Planning Category.
Can you summarize for me where you see yourself right now in relation to the use of the innovation? (Optional Question)	To get a concise picture of the user's perception of his/her use or nonuse.

Question	Purpose
Past-User Questions	
Why did you stop using the innovation? Can you describe for me how you organized your use of the innovation, what problems you found, and what its effects appeared to be on students? When you assess the innovation at this point in time, what are its strengths and weaknesses for you?	

Appendix D

The Innovation Configuration Map Survey

Innovation Configuration Map Based on the SAMR Model

Directions: Please read and understand the map below. If you have any questions about the categories of substitution, augmentation, modification, and redefinition, please ask the interviewer.

	Substitution	Augmentation	Modification	Redefinition
Description	Technology acts as a direct tool substitute with no functional change.	Technology acts as a direct tool substitute with functional improvement.	Technology allows for significant task redesign.	Technology allows for the creation of new task that were inconceivable before technology.
Characteristics	Students use the lower levels of Bloom's Revised Taxonomy to remember, understand, and apply.	Students use the lower levels of Bloom's Revised Taxonomy to remember, understand, and apply.	Students use the upper levels of Bloom's Revised Taxonomy to analyze, evaluate, and create.	Students use the upper levels of Bloom's Revised Taxonomy to analyze, evaluate, and create.
Examples	Use Google Earth instead of an atlas to locate a place [remember].	Use Google Earth rulers to measure the distance between two places [understand].	Use Google Earth layers such as panoramio and 360 cities to research locations in order to determine the most desirable city to test the innovation you have created [analyze, evaluate].	Create a narrated Google Earth tour that synthesizes your research and explains your reasoning for choosing this city as the most desirable to test your innovation based on its features and publish this narrated tour on the Internet [synthesize, evaluate, create].

Directions: Using the map above, please answer the following questions based on your classroom practice.

1. How comfortable are you with *teaching* students how to complete assignments that involve **substitution**? (i.e., using the dictionary to copy definitions, copying notes in Pages or Keynote from the Promethean board, completing a digital worksheet in Preview, etc.)
    a. Extremely comfortable
    b. Fairly comfortable
    c. Somewhat comfortable
    d. Not very comfortable
    e. I do not teach students how to complete these types of assignments.

2. How comfortable are you with *asking students to complete assignments* that involve **substitution,** regardless of whether you teach them or someone else teaches them how to do so? (i.e., using the dictionary to copy definitions, copying notes in Pages or Keynote from the Promethean board, completing a digital worksheet in Preview, etc.)
    a. Extremely comfortable
    b. Fairly comfortable
    c. Somewhat comfortable
    d. Not very comfortable
    e. I do not ask students to complete these types of assignments.

3. How often do students complete **substitution** assignments in your class?
    a. Daily
    b. Weekly
    c. Monthly
    d. Once or twice per semester
    e. Not at all

4. What obstacles, if any, have you experienced in implementing **substitution** assignments in your classroom?

5. Did you overcome those obstacles? If so, how?

6. If you did not overcome the obstacles, why and what resources would you need to overcome those obstacles?

7. How comfortable are you with *teaching* students how to complete assignments that involve **augmentation**? (i.e., using the highlight tool to annotate, using the text to speech tool, adding pictures to illustrate, etc.)
   a. Extremely comfortable
   b. Fairly comfortable
   c. Somewhat comfortable
   d. Not very comfortable
   e. I do not teach students how to complete these types of assignments.

8. How comfortable are you *with asking students to complete assignments* that involve **augmentation,** regardless of whether you teach them or someone else teaches them how to do so? (i.e., using the highlight tool to annotate, using the text to speech tool, adding pictures to illustrate, etc.)
    a. Extremely comfortable
    b. Fairly comfortable
    c. Somewhat comfortable
    d. Not very comfortable
    e. I do not ask students to complete these types of assignments.

9. What obstacles, if any, have you experienced in implementing **augmentation** assignments in your classroom?

10. Did you overcome those obstacles? If so, how?

11. If you did not overcome the obstacles, why and what resources would you need to overcome those obstacles?

12. How comfortable are you with *teaching* students how to complete assignments that involve **modification**? (i.e., using a classroom blog to analyze a news article, using a Google Doc for a group of students in different classes to collaborate on how to complete a science project, using an online Flowchart for the student School Improvement Team to analyze the resources needed at specific times to complete their action research, etc.)
    a. Extremely comfortable
    b. Fairly comfortable
    c. Somewhat comfortable
    d. Not very comfortable
    e. I do not teach students how to complete these types of assignments.

13. How comfortable are you with *asking students to complete assignments* that involve **modification,** regardless of whether you teach them or someone else teaches them how to do so? (i.e., using a classroom blog to analyze a news article, using a Google Doc for a group of students in different classes to collaborate on how to complete a science project, using an online Flowchart for the student School Improvement Team to analyze the resources needed at specific times to complete their action research, etc.)
    a. Extremely comfortable
    b. Fairly comfortable
    c. Somewhat comfortable
    d. Not very comfortable
    e. I do not ask students to complete these types of assignments.

14. What obstacles, if any, have you had in implementing **modification** assignments in your classroom?

15. Did you overcome those obstacles? If so, how?

16. If you did not overcome the obstacles, why and what resources would you need to overcome those obstacles?

17. How comfortable are you with *teaching* students how to complete assignments that involve **redefinition**? (i.e., create a game using the math principles recently taught, develop campaign websites that analyze and problem-solve an aspect of our society, create how-to video tutorials for auto mechanics' "most asked about" topics based on material recently taught in Auto Tech, etc.)
    a. Extremely comfortable
    b. Fairly comfortable
    c. Somewhat comfortable
    d. Not very comfortable
    e. I do not teach students how to complete these types of assignments.

18. How comfortable are you with *asking students to complete assignments* that involve **redefinition,** regardless of whether you teach them or someone else teaches them how to do so? (i.e., create a game using the math principles recently taught, develop campaign websites that analyze and problem-solve an aspect of our society, create how-to video tutorials for auto mechanics' most asked about topics based on material recently taught in Auto Tech, etc.)
    a. Extremely comfortable
    b. Fairly comfortable

c. Somewhat comfortable
d. Not very comfortable
e. I do not ask students to complete these types of assignments.

19. What obstacles, if any, have you had in implementing **redefinition** assignments in your classroom?

20. Did you overcome those obstacles? If so, how?

21. If you did not overcome the obstacles, why and what resources would you need to overcome those obstacles?

Appendix E

Superintendent's Permission

[redacted]

Research Request
3 messages

Elicia Massengil [redacted] Tue, Aug 12, 2014 at 12:23 PM

[redacted]

As you are aware, I have been working on completing my Doctor of Education degree at Gardner-Webb University and have greatly appreciated all the opportunities you and the district have afforded me to broaden my understanding of the school system as a whole as well as participate and/or lead activities outside my role as an English teacher.

With that said, I was hoping that you would allow me yet another opportunity. I would very much like to complete my dissertation work within the district because I feel that my study will complement the work that is already being completed in the district in regards to technology integration and nurturing of future-ready students.

The purpose of my study is to investigate the process teachers experience in a one-to-one technology adoption, the obstacles encountered, and the resources that allow them movement into the final two stages of the implementation process [modification and redefinition, as defined by Puentedura] in order to identify "next steps" toward full implementation. For my study, I would analyze two questionnaires: (1)The Concerns Based Adoption Model Stages of Concern Questionnaire, which asks teachers to respond anonymously to a 34 question survey. This survey will identify where each teacher is in the stages of concern. Throughout implementation, teachers should move from self-concerns to student-concerns. Understanding where teachers are on this continuum allows technology facilitators to know how to address concerns so teachers may concentrate only on how the technology integration is affecting the students. (2) The Concerns Based Adoption Model Innovations Configuration questionnaire which utilizes Apple's SAMR model to determine where along the continuum of innovation integration teachers lie—from simply substituting technology for paper to fully redefining how technology defines the classroom space. Both of these questionnaires would be completed anonymously and no identifying characteristics would be collected.

The final stage of my research is qualitative in nature. I will offer a workshop for interested teachers who feel they want to move into the final two stages of the SAMR model but just aren't sure how to make that transition and for teachers who have made that transition and are willing to share their knowledge. During this workshop, I will conduct a group interview to allow teachers to share concerns about moving into those final stages of implementation and effective methods of making that move. At the end of the group interview, I will provide teachers with resources, ideas and simulations of what this type of integration looks like and how to make it happen in their classroom. I will not use the names of the teachers involved in these groups interviews or any identifying characteristics other than that they work in a traditional high school setting. The use of pseudonyms will allow me to discuss the findings from the interviews within the text of my research.

I assure you that I will be happy to supply you with any and all data and work that I collect and complete for review and approval if you would like to do so. Again, I would very much like to do my research in this county because I feel it would help us improve the great work that is already occurring, and I wanted to make sure that I have your approval before I start working heavily on my proposal. Please feel free to call me at 828-329-1587 or email me if you have any questions about this process or my intentions. I am excited to hear back from you soon and thank you so much for your time.

Sincerely,

Elicia Massengill
English Teacher
[redacted]

All e-mail correspondence to and from this address is subject to the North Carolina Public Records Law, which may result in monitoring and disclosure to third parties, including law enforcement.

[redacted] Mon, Aug 18, 2014 at 2:44 PM
To: Elicia Massengill [redacted]

Dear Mrs. Massengill,

I am happy to approve your request. Please let me know if I can do anything to support your work.

Sincerely,
[redacted]
[Quoted text hidden]
--
[redacted]
Superintendent
[redacted]
[Quoted text hidden]

[redacted] Mon, Aug 18, 2014 at 5:14 PM
[redacted]

[redacted]
[Quoted text hidden]
--
[Quoted text hidden]

Appendix F

Principals' Permission

[redacted]

Permission Request

3 messages

Elicia Massengill [redacted] Thu, Apr 7, 2016 at 10:49 AM

[redacted]

I am currently attending Gardner Webb University to obtain my doctorate in Curriculum and Instruction and am in the final stages of obtaining research and writing the remainder of my dissertation, "An Examination of Teacher Behavior Beyond the Initial Stages of a District's One-to-One Technology Adoption."

[redacted] has approved this research being completed in the traditional high schools of [redacted] This letter is to request your permission to involve your teachers an[redacted]n the process. With your permission, [redacted] will identify ten teachers within your school to participate in a survey and interview about how they use the technology provided by the one-to-one implementation and what obstacles they have found or resources they would need to improve how they integrate technology. These ten teachers will be asked to volunteer to participate, if they choose to participate. Their responses will be anonymous and will be published as "a teacher in a rural, traditional public school in North Carolina" with no other identifying characteristics.

Once the ten teachers are identified who will participate in the research, a person from outside your school will set up a time with the selected teachers to conduct the survey and interview. This will take approximately one hour of the teachers' time.

The information obtained from all three schools will be compiled to represent a composite understanding of how teachers at every level from non-users to proficient users of technology utilize technology, how they have overcome barriers to implementation, and what resources are still needed to be able to improve their use of technology. It is my desire that this information will be valuable in informing next steps for our technology team as they seek to improve the effectiveness of our technology integration.

If you have any questions or concerns about this process, please do not hesitate to let me know. I look forward to your response, and hopefully, working with your teachers.

Sincerely,

--
Elicia Massengill, MAEd, NBCT
Assistant Principal
[redacted]

[redacted] Thu, Apr 7, 2016 at 3:59 PM
To: Elicia Massengill [redacted]

Sounds great. Good luck.

[redacted]

[redacted]

Permission Request

1 message

Elicia Massengill <[redacted]> Thu, Apr 7, 2016 at 10:49 AM

[redacted]

I am currently attending Gardner Webb University to obtain my doctorate in Curriculum and Instruction and am in the final stages of obtaining research and writing the remainder of my dissertation, "An Examination of Teacher Behavior Beyond the Initial Stages of a District's One-to-One Technology Adoption."

[redacted] has approved this research being completed in the traditional high schools of [redacted] This letter is to request your permission to involve your teachers and [redacted] in the process. With your permission, [redacted] will identify ten teachers within your school to participate in a survey and interview about how they use the technology provided by the one-to-one implementation and what obstacles they have found or resources they would need to improve how they integrate technology. These ten teachers will be asked to volunteer to participate, if they choose to participate. Their responses will be anonymous and will be published as "a teacher in a rural, traditional public school in North Carolina" with no other identifying characteristics.

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If you have any questions or concerns about this process, please do not hesitate to let me know. I look forward to your response, and hopefully, working with your teachers.

Sincerely,

--
Elicia Massengill, MAEd, NBCT
Assistant Principal
[redacted]ool

M [redacted]

Permission Request

3 messages

Elicia Massengill [redacted] Thu, Apr 7, 2016 at 10:48 AM

[redacted]

I am currently attending Gardner Webb University to obtain my doctorate in Curriculum and Instruction and am in the final stages of obtaining research and writing the remainder of my dissertation, "An Examination of Teacher Behavior Beyond the Initial Stages of a District's One-to-One Technology Adoption."

[redacted] has approved this research being completed in the traditional high schools o[redacted] County. This letter is to request your permission to involve your teachers and [redacted] in the process. With your permission, [redacted] will identify ten teachers within your school to participate in a survey and interview about how they use the technology provided by the one-to-one implementation and what obstacles they have found or resources they would need to improve how they integrate technology. These ten teachers will be asked to volunteer to participate, if they choose to participate. Their responses will be anonymous and will be published as "a teacher in a rural, traditional public school in North Carolina" with no other identifying characteristics.

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If you have any questions or concerns about this process, please do not hesitate to let me know. I look forward to your response, and hopefully, working with your teachers.

Sincerely,

--

Elicia Massengill, MAEd, NBCT

Assistant Principal

[redacted]ol

[redacted] Thu, Apr 7, 2016 at 11:01 AM

To: Elicia Massengill [redacted]

That is fine with me.

--

[redacted]

Appendix G

Technology Facilitators' Agreement

[redacted]

Permission Request

4 messages

Elicia Massengil [redacted] Thu, Apr 7, 2016 at 4:02 PM

[redacted]

I am currently attending Gardner Webb University to obtain my doctorate in Curriculum and Instruction and am in the final stages of obtaining research and writing the remainder of my dissertation, "An Examination of Teacher Behavior Beyond the Initial Stages of a District's One-to-One Technology Adoption."

[redacted] has approved this research being completed in the traditional high schools of [redacted] County. This letter is to request your assistance in identifying ten teachers within your school to participate in a survey and interview about how they use the technology provided by the one-to-one implementation and what obstacles they have found or resources they would need to improve how they integrate technology. These ten teachers will be asked to volunteer to participate. Their responses will be anonymous and will be published as "a teacher in a rural, traditional public school in North Carolina" with no other identifying characteristics.

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If you have any questions or concerns about this process, please do not hesitate to let me know. I look forward to your response, and hopefully, working with you during this process.

Thank you,

--

Elicia Massengill, MAEd, NBCT

Assistant Principal

[redacted]

[redacted] Thu, Apr 7, 2016 at 4:02 PM

[redacted]

[redacted]

--
[Quoted text hidden]

[redacted] Thu, Apr 7, 2016 at 4:05 PM
To: Elicia Massengill [redacted]

I am glad to help and will attend the meeting at East at 7:45 Monday morning. See you then!

[Quoted text hidden]
[Quoted text hidden]

"All e-mail correspondence to and from this address is subject to the North Carolina Public Records Law, which may result in monitoring and disclosure to third parties, including law enforcement."

--

[redacted]
Instructional Technology Facilitator
[redacted]

All e-mail correspondence to and from this address is subject to the North Carolina Public Records Law, which may result in monitoring and disclosure to third parties, including law enforcement.

"All e-mail correspondence to and from this address is subject to the North Carolina Public Records Law, which may result in monitoring and disclosure to third parties, including law enforcement."

Elicia Massengill <eliciam@rcsnc.org> Thu, Apr 7, 2016 at 4:05 PM
[redacted]

[redacted]

Permission Request

4 messages

Elicia Massengill <[redacted]> Thu, Apr 7, 2016 at 4:03 PM

[redacted]

I am currently attending Gardner Webb University to obtain my doctorate in Curriculum and Instruction and am in the final stages of obtaining research and writing the remainder of my dissertation, "An Examination of Teacher Behavior Beyond the Initial Stages of a District's One-to-One Technology Adoption."

[redacted] has approved this research being completed in the traditional high schools of [redacted]. This letter is to request your assistance in identifying ten teachers within your school to participate in a survey and interview about how they use the technology provided by the one-to-one implementation and what obstacles they have found or resources they would need to improve how they integrate technology. These ten teachers will be asked to volunteer to participate. Their responses will be anonymous and will be published as "a teacher in a rural, traditional public school in North Carolina" with no other identifying characteristics.

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If you have any questions or concerns about this process, please do not hesitate to let me know. I look forward to your response, and hopefully, working with you during this process.

Thank you,

--
Elicia Massengill, MAEd, NBCT
Assistant Principal
[redacted]

Thu, Apr 7, 2016 at 4:03 PM

I am currently attending Gardner Webb University to obtain my doctorate in Curriculum and Instruction and am in the final stages of obtaining research and writing the remainder of my dissertation, "An Examination of Teacher Behavior Beyond the Initial Stages of a District's One-to-One Technology Adoption."

[redacted] has approved this research being completed in the traditional high schools o[redacted]County. This letter is to request your assistance in conducting a research process with ten teachers who have been identified within your school to participate in a survey and interview about how they use the technology provided by the one-to-one implementation and what obstacles they have found or resources they would need to improve how they integrate technology. Their responses will be anonymous and will be published as "a teacher in a rural, traditional public school in North Carolina" with no other identifying characteristics.

If you agree to be a part of this research process, I will train you in the necessary protocols for conducting the surveys and interviews. At this point, you will administer the surveys and interviews to the ten selected teachers. This process will take approximately one hour for each teacher.

[Quoted text hidden]

[redacted] Fri, Apr 8, 2016 at 8:16 AM

To: Elicia Massengill [redacted]

Hi Mrs. Massengill,

I would be happy to help in this project for you. Donna has already made contact with me and mentioned meeting with you on Monday about what to do. Looking forward to it.

[redacted]

[Quoted text hidden]

> [Quoted text hidden]
>
> "All e-mail correspondence to and from this address is subject to the North Carolina Public Records Law, which may result in monitoring and disclosure to third parties, including law enforcement."

--

Thanks,

[redacted]

Instructional Technology Facilitator

[redacted]

All correspondence to and from this address is subject to North Carolina Public Records Law, which may result in monitoring and disclosure to third parties, including law enforcement.

"All e-mail correspondence to and from this address is subject to the North Carolina Public Records Law, which may result in monitoring and disclosure to third parties, including law enforcement."

Elicia Massengill <[redacted] Fri, Apr 8, 2016 at 8:17 AM

[redacted]

[redacted]

Permission Request

3 messages

[redacted]

Thu, Apr 7, 2016 at 10:52 AM

I am currently attending Gardner Webb University to obtain my doctorate in Curriculum and Instruction and am in the final stages of obtaining research and writing the remainder of my dissertation, "An Examination of Teacher Behavior Beyond the Initial Stages of a District's One-to-One Technology Adoption."

[redacted] has approved this research being completed in the traditional high schools of [redacted] This letter is to request your assistance in identifying ten teachers within your school to participate in a survey and interview about how they use the technology provided by the one-to-one implementation and what obstacles they have found or resources they would need to improve how they integrate technology. These ten teachers will be asked to volunteer to participate. Their responses will be anonymous and will be published as "a teacher in a rural, traditional public school in North Carolina" with no other identifying characteristics.

Once the ten teachers are identified who will participate in the research, a person from outside your school will set up a time with the selected teachers to conduct the survey and interview. This will take approximately one hour of the teachers' time.

The information obtained from all three schools will be compiled to represent a composite understanding of how teachers at every level from non-users to proficient users of technology utilize technology, how they have overcome barriers to implementation, and what resources are still needed to be able to improve their use of technology. It is my desire that this information will be valuable in informing next steps for our technology team as they seek to improve the effectiveness of our technology integration.

If you have any questions or concerns about this process, please do not hesitate to let me know. I look forward to your response, and hopefully, working with you during this process.

Thank you,

--

Elicia Massengill, MAEd, NBCT

Assistant Principal

[redacted]

Thu, Apr 7, 2016 at 10:53 AM

[redacted]>

I am currently attending Gardner Webb University to obtain my doctorate in Curriculum and Instruction and am in the final stages of obtaining research and writing the remainder of my dissertation, "An Examination of Teacher Behavior Beyond the Initial Stages of a District's One-to-One Technology Adoption."

[redacted] has approved this research being completed in the traditional high schools of [redacted] County. This letter is to request your assistance in conducting a research process with ten teachers who have been identified within your school to participate in a survey and interview about how they use the technology provided by the one-to-one implementation and what obstacles they have found or resources they would need to improve how they integrate technology. Their responses will be anonymous and will be published as "a teacher in a rural, traditional public school in North Carolina" with no other identifying characteristics.

If you agree to be a part of this research process, I will train you in the necessary protocols for conducting the surveys and interviews. At this point, you will administer the surveys and interviews to the ten selected teachers. This process will take approximately one hour for each teacher.

The information obtained from all three schools will be compiled to represent a composite understanding of how teachers at every level from non-users to proficient users of technology utilize technology, how they have overcome barriers to implementation, and what resources are still needed to be able to improve their use of technology. It is my desire that this information will be valuable in informing next steps for our technology team as they seek to improve the effectiveness of our technology integration.

If you have any questions or concerns about this process, please do not hesitate to let me know. I look forward to your response, and hopefully, working with you during this process.

[Quoted text hidden]

[redacted] Sun, Apr 10, 2016 at 9:11 PM

To: Elicia Massengill [redacted]

Yes, I will participate. This is worded very well.

[redacted]

[redacted]

Instructional Technology Facilitator

[redacted]

[Quoted text hidden]

[Quoted text hidden]

"All e-mail correspondence to and from this address is subject to the North Carolina Public Records Law, which may result in monitoring and disclosure to third parties, including law enforcement."

"All e-mail correspondence to and from this address is subject to the North Carolina Public Records Law, which may

Appendix H

Participant Research Information Sheet

Information Sheet for Doctor of Education Dissertation Research

You will be given a copy of this information sheet.

Dissertation Title: An examination of teacher concerns beyond the initial stages of a district's one-to-one technology adoption

Researcher's Name: Elicia Massengill

Contact Details: Email: eliciam@rcsnc.org Phone: (828) 447-8142

Supervisor's Name: Dr. Steven Bingham

I would like to invite _____ to participate in this research project.

Details of Study:

This study seeks to understand what teachers in a mature one-to-one technology adoption think about the technology adoption, how they have implemented technology in their classrooms, what obstacles they have encountered, and what resources they used or would need to use to overcome those obstacles.

Each participant will anonymously take part in two surveys and a focused interview. Information gleaned from these instruments will be used to understand how teachers at every level of ability and technology use feel, behave, and utilize technology, the barriers they have encountered, and the resources they have found or would like to find in order to improve their implementation.

The intended outcome for this research is to inform professional development initiatives for districts with mature one-to-one initiatives as well as to prepare districts that are considering a technology adoption or are in the infancy stages of an adoption.

The results of the surveys and interviews will be published in the researcher's dissertation as a culmination of data from three different high schools. The results will be published in generalizable language in order to protect participants' anonymity. ["Teachers who implement technology on a daily basis….", "Teachers in a rural North Carolina district…", "Those teachers who have chosen to leave technology out of their instruction…"]

Role of the Participant:

- Ten teachers from each of the three traditional high schools within the district will participate in this study.

- These thirty teachers will be asked to participate in two surveys and one focused interview completed on a day of the teacher's choosing.
    - The approximate time for completion is one hour and can be completed before or after school or during the teacher's planning period.
    - The surveys will be completed online and take 10-15 minutes each to complete.
    - The interview will be audio recorded, conducted by a third party interviewer, and will take 20-30 minutes to complete.
- The technology facilitator for the participants' school will assign each participant a number when he/she signs the consent form. This number will be the only identifier used to refer to the participant from this time forward. No record connecting the participants' names to the participants' numbers will be created nor will this information be relayed to anyone other than the technology facilitator and researcher, both of which are bound by the confidentiality of this process.
- The audio recordings of interviews will be transcribed and the audio file will be discarded.
- Data from all three high schools will be combined to provide a representative description of teachers at every level of implementation instead of a representation of single teachers. All references to participants will be characterized by "secondary teachers within a North Carolina district."

It is up to you to decide whether to take part or not. Choosing not to take part will not disadvantage you in any way. If you do decide to take part, you are still free to withdraw at any time and without giving a reason.

All data will be collected and stored in accordance with Data Protection Act 1998.

Appendix I

Participant Consent Form

Informed Consent Form for Doctor of Education Dissertation Research

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Dissertation Title: An examination of teacher concerns beyond the initial stages of a district's one-to-one technology adoption

Researcher's Name: Elicia Massengill

Thank you for your interest in taking part in this research. Before you agree to take part, the person organizing the research must explain the project to you.

If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether to join the study. You will be given a copy of this Consent Form to keep and refer to at any time.

Participant's Statement:

I agree that

- I have read the notes written above and the Information Sheet and understand what the study involves.
- I understand that if I decide at any time that I no longer wish to take part in this project, I can notify the researchers involved and withdraw immediately.
- I understand the information I supply will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.
- I agree that the research project named above has been explained to me to my satisfaction and I voluntarily agree to take part in this study.
- I understand that my responses to the interviewer's questions will be recorded via an audio recording device, and I consent to the use of this material as part of the project.
- I understand that the information I have submitted will be published in the researcher's dissertation, confidentiality and anonymity will be maintained throughout the project, and it will not be possible to identify me from any publications.
- I agree that my non-personal research data may be used by others for future research. I am assured that the confidentiality of my personal data will be upheld through the removal of all identifiers.

Signature: _____Date:_____

Appendix J

Curriculum Specialists' Agreement

Curriculum Specialist,

I am a doctoral candidate at Gardner-Webb University. One of the requirements of the degree is that I complete a dissertation. My dissertation is entitled, “An Examination of Teacher Concerns Beyond the Initial Stages of a District’s One-to-One Technology Adoption.”

The superintendent has approved this research being completed in the traditional high schools of this county. A technology facilitator from each of the district’s three high schools will choose ten teachers with a wide variety of technology use in the classroom. These 30 teachers will complete a questionnaire, interview, and survey about how they utilize technology within their classrooms, what obstacles they have experienced, how they have overcome those obstacles, and what resources they still need.

The information obtained from all three schools will be compiled to represent a composite understanding of how teachers at every level from nonusers to proficient users of technology utilize technology, how they have overcome barriers to implementation, and what resources are still needed to be able to improve their use of technology. It is my desire that this information will be valuable in informing next steps for our technology team as they seek to improve the effectiveness of our technology integration.

This letter is to request your assistance in completing the data gathering for this study. If you agree to participate, you will receive the dates and times when the participants are scheduled. You would be required to complete CITI certification and Levels of Use interview protocol training with me. On the day of data gathering, you would be required to walk teachers through accessing the questionnaire, conducting the interview, and accessing the survey. Additionally, you would be asked to answer any questions the participants might have.

If you have any questions about this study, you may contact the researcher, Elicia Massengill at eliciam@rcsnc.org or 828-329-1587.

If you agree to the proposed study, please sign below. I look forward to working with you.

Sincerely,

Elicia Massengill
Doctoral Candidate, Gardner-Webb University

Signature _____ Date _____

Appendix K

Process Guide

One-to-One MacBook Adoption Research

Step One: Before the Interview (Technology Facilitator)

- Write the participant's number at the top of the information sheet and the consent form.
- Provide the participant with the information sheet and walk him/her through the information sheet.
- Provide the participant with the consent form and walk hi/her through the most important aspects. If the participant is still willing to participate, please have him/her sign the consent form and return to the technology facilitator. The participant should keep the information sheet.
- Provide the participant with the time/date of the interview.

Step Two: Day of the Interview (Curriculum Specialist)

1. Remind the participant of his/her rights and ask if he/she is still willing to participate.
2. If so, explain the sequence of events. The participant will take a 5-10 minute survey. After which, he/she will be interviewed. The interview will take approximately 20 minutes; the audio will be recorded. Once the interview has been completed, a final 10-15 minute survey will be taken.

Step Three: Stages of Concern Questionnaire (Curriculum Specialist)

1. Explain: When the questionnaire refers to the innovation, it means the one-to-one MacBook adoption.
2. Explain: The name of the questionnaire is the Stages of Concern. When it uses the word "concern," it does not mean "to be worried" but rather "to consider." For example, the question "How often do you concern yourself with the innovation?" This means, "How often do you consider using the innovation?" It is not intended to be a negative reaction, to worry, but simply to consider the innovation.
3. Go to http://wwww.sedl.org/concerns.
4. Password: 5hpn2d
5. After the participant reads the initial information, click "Continue to the Questionnaire."
6. Participant enters his/her participant number.
7. Make sure participant clicks "Submit" at the end.

Step Four: Levels of Use Interview

1. Explain: I will ask you a series of questions about the One-to-One MacBook Adoption and your use of technology in the classroom. Please take your time and respond honestly.
2. You may reword and clarify questions as needed.

Step Five: Innovation Configuration (Curriculum Specialist)

1. Explain: This last survey considers how you use technology in your classroom. It is based on the SAMR model and Bloom's Revised Taxonomy. If you have any questions about these as you take the survey, please feel free to ask.
2. Go to https://www.surveymonkey.com/r/RDD6RGR
3. Password: dis2016
4. Make sure participant clicks "Submit" at the end.

Appendix L

AIR Agreements for Permission to Publish

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AGREEMENT FOR PERMISSION TO REPUBLISH — PRINT & ELECTRONIC

Please fill out, sign, and return copy to American Institutes for Research, Attn: Kim O'Brien; 1120 E. Diehl Road, Suite 200; Naperville, Illinois 60563-1486; kobrien@air.org.
American Institutes for Research in the Behavioral Sciences (hereinafter called the "grantor") grants the undersigned, Elicia Massengill, Assistant Principal, East Rutherford High School, Mill Spring, North Carolina (hereinafter called the "applicant"), nonexclusive license to reprint the following (hereinafter called "the selection"):

Title and Credit Line: George, A. A., Hall, G. E., & Stiegelbauer, S. M. (2006). *Measuring implementation in schools: The Stages of Concern Questionnaire*, Appendix A, pages 79–82. Austin, TX: SEDL. A revised PDF version was uploaded in 2014 and is accessible at http://www.sedl.org/pubs/catalog/items/cbam21.html.

The undersigned agrees:

1. To give full credit in every copy printed; on the copyright page or as a footnote on the page on which the selection begins; or, if in a magazine or a newspaper, on the first page of each selection covered by the permission, exactly as indicated in this Agreement.
2. To make no deletions from, additions to, changes to, or electronic manipulation of the content without the written approval of the grantor. (NOTE: You may adapt this instrument as appropriate for the purpose of your research study.)
3. That permission granted herein is nonexclusive and nontransferable.
4. That permission applies, unless otherwise stated, solely to reprint the Stages of Concern Questionnaire in a dissertation titled *An Examination of Teacher Concerns Beyond the Initial Stages of a District's One-to-One Technology Adoption*, in all languages and forms and subsequent revisions in the United States and internationally. The anticipated publication date is June 2016.
5. That the permission shall automatically terminate at the end of the business day of June 29, 2018.
6. This permission does not extend to any copyrighted material from other sources that may be incorporated within the work in question—nor to any diagrams, illustrations, charts, or graphs—unless otherwise specified.
7. That the work containing grantor's selection may be reproduced in Braille, large type, and sound recordings provided no charge is made to the visually handicapped.
8. That unless the agreement is signed and returned within three months from the date of issue, the permission shall automatically terminate.

Date: 4/5/16

Signature of Applicant: Elicia Massengill

Printed Name: Elicia Massengill

Address: 1409 Owl Hollow Rd
Mill Spring NC 28756

Permission on the foregoing terms
American Institutes for Research

Date: May 12, 2016

By: Kim O'Brien

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Title and Credit Line:
Hall, G. E., Dirksen, D. J., & George, A. A. (2006). *Measuring implementation in schools: Levels of Use*. Austin, TX: SEDL. A PDF of the manual is available for download at http://www.sedl.org/cbam/lou_manual_201410.pdf, and the "Levels of Use" interview protocol is available at https://www.sedl.org/cbam/levels_of_use.html.

The undersigned agrees:

1. To give full credit in every copy printed; on the copyright page or as a footnote on the page on which the selection begins; or, if in a magazine or a newspaper, on the first page of each selection covered by the permission, exactly as indicated in this Agreement.
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3. That permission granted herein is nonexclusive and nontransferable.
4. That permission applies, unless otherwise stated, solely to reprint the Levels of Use (LoU) instrument in a dissertation titled *An Examination of Teacher Concerns Beyond the Initial Stages of a District's One-to-One Technology Adoption*, in all languages and forms and subsequent revisions in the United States and internationally. The anticipated publication date is June 2016.
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7. That the work containing grantor's selection may be reproduced in Braille, large type, and sound recordings provided no charge is made to the visually handicapped.
8. That unless the agreement is signed and returned within three months from the date of issue, the permission shall automatically terminate.

Date: 4/5/16

Signature of Applicant: EMassengill

Printed Name: Elicia Massengill

Address: 1409 Owl Hollow Rd
Mill Spring NC 28756

Permission on the foregoing terms
American Institutes for Research

Date: May 12, 2016

By: Kim O'Brien

AIR®
AMERICAN INSTITUTES FOR RESEARCH®

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Title and Credit Line: Hord, S. M., Stiegelbauer, S. M., Hall, G. E., & George, A. A. (2006). *Measuring implementation in schools: Innovation configurations*, Austin, TX: SEDL. Available at http://www.sedl.org/pubs/catalog/items/cbam19.html. The Concerns-Based Adoption Model (CBAM) is available at http://www.sedl.org/cbam/.

The undersigned agrees:

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2. To make no deletions from, additions to, changes to, or electronic manipulation of the content without the written approval of the grantor. (NOTE: You may adapt this instrument as appropriate for the purpose of your research study.)
3. That permission granted herein is nonexclusive and nontransferable.
4. That permission applies, unless otherwise stated, solely to complete the CBAM protocol by using an innovation configuration map to create a survey that will be distributed to teachers. This material will be published in a dissertation titled *An Examination of Teacher Concerns Beyond the Initial Stages of a District's One-to-One Technology Adoption*, in all languages and forms and subsequent revisions in the United States and internationally. The anticipated publication date is June 2016.
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American Institutes for Research

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Appendix M

SoCQ: Profile Interpretation

	Participant #	Stages in Order of Percentile Per Stage	Analysis of Results
Stage 0	1305	0 (87%), 6 (73%), 2 (72%), 3 (69%), 4/5 (59%), 1(45%)	The high Stage 0 score indicates a person who is not concerned about the innovation. The high Stage 6/low Stage 1 score indicates a person who is not interested in learning more about the innovation. The person is likely to feel he/she already knows all about the innovation and has plenty of ideas for improving the situation. Additionally, the high Stage 2/low Stage 1 score indicates a person who has "self" concerns. These individuals may be more negative toward the innovation and generally are not open to information about it.
	1307	0(61), 1(16), 6(14), 2/5(12), 3(11), 4(3)	If the Stage 0 percentile is particularly high relative to the other scores, the other stage scores may have little significance. Extremely high or low total scores (low, in this case) may reveal the respondent did not read the items, but instead simply marked items along one side of the column or the other.
	1308	0(94), 3(73), 2(57), 1(40), 6(30), 4(11), 5(10)	The high Stage 0 score indicates a person who is not concerned with the innovation. The second highest stage score of 3 indicates concerns about logistics, time and management. This is further supported by the high Stage 2 score, which suggests that respondents have intense personal concerns about the innovation and its consequences for them. Although these concerns reflect uneasiness regarding the innovation, they do not necessarily indicate resistance.
	1309	0(97), 2(76), 3(69), 1(34), 6(14), 4(8), 5(7)	The high Stage 0 score indicates a person who is not concerned with the innovation. The second highest stage score of 2 indicates a person who has intense personal concerns about the innovation and its consequences for him/her. Although these concerns reflect uneasiness regarding the innovation, resistance is not

Participant #	Stages in Order of Percentile Per Stage	Analysis of Results
		necessarily indicated. The high Stage 3 score indicates concerns about logistics, time, and management.
1310	0(75), 3(69), 5(68), 1(63), 4(43), 6(42), 2(31)	The high Stage 0 indicates a person who is not concerned about the innovation. The high scores on Stages 3, 5, and 1 indicate a desire to learn from what others know and are doing rather than a concern for leading the collaboration, but also harbor concerns about logistics, time and management.
1402	0(69), 2(31), 1(30), 5(22), 3(15), 4(11), 6(9)	The high Stage 0 indicates an individual who is not fully aware of the innovation and is somewhat concerned with other issues. Because Stages 1 and 2 are also high, the individual is interested in learning more about the innovation. The low, tailing-off Stage 6 score suggests that the individual does consider other ideas that would be potentially competitive with the innovation. This reflects a positive, willing to learn nonuser.
1403	0(69), 2(31), 1(30), 5(22), 3(15), 4(11), 6(9)	The high Stage 0 indicates an individual who is not fully aware of the innovation and is somewhat concerned with other issues. Because Stages 1 and 2 are also high, the individual is interested in learning more about the innovation. The low, tailing-off Stage 6 score suggests that the individual does consider other ideas that would be potentially competitive with the innovation. This reflects a positive, willing to learn nonuser.
1404	0(61), 5(31), 3(15), 2(14), 1(12), 6(11),	High Stage 0 indicates a person who is not concerned about the innovation. A high Stage 5 suggests concerns about working with others in relation to the use of the innovation. Low Stage 3 suggests that the person has minimal to no concerns about managing use of the innovation.

Participant #	Stages in Order of Percentile Per Stage	Analysis of Results
	4(8)	Low Stage 2 indicates that the person feels no personal threat in relation to the innovation. The low Stage 1 score indicates a person who feels he/she already knows enough about the innovation.
1406	0(69), 6(57), 2(52), 1(45), 5(44), 3(39), 4(33)	The high Stage 0 score indicates a person who is not concerned about the innovation. The high Stage 6 score coupled with the lower Stage 1 score indicates a person who is not interested in learning more about the innovation. The person is likely to feel that he or she already knows all about the innovation and has plenty of ideas for improving the situation.
1503	0(98), 1(66), 2(63), 3(60), 4(54), 5(48), 6(38)	The high Stage 0 indicates a person who is not concerned about the innovation. The high Stage 1 indicates a person who wants more information about the innovation. The high Stage 2 score suggests that respondents have intense personal concerns about the innovation and its consequences for them. Although these concerns reflect uneasiness regarding the innovation, they do not necessarily indicate resistance. The high Stages 0-3 and low Stages 4-6 indicate a user who has progressed little past self concerns.
1505	0(48), 1(40), 2(25), 5(19), 3(18), 6(11), 4(7)	The high Stage 0 indicates a person who is not concerned about the innovation. The high Stage 1 indicates a person who wants more information about the innovation. The high Stage 2 suggests that respondents have intense personal concerns about the innovation and its consequences for them. Although these concerns reflect uneasiness regarding the innovation, they do not necessarily indicate resistance. The low Stage 4 indicates the person has minimal concerns about the effects of the innovation on students.
1510	0(99), 1(40),	The high Stage 0 indicates a person is not concerned with the innovation. The extremely

	Participant #	Stages in Order of Percentile Per Stage	Analysis of Results
		2(31), 3(18), 5(10), 6(9), 4(3)	low scores progressing from 1 indicate either a nonuser or someone who uses the innovation very little.
Stage I	1405	1(37), 5(36), 3(30), 2(17), 4/6(11), 0(7)	High Stage 1 indicates a person who wants more information about the innovation. The high Stage 5 score along with the high Stage 1 score suggests a desire to learn from what others know and are doing, rather than a concern for leading the collaboration. The high Stage 3 concern indicates some concerns about logistics, time, and management. The low Stage 0 score indicates a person who is very involved with the innovation.
	1410	1(43), 5(40), 6(34), 4(24), 0(22), 2(21), 3(15)	The high Stage 1 paired with the low Stage 2 suggests that the person needs more information about the innovation. These respondents generally are open to and interested in the innovation. The high Stage 5 coupled with the high Stage 1 suggests a desire to learn from what others know and are doing, rather than a concern for leading the collaboration.
Stage II	1301	2(70), 6(57), 3(47), 4(38), 0(31), 5(25), 1(19)	The high Stage 2 score coupled with a low Stage 1 score indicates "self" concerns. This person may be more negative toward the innovation and generally is not open to more information about it. However, the high Stage 6 score indicates that this lack of desire for more information is because the person feels that he/she already knows all about the innovation and has plenty of ideas for improving the situation.
	1401	2(76), 3(73), 1(63), 6(57),	High Stage 2 suggests the respondent has intense personal concerns about the innovation and its consequences for him/her. Although these concerns reflect uneasiness regarding the

Participant #	Stages in Order of Percentile Per Stage	Analysis of Results
	4(43), 0(40), 5(28)	innovation, they do not necessarily indicate resistance. High Stage 3 scores indicate concerns about logistics, time, and management. And, high Stage 1 scores indicate a person who wants more information about the innovation.
1407	2(83), 1(80), 0(75), 5(59), 4(48), 6(30), 3(27)	The high Stage 2 score suggests that respondents have intense personal concerns about the innovation and its consequences for them. Although these concerns reflect uneasiness regarding the innovation, they do not necessity indicate resistance. The high Stage 1 score indicates a person who wants more information about the innovation.
1408	2(45), 5(28), 6(26), 1(19), 3(15), 4(13), 0(7)	Low Stage 1/high Stage 2 indicates a person who has self concerns. These individuals may be more negative toward an innovation and generally not open to information about it. High Stage 5 suggests concerns about working with others in relation to use of the innovation. High Stage 6/low Stage 1 indicates a person who is not interested in learning more about the innovation. The person is likely to feel that he or she already knows all about the innovation and has plenty of ideas for improving the situation.
1501	2(67), 6(65), 1(51), 5(40), 4(38), 3(27), 0(14)	The high Stage 2 score suggests that respondents who have intense concerns about the innovation and its consequences for them. Although these concerns reflect uneasiness regarding the innovation they do not necessarily indicate resistance. A high Stage 6 score Tailing Up for nonusers suggests the person has strong ideas about how to do things differently. These ideas may be positive, but are more than likely to be negative toward the innovation. The high Stage 1 score does indicate someone who wants more information about the innovation. Additionally, the low Stage 0 score suggests an intense

	Participant #	Stages in Order of Percentile Per Stage	Analysis of Results
			involvement with the innovation.
	1506	2(59), 1(48), 6(38), 3(34), 5(28), 4(27), 0(22)	The high Stage 2 suggests that respondents have intense personal concerns about the innovation and its consequences for them. Although these concerns reflect uneasiness regarding the innovation, they do not necessarily indicate resistance. The high Stage 1 score indicates a person who wants more information about the innovation. The high Stage 6 Tailing Up suggests the person has strong ideas about how to do things differently. These ideas may be positive, but are more likely to be negative toward the innovation. However, the low Stage 0 indicates intense involvement with the innovation.
	1509	2(92), 1(90), 6(87), 4(76), 3(47), 5(40), 0(14)	The high Stage 2 score suggests that respondents have intense personal concerns about the innovation and its consequences for them. Although these concerns reflect uneasiness regarding the innovation, they do not necessarily indicate resistance. The high Stage 1 score indicates a person who wants more information about the innovation. The Stage 6 Tailing Up score suggests the person has strong ideas about how to do things differently. These ideas may be positive but are more than likely to be negative.
Stage III	1302	3(77), 6(73), 1(72), 0(61), 2(55), 5(48), 4(38)	One common occurrence of multiple peaks is the profile with high Stage 3 and Stage 6 scores. Those are individuals who have intense Management concerns but also have strong ideas about how the change process should be different. In this case, the high Stage 1/low Stage 2 combination indicates the individual probably has a positive, proactive perspective, with little fear of the personal effects of the innovation.
	1303	3/6(92), 4(71),	Indicates a person who has become frustrated with not having management concerns resolved

Participant #	Stages in Order of Percentile Per Stage	Analysis of Results
	5(64), 2(59), 1(30), 0(21)	and has developed strongly held ideas about how the situation should be changed. The high Stage 6 score indicates that the person has ideas about how to change the innovation or situation from his or her point of view. The low Stage 0 score does indicate that despite this person's frustration, he/she is intensely involved with the innovation.
1304	3(47), 0/5(31), 4(30), 2(25), 6(17), 1(16)	This person's high scores were spread across four stages and the raw scores were closely grouped. The highest score, Stage 3, indicates concerns about logistics, time, and management. The second highest scores were in Stages 0 and 5. High Stage 0 scores indicate a person who is not concerned about the innovation. The high Stage 5 score indicates concerns about working with others in relation to the innovation. And along the same lines, the high Stage 4 score indicates concerns about the consequences of the innovation for students.
1502	3(90), 6(65), 4(43), 2(41), 1(27), 0(22), 5(14)	The high Stage 3 score indicates concerns about logistics, time, and management. The high Stage 6/ high Stage 3/low Stages 0-2 indicates a person who has become easily frustrated with not having Management concerns resolved and has developed strongly held ideas about how the situation should be changed. The high Stage 6 score indicates that the person has ideas about how to change the innovation or situation from his or her point of view.
1507	3(27), 2(21), 1(19), 5(16), 0(7), 6(6), 4(2)	The high Stage 3 score indicates concerns about logistics, time, and management. The high Stage 2 score suggests that respondents have intense personal concerns about the innovation and its consequences for them. Although these concerns reflect uneasiness regarding the innovation, they do not necessarily indicate resistance. The high

	Participant #	Stages in Order of Percentile Per Stage	Analysis of Results
			Stage 1 score indicates a person who wants more information about the innovation. The low Stage 4 score indicates minimal concern about the effects of the innovation on students.
Stage IV	1508	4(96), 5(84), 6(42), 2(39), 3(30), 1(19), 0(14)	The high Stage 4 score indicates concerns about the consequences of use of the innovation for students. The high Stage 5 with a combination of high Stage 4 and 6 suggests concerns about a collaborative effort in relation to the other stages with high scores, which indicate concern about the innovation's effect on students. The low Stages 0-3 indicates an experienced user who is still actively concerned with the innovation.
Stage V	1306	5(98), 4(76), 6(60), 3(47), 0(31), 2(28), 1(16)	Low Stages 0-3 indicate an experienced user who is still actively concerned about the innovation. The high Stage 5 score indicates concern about working with others in relation to the technology integration; this is a priority. The high Stage 6 and 4 scores indicate concerns about the innovation's impact on students and some frustration with not having Management concerns resolved and has developed strongly held ideas about how the situation should be changed.
	1409	5(95), 4(71), 6(47), 1(19), 3(18), 2/0(14)	High Stage 5 with a combination of Stages 4 and 6 also high suggests concerns about a collaborative effort in relation to the other stages with high scores, which are a high Stage 4 and 6, indicative of concerns about the consequences of use of the innovation for students. The low Stages 0-3 indicates an experienced user who is still actively concerned about the innovation.
	1504	5(88), 0(75), 1/3(30), 4(27),	The high Stage 5 score suggests concerns about working with others in relation to use of the innovation. The high Stage 0 indicates someone is not concerned with the innovation. The low

Participant #	Stages in Order of Percentile Per Stage	Analysis of Results
	6(17), 2(12)	Stage 2 score indicates someone who feels no threat in relation to the innovation.