THE DEVELOPMENT AND PILOT OF THE TECHNOLOGY INTEGRATION MATRIX QUESTIONNAIRE

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ABSTRACT

While research in the field of education suggests teachers are using technology more frequently, whether or not this usage occurs at higher levels of integration and in constructivist settings remains to be seen. For school and district leaders wishing to increase the use of technology in teacher practices within their buildings, an assessment tool is necessary for determining needs and prescribing professional development on an individual basis. With such a tool and in collaboration with leaders, teachers will be able to reflect upon individual practice, becoming aware of ways to increase technology integration while facilitating increased student engagement.

The purpose of this study was to develop and pilot a valid and reliable instrument for measuring levels of integration within constructivist learning environments as noted by the indicators in the Technology Integration Matrix (TIM) model. Developers of the TIM communicated that an instrument for measuring technology usage practices according to the indicators in the Matrix could be useful in helping school leaders prescribe professional development at the individual teacher level. As a result, the Technology Integration Matrix Questionnaire (TIMQ) was designed to measure levels of frequency for each of the 25 indicators in the TIM.

Analyses included the use of expert panels for reviewing the instrument's development in order to establish content validity. Cronbach's alpha was used to test the reliability of the five integration level constructs and the five constructivist characteristic constructs within the TIM. Parallel forms analysis was used to determine the reliability of the two questionnaire items per indicator in measuring the frequency of technology usage. While these analyses showed the TIMQ to be a highly valid and reliable

instrument in terms of measuring the TIM indicators, minor revisions to the wording of a few items and modifications to examples with sensitivity to elementary and secondary needs have been suggested.

Based on the findings, the TIMQ is recommended for use within schools that desire improved integration of technology in student-centered environments. Future studies may wish to explore the relationship between the amount of frequency of technology usage and teacher professional development or technology access and connectivity in the classroom.

DEDICATION

This work is dedicated to the many teachers who are in the trenches daily pioneering the use of technology in order to increase student learning through constructivist, student-centered activities and settings.

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CHAPTER ONE

INTRODUCTION AND RATIONALE

Despite greater technology access and connectivity in today's classrooms, experts warn little has changed in terms of the number of teachers integrating technology into these settings (Hargadan, 2006). In order for schools to increase the number of teachers integrating technology into their classrooms, school and district leaders must be able to measure teacher practices on an individual basis. To achieve such an outcome, it is necessary to have an instrument which can measure levels of technology integration within student-centered environments.

This chapter provides an overview of the many initiatives and historical events leading to widespread availability and access to technology and the Internet in today's public schools. The current dilemma faced by school districts is presented where, regardless of greater technology resources, the majority of teachers are not using technology at ideal, seamless levels. These disparities in technology integration and the need for a tool to measure technology usage are included.

Problem Statement

Though 1969 marked the true birth of the Internet with the government-funded network known as the Advanced Research Projects Agency (ARPAnet), its universal emergence along with advances in computer technology did not have a dramatic societal impact until the mid-1980s and early 90s (Segaller, 1998). During these decades, a shift occurred not only regarding technology in modern society, but also in the realm of public education. According to figures from the National Center for Education Statistics, in 1994 a mere 3% of the Nation's public schools had Internet access. By 2005, this figure jumped to a remarkable 94%. In 1998, the ratio of students to computers with Internet access in public schools was only 12.1 to 1, but by 2005 this ratio had decreased to 3.8 to 1 (Wells & Lewis, 2006).

Because of these increases in the availability of computers, tools, and immediate access to information via the Internet, students of the 21st Century enter schools with a completely different mindset than did students from the 1990s (Brumfield, 2006). Given a high degree of technology savvy, a plethora of electronic devices, increased classroom hardware/software availability, and instant access to boundless repositories of information via the Information Superhighway, these native-born citizens of the post-industrial era come to school equipped for an entirely different type of learning experience ("Getting an 'A'," 2009).

Students have multiple devices readily available, including cellular phones, handheld computers, MP3 players, GPS locaters, and miniature camcorders to incorporate them seamlessly into every facet of their lives. While forward-thinking teachers are capitalizing on these students' technological interests and skills to integrate technology into student-centered activities, a majority of the Nation's educators find themselves ill-equipped to handle such leaps in innovation (Hargadan, 2006).

Much of the push to outfit America's classrooms with adequate technology and Internet access came during the 90s with the Clinton Administration. The administration established guidelines for connectivity initiatives to equip classrooms in the first national educational technology plan while focusing on bringing equitable access to poorer school districts. The evolution of wireless technology has also helped to break the physical barriers posed by network cabling and other building or facility constraints. What was once considered a digital gap among the nation's schools has now been redefined to include access and availability prevalent among all socioeconomic classes (Trotter, 2007).

Just before the close of his administration, President Clinton approved the second national technology plan, this time with the goal of assessing the effectiveness of the connectivity initiatives (Trotter, 2007). However, the George W. Bush Administration had a different idea in mind. The main thrust of the Bush plan was to redirect federal spending away from connectivity initiatives instead focusing on data management initiatives intended to improve student competencies in accordance with No Child Left Behind (2001). "Federal…policy initiatives have poured billions of dollars of technology spending into schools" (Trotter, 2007, p.10), over the past decade to supply the nation's schools with equipment and resources.

As of this writing, however, a new threat to technology access and availability has emerged. Faced with the current recession, school districts are forced to sharply cut technology budgets and support services (P. All, personal communication, 2009). This causes districts to reevaluate practices and look for alternative solutions. Such alternatives lie in emerging technologies and free online tools (known as Web 2.0). These tools allow teachers to capitalize on improved Internet access and connectivity through a variety of online resources and Open Source applications with relatively little or no additional cost in terms of district expenditures. Open Source refers to Web or software applications, which are freely accessible and available to the general public (Hargadan, 2006).

Overall, increased demands for the availability of computer applications, equipment, and Internet access, have equally increased the accountability for educators in terms of integrating technology into classroom instruction. The results of a survey conducted by Quality Educational Data (QED) confirmed these landscape shifts when teachers reported classroom usage of technology was on the rise (as cited in Brumfield, 2006). Veteran educators, at least ten years in the field, reported seeing a dramatic change in the way technology was incorporated into daily instruction. However, in his book, *Oversold and Underused*, Larry Cuban (2001) argued that only a minority of the nation's teachers actually adopt and integrate technology into daily instruction. In a Podcast interview with Steve Hargadan (2006) from Ed Tech Live, Cuban estimated only around 10% of the nation's teachers truly incorporate technology into their instruction from once a week to daily.

This fact is significant, considering educational reform efforts (NCLB, 2001) have focused on improving technology access and availability over the past two decades. With greater technology accessibility in schools, Web 2.0 tools, and classroom usage on the rise, stakeholders might mistakenly infer an increase in the number of teachers integrating technology to promote engaged classrooms with authentic learning experiences. Unfortunately, in spite of efforts to improve education through appropriate access to and availability of technology, there has been little impact according to Zhao & Frank (2003).

Furthermore, though research (Sprague & Dede, 1999) suggests integrating technology into instructional practices can increase engaged learning, many educators remain uninformed, entrenched in traditional teaching formats (Hargadan, 2006).

Consequently, teachers are left with no means of developing technology-rich, engaged lessons and little guidance in terms of how to integrate technology at the instructional level.

Background and Conceptual Framework

Integration refers to the process of synthesizing technology with lessons and instructional delivery in order to provide engaging learning experiences for children (Dias, 1999). While various perspectives exist regarding the progression and implementation of integrating technology in meaningful learning environments, the prevailing view is one where the integration of technology occurs along a continuum with various stages or levels of synthesis being attained over time and in diverse settings. Some of the earliest work in this field can be attributed to Sandholtz, Ringstaff, and Dwyer (1997). Their work divides the stages of the integration continuum into five categories: *Entry*, *Adoption*, *Adaptation*, *Appropriation*, and *Invention*. Another widely used model, based on these five stages, was developed by Chris Moersh (1995) and utilizes similar categorizations divided into seven levels. Moersh's model adds a *Nonuse* level before the *Entry* designation and ultimately the *Entry* level is divided into two levels: *Awareness* and *Exploration*.

In terms of the impact of such integration, some experts insist students cognitively process at higher levels when taking part in constructivist settings (Sprague & Dede, 1999). These kinds of environments promote authentic, real-world learning. In their work, *Learning to solve problems with technology: A constructivist perspective,* Jonassen, Howland, Moore, and Marra (2003) identify five attributes of meaningful learning which promote engaged learning through technologically enhanced means:

Active, *Constructive*, *Intentional*, *Authentic*, and *Cooperative*. Constructivist theory differs from behaviorism, which uses conditioning strategies to teach students, in that it places the emphasis on students' prior knowledge to make meaning of new information.

The Technology Integration Matrix (TIM), developed by the Florida Center for Instructional Technology (FCIT), at the University of Southern Florida, merged the concepts of the technology integration continuum and characteristics of meaningful learning environments to create the multidimensional matrix seen in Figure 1. The TIM is divided into five columns with headings identifying levels of integration from low to high (*Entry*, *Adoption*, *Adaptation*, *Infusion*, and *Transformation*) and five rows with headings identifying characteristics of meaningful learning environments (*Active*, *Constructive*, *Intentional*, *Authentic*, and *Cooperative*) to form a matrix with 25 unique indicators as detailed in Figure A1 of Appendix A (FCIT, 2007).

Characteristics of the Learning Environment / Levels of Technology Integration into the Curriculum				
Active Entry	**Active Adoption**	**Active Adaptation**	**Active Infusion**	**Active Transformation**
Collaborative Entry	**Collaborative Adoption**	**Collaborative Adaptation**	**Collaborative Infusion**	**Collaborative Transformation**
Constructive Entry	**Constructive Adoption**	**Constructive Adaptation**	**Constructive Infusion**	**Constructive Transformation**
Authentic Entry	**Authentic Adoption**	**Authentic Adaptation**	**Authentic Infusion**	**Authentic Transformation**
Goal Directed Entry	**Goal Directed Adoption**	**Goal Directed Adaptation**	**Goal Directed Infusion**	**Goal Directed Transformation**

Figure 1. Technology Integration Matrix

From: FCIT. (2007). *Technology integration matrix*. Retrieved December 16, 2008, from http://fcit.usf.edu/matrix. Adapted with permission of the Florida Center for Instructional Technology.

The Director of the FCIT, Roy Winkelman, indicated that an instrument measuring technology usage according to each of the indicators could be useful in the effort to prescribe individual professional development for teachers. While it is possible to create a profile for where a teacher falls on the matrix, it is difficult to determine the barriers keeping teachers from progressing to the next levels of integration and to prescribe professional development based on these identifications. Currently, it is possible to prescribe professional development from a building perspective (Personal communication, January 3, 2009).

Significance of the Study

Given schools' improved access to technology and the Internet, stakeholders desire assurances that students are actively involved in lessons where teachers are integrating technologies at high levels. Currently, the TIM is being used by school districts to determine professional development needs regarding technology integration at the building level (R. Winkelman, personal communication, January 3, 2009).

The Inventory of Teacher Technology Skills is sometimes used in conjunction with the Technology Integration Matrix and "can be used by teachers and administrators to plan and implement professional development in basic technology literacy" (Black, 2009). However, when it comes to measuring the levels of integration and characteristics of the learning environment as outlined by each indicator in the TIM, an instrument designed specifically for this purpose was warranted.

Developing an instrument, which reliably measures technology integration at the individual teacher level, could be of benefit to the FCIT as well as other institutions wishing to focus on technology professional development for teachers. This instrument could provide teachers with a vehicle to evaluate themselves, reflect upon practice, and make modifications to goals or plans of action for increasing the frequency and quality of technology integration in their classrooms. Furthermore, it could help school districts focus improvement efforts on specific areas with deficiencies.

Purpose of the Study

The purpose of this study was to develop and pilot an instrument to reliably measure the frequency of technology usage in terms of levels of technology integration in conjunction with characteristics of the learning environment as framed in the TIM from the FCIT. After contacting the Director of the FCIT to secure permission for use of the matrix model, this researcher discovered no survey instrument currently existed for measuring the 25 indicators located on the grid. After discussions with the director (R. Winkelman, personal communication, December 17, 2008; R. Winkelman, personal communication, January 3, 2009) and after establishing the need for such a tool, the goal of creating a reliable instrument was set in motion.

The intent was to provide school leaders and, more importantly, teachers themselves with a tool for obtaining reliable feedback regarding their individual technology integration practices in learning environments in order to enhance school improvement efforts.

Delimitations

Expert panels were asked to provide feedback electronically regarding the instrument via the researcher's Moodle server and Web site. The pilot of the instrument was conducted in an electronic, Web-based format only. No questionnaires were administered by paper.

Only Pre-Kindergarten through Twelfth Grade teachers were invited to participate in the study. Respondents in the pilot consisted of core, elective, and special education teachers from public schools. Post-secondary instructors were excluded from participating in the pilot.

Assumptions

Members of the two expert panels consisted of educators with competent skills and experience in the area of technology integration. All respondents approached the questionnaire in a serious manner and responded in a way that provided good measurement. The short examples for each of the survey items brought about clarity whenever teachers did not understand indicator questions and provided them with the necessary information to complete each question.

Research Questions

Based on the need for the development of this instrument, four research questions directing the study were established:

1. What evidence supports the content validity of items in the Technology Integration Matrix Questionnaire?
2. What do the Cronbach's alpha coefficients imply concerning the reliability of the integration level constructs in the Technology Integration Matrix Questionnaire?
3. What do the Cronbach's alpha coefficients imply concerning the reliability of the constructivist characteristic constructs in the Technology Integration Matrix Questionnaire?
4. What do the parallel forms tests indicate regarding the reliability of the question sets measuring each indicator in the Technology Integration Matrix?

Definition of Terms

Active: Students are vigorously engaged in using technology as a tool rather than passively receiving information from the technology (FCIT, 2007).

Adaptation: The teacher encourages students to modify software and Web-ware tools in order to accomplish the task at hand (FCIT, 2007).

Adoption: The teacher directs students in the conventional use of tool-based software (FCIT, 2007).

ARPAnet: refers to the Advanced Research Projects Agency Network created by the United States Department of Defense during the Cold War as a strategy to maintain communication using a decentralized system in the event of a nuclear strike (Segaller, 1998).

Authentic: Students use technology tools to solve real-world problems meaningful to them rather than working on assignments to solve hypothetical problems (FCIT, 2007).

Collaborative: Students use technology tools to collaborate with others rather than working individually at all times (FCIT, 2007).

Constructive: Students use technology tools to build understanding rather than simply receive information passively (FCIT, 2007).

Educational technology: any technology, both hardware and software, that assists teachers with curriculum and/or instruction (FCIT, 2007).

Entry: The teacher uses technology to deliver curriculum content to students (FCIT, 2007).

Goal Directed: Students use technology tools to set goals, plan activities, monitor progress, and evaluate results rather than simply completing assignments without reflection (FCIT, 2007).

Infusion: The teacher creates a learning environment that combines the power of technology tools with other subject areas throughout the day (FCIT, 2007).

Transformation: The teacher creates a rich learning environment in which students regularly engage in activities that would have been impossible to achieve without technology (FCIT, 2007).

Online: refers to the act of being connected to a Web site on a computer workstation, laptop, mobile phone and other handheld devices via the Internet (Merriam-Webster, 2010); an example is an instrument such as an electronic survey or questionnaire.

Survey instrument: a measuring device for determining a quantity through observation (Merriam-Webster, 2010).

Technology integration: this is the act of incorporating technological content into instruction and curriculum design such as PowerPoint presentations, interactive Internet projects, online activities, etc. (Recesso & Orrill, 2008).

Technology professional development: refers to staff or professional development, which fuses technology with teaching strategies, lesson design, and instructional practices to improve teacher and principal effectiveness and impact student achievement (NSDC, 2010).

Web 2.0 Tools: this designation refers to Open Source or computer-based/Web applications having programming code, which is freely accessible to the public to use and is able to be modified by developers through a virtual community (Hargadon, 2006).

Overview of Methodology

A draft instrument of 62 questions was developed. The first 12 questions were designed to gather pertinent demographic data from teachers. The remaining 50 questions, intended to measure the 25 indicators as framed in the Technology Integration

Matrix at http://fcit.usf.edu/matrix, were developed based upon the researcher's review of the two original works on which the TIM was built (Jonassen, Howland, Moore, & Marra, 2003; Sandholtz, Ringstaff, & Dwyer, 1997; FCIT, 2007).

The design of this study began with question writing. Next, two expert panels were assembled to evaluate the survey questions. The first expert panel included original developers of the Matrix, university educational technology professors, and technology leaders from selected school districts. The second expert panel consisted of two subgroups. The first subgroup included technology teacher-leaders—both elementary and secondary—from the Olathe School District. The second subgroup included mostly Olathe teachers involved in an ESOL program through the district and MidAmerica Nazarene University.

The first panel of experts established content validity providing feedback on the draft survey through discussions on a Moodle platform, via direct feedback through a Web-based prototype of the questionnaire, and via a WIKI environment also located on the researcher's Moodle site. Feedback was organized and examined according to each of the survey items. Feedback associated with the 50 items that provided measurement for the 25 matrix indicators was aligned to the levels of integration and constructivist environment characteristics. The 50 items were then modified to measure each indicator. The panel provided additions, deletions, and modifications to the 12 demographic questions. The second panel also helped with establishing content validity. The subgroups of this panel were asked to rate their level of understanding and their perception regarding other teachers' level of understanding for each question. This panel's copy of the online instrument did not reveal the names of the indicators to respondents so as not to influence respondents' choices.

After revisions were made to the items and to the number of items in the instrument, the questionnaire was administered to teachers in Kansas and Florida between November 11, 2009 and February 13, 2010. Respondents from the various school districts and populations completed the survey on a volunteer basis. The purpose of this pilot was to establish reliability. This reliability was evaluated using Cronbach's alpha and parallel forms correlation analyses.

Summary/Organization of Study

Chapter One introduced the topics of technology usage in education and the Technology Integration Matrix, posed the need for an instrument to measure teacher practices, presented the research questions, defined terms, and provided an overview of the methodology in addition to the limitations and assumptions. In Chapter Two, literature concerning the evolution of learning theories up to present day constructivism, the development of levels of technology integration, constructivist attributes of meaningful learning, the Technology Integration Matrix model, and established practices for developing and field-testing valid reliable surveys are examined. The design of the study is covered in Chapter Three discussing how the survey instrument was created from the draft to the pilot study and the parties involved. The data retrieved from the pilot phase of the study is presented in Chapter Four. Several visuals are provided to illustrate percentages of reliability. The concluding chapter includes a summary of the research study, discussion of the results, how valid and reliable the instrument measures individual teacher levels of integration across constructivist environments, and recommendations for future research. Thoughts about future studies in other locations and states using the developed Technology Integration Matrix Questionnaire instrument are included.

CHAPTER TWO

REVIEW OF LITERATURE

This chapter addresses literature relating to constructivism, technology integration, the Technology Integration Matrix model, and the development of valid and reliable research instruments. First, the evolution of learning theories is addressed providing a foundation of thought leading to present day constructivism as the prominent theory accepted by educational technologists. Second, a brief overview is provided concerning the introduction of computer technology into education with a glimpse of constructivism. Third, the chapter focuses on how constructivist environments address children's learning styles. In particular, five attributes of meaningful learning are addressed. The historical development of distinct levels of technology integration and an explanation of how these levels relate to higher order thinking processes are provided. Next, levels of thinking are addressed regarding various learning taxonomies. The chapter then includes how the Technology Integration Matrix model combines levels of integration with attributes of meaningful learning to form a multidimensional instrument for assessing technology usage practices in education. Finally, the chapter focuses on practices and procedures for developing reliable and valid research instruments.

Evolution of Learning Theories and Present Day Constructivism

Early 20th century theorists (Skinner, 1953) studied learning in terms of observable behaviors. They viewed learning in terms of how subjects responded to external stimuli. This practice came to be known as behaviorism. For his work in the field, one of the most noted theorists is B. F. Skinner (Recesso & Orrill, 2008). Unlike Ivan Pavlov's historic work where involuntary responses like salivation could be elicited through conditioning a dog to expect food at the sound of a tuning fork, Skinner focused on the voluntary responses or operants in humans relating to external stimuli. In his work, Skinner examined the conditioning of subjects through antecedents, causal events preceding certain behaviors, and through consequences, causal events following behaviors (Skinner, 1953).

While the behaviorist perspective was effective in explaining some learning through measurable external outcomes, the advent of new research during the World War II era led cognitive theorists to begin examining processes that occur inside the human mind (Woolfolk, 1995). Also known as cognitive information-processing (CIP), the way a computer operates is used to illustrate the concept. In this metaphorical view, the brain operates in a similar fashion to a microprocessor that receives input, performs various calculations on information, and then stores the information away and/or generates some type of output (Recesso & Orrill, 2008).

CIP theories attempt to explain how the mind processes information. In the *Three Memory Stores* model (as cited in Woolfolk, 1995), cognitive processes are explained in terms of sensory memory, short-term memory, and long-term memory. Sensory memory is where outside stimuli are sorted and prepared for delivery to either short-term or long-term memory. Information needing to be held temporarily is prepared for short-term memory while information that is more substantial is prepared for long-term memory. In two other theories, *Levels of Processing* and *Connectionism*, researchers (Craik & Lockhart, 1972; Iran-Nejad, Marsh, & Clements, 1992; Driscoll, 1994) diminish the emphasis placed on where information is contained as in the *Three Memory Stores* model and instead highlight the importance of establishing data patterns and making critical connections.

Though the above cognitive theories vary in terms of the best way to handle memory storage, they serve to lay the foundation for today's constructivist theories (Woolfolk, 1995). The main premise behind constructivist thought is that humans make meaning of their world through new experiences by associating or relating to prior experiences and knowledge (Recesso & Orrill, 2008). While renowned psychologist Jean Piaget could be considered a cognitivist based on his extensive work in the field, it was his work regarding the stages of human development that was of greatest consequence to constructivism. Through his research, Piaget (as cited in Lever-Duffy & McDonald, 2008) reached the conclusion that humans in all developmental stages can construct meaning from new experiences by connecting these to previously learned patterns or mental maps. Just as different theories exist within cognitivism, two prominent views exist within constructivism. One view, held by theorist Robert Gagné, emphasized the construction of meaning from prior knowledge as primarily an individual act. Noted for his work with language and speech, theorist Lev Vygotsky's view focused on the social aspects of learning. This view held that the construction of meaning is most favorable when it occurs in a social or collaborative context (as cited in Lever-Duffy & McDonald, 2008).

The Introduction of Computer Technology into Education

As changes in learning theory progressed from the traditional operant conditioning perspective of behaviorism to modern day constructivism, the focus on teacher-centered instruction moved to a focus on student-centered instruction. In traditional models "teachers were the purveyors of knowledge and students the recipients" (Jonassen et al., 2003, p. 13). In a similar manner, educational technology usage during the 50s and 60s concentrated on teaching through programmed instruction. In such instances, students were expected to learn as content was delivered through technologies like television and film. Even with the advent of the microcomputer in the 80s, educational technologies were still being used primarily to deliver drill, practice, and tutorial types of instruction as evidenced in a national survey regarding school computer usage (Becker, 1985). Fortunately, during the same decade these practices changed as educators began to recognize the interactive and productivity capabilities of computers (Jonassen et al., 2003). This time period also marked the beginning of the first longitudinal study devoted to observing how technology usage affected educational practice (Sandholtz et al., 1997).

A mathematician and former colleague of Piaget by the name of Seymour Papert is considered one of the earliest educational technologists. Based on Piaget's research, Papert developed a programming language at MIT designed to provide children with interactive technology experiences enabling the construction of mental maps to illustrate learning (as cited in Lever-Duffy & McDonald, 2008; Recesso & Orrill, 2008). This was during the 70s and 80s when computers were still rarely used for purposes other than business. "We are at a point in the history of education when radical change is possible, and the possibility for that change is directly tied to the impact of the computer" (Papert, 1980, pp. 36-37). From this perspective, Papert believed technology could facilitate multiple types of learning experiences for children.

Kinds of Learning and Attributes of Meaningful Learning

Constructivists believe learning content is different for each child because no two children have had the exact same prior life experiences (Jonassen et al., 2008). In the same way these experiences differ, the ways in which children learn also differ. Constructivist environments are ideal for enabling different learning styles because they do not restrict learners to one approach for constructing meaning. Instead, such environments encourage learners to select and direct their own paths of learning (Recesso & Orrill, 2008). Best known for his theory and work with multiple intelligences, Howard Gardner (1999) did not believe one type of intelligence was sufficient to explain how humans learn. These intelligence types included *Linguistic*, *Spatial*, *Logical-Mathematical*, *Bodily-Kinesthetic*, *Interpersonal*, and *Intrapersonal* (Lever-Duffy & McDonald, 2008). Over the past decade, two intelligences were added: *Natural* and *Existential*. Constructivists recommend planning learning environments and activities incorporating all nine intelligences in order to meet the needs of all types of learners (Recesso & Orrill, 2008).

In their work, *Learning to Solve Problems with Technology*, Jonassen, Howland, Moore, and Marra (2003) identify five attributes of meaningful learning based on constructivist principles. The authors argue that meaningful learning is defined by *Active, Constructive*, *Intentional*, *Authentic*, and *Cooperative* qualities. They define meaningful in terms of how learners make meaning through new experiences based upon their previous and current schema of the world. Strong relationships exist between these attributes.

The *Active* attribute describes the way learners engage in manipulating and observing the world around them. Here learners manipulate variables in the environment and then observe subsequent outcomes. Learners use this trial and error process to form understandings. The important note is learners do not make meaning by merely absorbing knowledge in a passive manner. They participate actively in exploring their world (Jonassen et al., 2003). Constructivist classrooms often appear chaotic to the casual observer. However, because they are usually motivated and interested in classrooms providing engaged activities, "students are more actively involved than in a traditional classroom…sharing ideas, asking questions, discussing concepts, and revising their ideas and misconceptions" (Sprague & Dede, 1999, p. 8). Technology-rich lessons can facilitate learning through these kinds of engaging activities to compliment teacher instruction (Recesso & Orrill, 2008).

Meaningful learning takes place when the *Constructive* attribute is present through the involvement of participants who reflect upon new learning and then articulate this knowledge in some way. When learners encounter discrepancies with new experiences through reflection, they seek to resolve these discrepancies (Jonassen et al., 2003). Learners resolve these by two methods. The first involves assimilating or merging new learning into existing mental maps. The second involves making modifications to or rewriting one's mental maps to accommodate the new learning (Lever-Duffy & McDonald, 2008). It is this constant resolution of discrepancies and altering of schema that leads to greater complexities of thought and meaning (Jonassen et al., 2003).

The *Intentional* attribute for meaningful learning entails additional reflection on the learner's part. It is through reflecting that goals are realized and established. Once this has occurred, learners can act with intentionality to formulate goals and track performance. Technology productivity tools either via the Web, via a software application, or both, have made the process manageable and attainable (FCIT, 2007). Teachers typically utilize such tools; however, the benefits of preparing students to track and monitor their own educational goals are multifaceted. Keeping records via a digital calendar allows students to keep goals within reach. If, after self-reflection plans are not shaping up as anticipated, they can be revisited and revised (Jonassen et al., 2003).

With regard to the *Authentic* attribute, meaningful learning occurs when students learn how to solve real-world problems as opposed to relying upon a step-by-step method or algorithm. Jonassen et al. (2003) argues that much of the problem solving occurring in classrooms is contrived. One example is when, at the end of a chapter, textbooks incorporate content into problems with predictable outcomes. As a result, learners become used to problems with few ties to real-world situations and are ill equipped when faced with complex problems. "Unless learners are required to engage in higher order thinking, they will develop oversimplified views of the world" (Jonassen et al., 2003, p. 8). Working with a real-world scenario "engages students in finding a solution to an ill-structured problem" (Recesso & Orrill, 2008, p. 42). Ill-structured problems are considered complex since they often mirror real-world situations.

In terms of the *Cooperative* attribute, meaningful learning takes place when learners participate in collaborative experiences. According to Jonassen et al. (2003), humans follow their natural inclinations of working with one another or in a community by seeking each other out to solve problems and make meaning of their world. Constructivists like Lev Vygotsky were convinced of the social aspects to meaningful learning. He believed that through collaborative experiences, learners are capable of constructing a common body of knowledge (as cited in Lever-Duffy & McDonald, 2008).

Levels of Technology Integration

Friedrich Nietzsche wrote, "The press, the machine, the railway, the telegraph are premises whose thousand-year conclusion no one has yet dared to draw" (as cited in Hollingdale, 1996, p. 378). Reflective of Nietzsche's statement regarding these historic technologies, researchers in the groundbreaking *Apple Classrooms of Tomorrow* (ACOT) study (Sandholtz et al., 1997) on technology integration remarked, "None, in the early days had any idea how they would come to depend on technology for teaching and how profoundly it would affect the way they taught" (p. xvi). This longitudinal study, which began over 20 years ago and spanned a little over a decade, marks the earliest research establishing distinct levels of technology integration in classroom settings. The project began as a collaboration between company researchers, schools, and universities across the nation.

While addressing technology integration in terms of student-centered classrooms throughout their book written about the study, researchers Sandholtz et al. (1997) primarily discuss integration from the perspective of teacher professional development when addressing the five levels: *Entry*, *Adoption*, *Adaptation*, *Appropriation*, and *Invention*. The *Entry* phase was described as an awkward period where teachers spent most of their efforts becoming acquainted with the new technology. During the *Adoption* phase, teachers began incorporating technology into lesson design, but utilized traditional means of instruction. While teachers still utilized direct instruction in the *Adaptation* phase, productivity emerged from the student perspective using computer applications like word processors and spreadsheets. In the fourth phase of *Appropriation*, teachers moved beyond traditional modes of instruction and utilized technology effortlessly in lesson design and classroom practice. In the final *Invention* phase, teachers formed new patterns for incorporating technology into instruction developing cross-curricular units and opening the door for team teaching.

Based on the original levels identified in the ACOT study (Dwyer, Ringstaff, & Sandholtz, 1992), the work of Hall, Loucks, Rutherford, and Newlove (1975), and the work of Thomas and Knezek (1991), the *Levels of Teaching Innovation* (formerly *Levels of Technology Implementation*) or LoTi instrument developed by Chris Moersch (1995) is comprised of eight levels: *Non-Use*, *Awareness*, *Exploration*, *Infusion*, *Integration (Mechanical)*, *Integration (Routine)*, *Expansion, and Refinement*. These are closely aligned with the seven levels found in the Concerns-Based Adoption Model, which was originally designed for use with professional development for a variety of fields. This model is comprised of seven levels as identified by Hall et al. (1975): *Awareness*, *Information*, *Personal*, *Management*, *Consequence*, *Collaboration*, and *Refocusing.*

In the *Non-Use* phase, technology is absent in the classroom. In one sense, this level falls below the ACOT *Entry* level. However, this level also mentions access to traditional forms of technology like blackboards, overhead projectors, and textbooks, which is noted in the *Entry* level of the ACOT model. In the *Awareness* level, most of the technology use occurs through the teacher's use of applications for managing grades, taking attendance, or creating presentations. However, in the sense that students are limited in their access to technology tools, the characteristics found at this level most closely identify it with the ACOT *Entry* level. The *Exploration* level most closely resembles ACOT's *Adoption* level where students are engaged in computer-based activities like tutorials or drill and practice. Though the *Infusion* level discusses higher order thinking processes, like the ACOT *Adaptation* level, it is described by activity where students are using productivity tools like spreadsheets, word processing, and presentation software to complete assigned tasks. Parts of the *Integration: Mechanical* and *Integration: Routine* levels can be associated with ACOT's *Adaptation* level where students begin selecting digital tools to solve problems. From an instructional perspective, these levels resemble the incorporation of technology into lesson design and classroom practice as in the ACOT *Appropriation* level. Finally, the *Expansion* and *Refinement* levels seem to incorporate cross-curricular thinking, new innovative patterns of thought, and seamless technology integration just as the ACOT *Invention* and *Appropriation* levels (Sandholtz et al., 1997; Moersch, 1995).

Even though the LoTi instrument incorporates divisions of integration established in the ACOT project (Moersh, 1995) and attributes of meaningful learning as identified in the work of Jonassen et al. (2003), some argue Moersch's instrument remains teacher-focused. In Stager's work (2008), he notes that in spite of its references to student-centered activity, the application of the LoTi instrument does little more than describe teaching practices. While the ACOT study briefly outlines levels of integration in terms of instructional transitions, it serves to classify integrative activities from a student perspective. Furthermore, these divisions are identified as being completely student-centered in conjunction with attributes of meaningful learning in the Technology Integration Matrix (2007).

Learning Taxonomies and Technology

Best known for his *Taxonomy of Educational Objectives*, Benjamin S. Bloom and colleagues from the University of Chicago, developed three learning hierarchies based on cognitive, affective, and psychomotor learning domains (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956). Of the three domains, the cognitive classification system has received the most attention in academic circles over the past 50 years. This domain consisted of *Knowledge*, *Comprehension*, *Application*, *Analysis*, *Synthesis*, and *Evaluation* cognitive levels. These six categories were ordered from simple to complex with *Knowledge* being at the lowest level of the continuum and *Evaluation* at the highest level. In the taxonomy's original format, it was thought each level of cognition was dependent upon the one before it. For instance, it was necessary to have obtained *Knowledge* before *Comprehension* could occur (Krathwohl, 2002).

Approximately 45 years later, much in the same way Bloom had a team of psychologists in the development of the three taxonomies, his former student Lorin Anderson and colleague David Krathwohl led an effort to update the cognitive portion of the taxonomy. Known as *Bloom's Revised Taxonomy*, significant changes reflect these updates. In particular was the shift from a one-dimensional taxonomy to a two-dimensional taxonomy. The original taxonomy used nouns to characterize the six categories, each with subcategories—minus the exception of the *Application* category. The lowest level or *Knowledge* level was unique in that it used both nouns and verbs to describe its features. Based on updated research, the revised taxonomy separated the use of nouns to describe categories in the *Knowledge* dimension from the use of verbs to describe categories in the *Cognitive Processes* dimension. This effectively eliminated the noun-verb inequities between the *Knowledge* category and the other five categories posed by the original taxonomy. The *Knowledge* category became its own separate dimension in the revised taxonomy, while using *Remembering* in place of the former *Knowledge* designation retained six categories. Used to designate the six categories of objectives, all of the nouns were replaced by verbs to describe the activeness found in the *Cognitive Processes* dimension: *Remembering, Understanding, Applying, Analyzing, Evaluating,* and *Creating* (Krathwohl, 2002). The two categories of *Synthesis* and *Evaluation* were reversed and replaced with *Evaluating* and *Creating*. Furthermore, little emphasis was ever placed upon the subcategories that defined the main six categories.

Regardless of whether the original taxonomy or the revised taxonomy is used to classify educational objectives, educators have used active descriptors to identify the kinds of engaged learning that occurs (Churches, 2009; Lever-Duffy & McDonald, 2008; Pitler, Hubbell, Kuhn, & Malenoski, 2007; Recesso & Orrill, 2008). For instance, the action verbs "separate, order, explain, connect, classify, arrange, divide, [and] compare" (Recesso & Orrill, 2008, p. 80) provide examples of what can be used to describe the kinds of cognitive activities occurring in the *Analysis*/*Analyze* category of the taxonomy. Using Anderson and Krathwohl's revised taxonomy (2001), Andrew Churches, from the Kristin School in New Zealand, builds upon accepted active descriptors to utilize verbs reflective of the current *Digital Age*. In *Bloom's Digital Taxonomy* (2009), he added action verbs for each of the six taxonomy categories like bookmarking for *Remembering*, twittering for *Understanding*, hacking for *Applying*, reverse engineering for *Analyzing*, networking for *Evaluating*, and wiki-ing for *Creating*. Later on in *Bloom's Digital Taxonomy*, Churches details the types of activities associated with each of the new descriptors.

While taxonomies based upon Bloom's work have received acceptance worldwide (Forehand, 2005; Krathwohl, 2002), researcher Robert Marzano (2000) developed a taxonomy some may consider a challenge to the ever-present emphasis on Bloom's. However, a careful examination of all the taxonomies shows that while Marzano's taxonomy may be organized differently (Marzano & Kendell, 2007), it still includes some of the common structures found in Bloom's original taxonomy (Bloom et al., 1956) and Anderson's revised taxonomy (Anderson & Krathwohl, 2001).

Marzano's *New Taxonomy of Educational Objectives* "is an intersecting matrix of three systems of thought and three knowledge domains" (Pitler, Hubbell, Kuhn, & Malenoski, 2007, p. 4). Just as a separate *Knowledge* dimension exists in *Bloom's Revised Taxonomy*, the *Knowledge* domains of Marzano's taxonomy represent a separate dimension also within a two-dimensional model. All three systems of *Self-Esteem*, *Metacognition*, and *Cognition* are dependent upon the knowledge domains of *Information*, *Mental Procedures*, and *Psychomotor Procedures* for content. In the *Self-Esteem System*, whether or not an individual continues to take part in a particular learning activity is determined by their positive or negative self-image. The *Metacognitive System* focuses on setting goals and tracking progress. Metacognition occurs when learners examine how they think and learn. Finally, the *Cognitive System* describes thinking processes in much the same way earlier taxonomies viewed the six categories (Marzano & Kendell, 2007).

One unique aspect to Marzano's taxonomy is that it includes the emotional components found in Bloom's affective domain as part of the *Self-Esteem System*. The *Metacognitive* and *Cognitive* systems contain features found in *Bloom's Revised Taxonomy*. While Bloom's original taxonomy placed little emphasis on the learner's metacognition, the revised taxonomy included it as a subcategory in its *Knowledge* dimension based on the latest developments in psychological research. In terms of cognitive processes, the *Cognitive* system's categories of *Knowledge Retrieval*, *Comprehension*, *Analysis*, and *Knowledge Utilization* closely match the categories of *Remembering*, *Understanding*, *Analyzing*, and *Applying* from *Bloom's Revised Taxonomy* (Krathwohl, 2002).

Though Marzano's taxonomy offers an innovative perspective on learning, educational technologists still refer to the integration of technology in terms of moving from simple to complex cognitive processes as identified in *Bloom's Taxonomy*. Authors Recesso and Orrill (2008) discuss the use of Bloom's in relation to the learning continuum in their *Technology and Learning Continuum Model*—a model used as a vehicle for facilitating "learner-focused and technology-infused learning" (p. 74). The learning continuum is comprised of three sets of activities: the *initiating activity*, *guided learning*, and the *culminating* performance. Though Bloom's levels can occur throughout this continuum, the following describes one possible sequence of these levels. For instance, in the *initiating activity* where connections are made between prior learning and what is to be learned, the learner must utilize the *Knowledge* level of *Bloom's Taxonomy*. Any of the *Comprehension*, *Analysis*, *Synthesis*, and *Application* levels may be used during the *guided learning* phase of the continuum where the teacher and technology act in supportive roles throughout the course of the learning activities. Finally, *Evaluation* may emerge during the *culminating performance* phase where learners demonstrate achieved outcomes (Recesso & Orrill, 2008).

The Technology Integration Matrix

In accordance with No Child Left Behind's (NCLB) *Enhancing Education Through Technology Act of 2001* and through funding from the Florida Department of Education, researchers from the Florida Center for Instructional Technology (FCIT) at the University of South Florida developed a tool which could assist teachers with seamless integration of technology in classrooms. Researchers combined levels of technology integration—closely matched to the levels set forth in the groundbreaking ACOT study (Sandholtz et al., 1997)—with five constructivist attributes associated with meaningful learning (Jonassen et al., 2003) to form a two-dimensional model known as the *Technology Integration Matrix* (TIM). The original five levels introduced in the ACOT research included *Entry*, *Adoption*, *Adaptation*, *Appropriation*, and *Invention*. FCIT researchers kept the designations for the first three while replacing *Appropriation* with *Infusion* and *Invention* with *Transformation* (FCIT, 2007). The original five constructivist attributes of meaningful learning as defined by the authors of *Learning to Solve Problems with Technology* (Jonassen et al., 2003) were *Active (Manipulative/Observant)*, *Constructive (Articulative/Reflective)*, *Intentional (Reflective/Regulatory)*, *Authentic (Complex/Contextualized)*, and *Cooperative (Collaborative/Conversational)*. FCIT researchers termed these attributes, "Characteristics of the Learning Environment," and replaced the *Intentional* designation with *Goal Directed* and the *Cooperative* designation with *Collaborative*.

With the levels of integration across the top of the matrix denoting five columns and the learning environment attributes down the side denoting five rows, a matrix of 25 cells was formulated. Each of the cells represents the intersection of a level of integration with an environmental attribute to form 25 unique indicators for gauging teacher technology use. Within each of the indicator cells are two links. One is anchored to a Web page with lesson resources for classrooms with one-to-one computer access while the other is linked to resources for classrooms with limited or shared computer access. Each Web page covers a lesson matching the matrix indicator and type of computer access. Furthermore, each consists of lesson objectives, materials (including electronic templates), procedures, extension activities, a video illustrating the lesson, the Sunshine Standards (SSS, 2010) addressed, and the National Educational Technology Standards Profiles for Technology Literate Students (ISTE, 2010) addressed in the activity.

A perusal of the objectives for each of the 50 lessons reveals use of the active descriptors found in the varying versions of Bloom’s taxonomy. In the same way learners progress from simple to complex along the cognitive portion of the taxonomy (lower order levels of thinking to higher order levels of the thinking), lessons moving left to right from the *Entry* level and on to the *Transformation* level also increase in complexity. For example, an observer examining the lesson objectives regarding the five attributes at the *Entry* level may see action verbs relating to the *Remembering* or *Understanding* classifications of the revised taxonomy (i.e. name, place, recognize, review, understand, describe). Examining objectives at the *Adoption* level may see action verbs relating to the *Remembering*, *Understanding*, or *Applying* classifications (i.e. read, identify, compare, contrast, use, discuss). Consequently, there is some overlap in the way the taxonomy classifications relate to the levels of integration. Nonetheless, the levels of integration represent a hierarchical nature where the higher levels of integration build upon the preceding levels in the same manner lower order thinking skills must be mastered before moving on to higher levels of thinking. Therefore, the goal of the TIM model is to provide a classification system to which teachers can refer while continually seeking to provide the higher levels of student-centered, technology-rich activities.

While teachers can currently use the TIM to establish professional development goals, no tool exists for determining exact placement on the matrix. FCIT researchers have discussed the development of such a tool. They have received positive feedback at the prospect of designing an additional section to the companion tool—Inventory for Teacher Technology Skills (ITTS)—for measuring teachers' placement in the matrix. Used primarily by districts to determine professional development needs, the ITTS is an inventory that measures teacher technology proficiencies.

Instrument Design, Field Testing, Reliability, and Validity

When researchers are unable to find a research instrument to measure variables related to their research topic, it becomes necessary to design an instrument (Roberts, 2004). Several aspects must be considered when designing a survey instrument. These include determining what is to be measured, the format of the instrument, the types of questions to ask, how questions must be crafted to measure data accurately, what stakeholders should be involved, and how data will be collected. Before the construction of an instrument can begin, a researcher must develop a conceptual framework. This results from carefully examining survey objectives and research questions. Once a framework is in place, it must be referenced throughout the instrument design process (Punch, 2003).

An important part of the process involves eliciting authentic answers from respondents based on questions that simulate real world situations. "On paper or via a computer, the researcher speaks directly to the respondent through a written questionnaire" (Fowler, 2009, p.88). According to Fowler, survey questions fall into two categories—open-ended or closed. Open-ended questions commonly warrant descriptive responses and are found in qualitative research (Gall, Gall, & Borg, 2005). While these types of questions tend to obtain more specific information from respondents (Fowler, 2009), because of the varying formatting possibilities along with the lengthy narrative data, it is often a challenge to perform more complex methods of statistical analysis (Punch, 2003). On the other hand, closed questions typically offer a list of alternatives and ordered responses and are easily quantified. Fowler (2009) cites advantages to working with responses to closed question instruments. This kind of questioning makes it easier for respondents to make selections and for researchers to organize and interpret the data, whereas narrative data must be carefully scrutinized and labeled. Chances of obtaining data that is analytically interesting and useful are also increased.

Fowler (2009) identifies three requirements for designing quality survey questions. First, questions should be scripted in such a way that the respondent is completely prepared to provide an answer. When designing an instrument, it is important to provide complete questions. With incomplete questions, respondents are forced to fill in meanings on their own. Likewise, poor wording can also result in unintended answers. In research studies using interviewers, questions may have optional wording off to the side in case respondents are unable to provide an answer. Because the answer to the original question may be completely different from the answer to the optionally worded question, responses ultimately lead to measurement error; it is best to avoid optional wording (Fowler, 2009).

Second, the questions should mean the same things to every respondent. The key to making sure questions mean the same is to define and use terms that are not ambiguous. Another example of bad question design is when multiple questions are embedded into single survey items. Items should be checked carefully to be certain more than one question is not being asked (Fowler, 2009).

Third, acceptable responses for answering questions should be clear to respondents. The simplest means for accomplishing this is to offer a list of responses (Fowler, 2009). In order to gauge these responses, the kind of measurement must be determined. According to Fowler (1995) measurement types fall into two categories: objective and subjective. Objective measures refer to the act of measuring events or facts, while subjective measures refer to the act of measuring intangibles like perceptions and feelings. In terms of levels of measurement, the idea originated with Psychologist S. S. Stevens toward the end of World War II when he sought to classify measurement outcomes to make them more meaningful (Salkind, 2006). Levels used to describe different kinds of questions in the social sciences are *nominal*, *ordinal*, *interval*, and *ratio*. *Nominal* refers to a list of responses in terms of categories; *ordinal* refers to a list based on rank order with the most common examples being of the Likert scale style; *intervals* are concerned with distances between variables; and *ratio* refers to lists of distances between variables compared to other distances between variables. *Nominal* and *ordinal* levels are most commonly used in research studies. Objective measures can be applied to *nominal* and *ordinal* levels of measurement and provide a way for establishing test validity. Yet, while subjective measures can be applied to *ordinal* levels, it is very difficult to determine test validity (Fowler, 2009).

The field test stage is a necessity for any newly designed survey instrument. Though the extent to which an instrument must be tested varies depending on the situation, Punch (2003) provides some general goals for conducting a field test. Survey items need to be clear and understandable so the respondent can answer the questions easily. The means of collecting data must be tested to ensure that the survey instrument is accessible, that the instructions are appropriate for completing the survey, that no errors exist when collecting responses, and to determine the length of the instrument. According to Nassar-McMillan (2002), focus groups are ideal for helping with these tasks. She notes that currently no defined rules exist for the use of focus groups. Fowler, on the other hand, provides very clear protocols for incorporating focus groups into research (2009). He recommends no more than six to eight panel members per focus group. These panel members should typically come from the target population because of their insight into the problem addressed by the study. "The general protocol is to discuss people's perceptions, experiences, and perhaps feelings to what is to be measured in the survey" (p. 117). Overall, Fowler recommends incorporating at least a couple of focus groups during the early stages of instrument development in order to receive the greatest benefit.

Of great importance to the field test process is instrument delivery. The most common types of delivery include personal interviews, phone interviews, postal mail, electronic mail, and the Internet. Because Internet surveys are the newest means for administering surveys, less research data exists. Though the administration of surveys via the Web is instantaneous and allows for ease of completion by respondents, some studies have shown the rate of completion to be roughly the same between those completed on the Web and those completed by regular mail. Other studies have shown the rate of response to be far lower on the Web than by regular mail (Fowler, 2009).

Fowler suggests common steps for increasing responses for multiple types of survey delivery and collection. He directs researchers to be clear about the purpose of the survey and to convey the importance and usefulness of their responses to participants. The number of survey completers will be greater if respondents view the sources as credible. One factor for enhancing credibility is the appearance of a survey. The more attractive and professional looking the instrument layout—either in paper or electronic form—the more credible the survey is perceived to be. A second factor is that respondents are more willing to complete a survey when it is associated with a well-established organization or institution. Therefore, getting the approval to conduct research and even endorsements from leaders at respected institutions can serve to enhance the instrument's credibility. Fowler also emphasizes the importance of maintaining confidentiality. Respondents are more likely to participate when they know their responses will not be associated with them or affect them in negative manner. Building anonymity into the instrument can eliminate this concern (Fowler, 2009). Additionally, carefully rewording questions to eliminate negative connotations while still being able to measure the desired data can increase responses (Fowler, 1995). With mail and Internet surveys, it is recommended to send reminder letters and e-mails approximately ten days following the initial contact while emphasizing the importance of a response. Another reminder is suggested ten days later with another copy of the survey if sent by regular mail. After this, it is recommended that contact be made via phone (Fowler, 2009).

Critical to the design of quality survey instruments are the properties of reliability and validity. Reliability refers to the consistency of responses over time. An instrument is considered reliable when respondents answer the items in the same way each time they complete the instrument. In other words, regardless of how often they take the survey or their frame of mind from one time to the next, if they always answer the items in the same way, the instrument is reliable. Validity refers to whether or not the instrument measures what it is supposed to measure. This means if respondents' answers to survey items truly reflect what the items were designed to measure, the instrument is considered valid (Gall, Gall, & Borg, 2005; Punch, 2003, Salkind 2006).

Salkind (2006) identifies means for determining reliability. Using the *test-retest* or *sampling* calculation for reliability requires an instrument be administered at a point in time and then administered again at another point in time. Here both administrations of the instrument are compared to see how the results are the same or different. If the results are highly similar, the test is considered reliable. Using the *parallel forms* method of determining reliability refers to when the results from administering different forms of an instrument are the same for each respondent. The *internal consistency* method looks to see if questions within a construct or a dimension are answered with similar responses and item total correlations are useful for assessing this consistency. In other words, if respondents score the same way on all the questions within each construct in a survey, the instrument is considered consistent (Gall, Gall, & Borg, 2005). The fourth means for calculating reliability, known as the *inter-rater* method, determines whether inconsistencies existed between scorings by the different administrators of an instrument. If there is little variation between the way different administrators scored the same instrument, then the instrument could be considered reliable (Gall, Gall, & Borg, 2005; Salkind, 2006).

In terms of validity, Salkind (2006) identifies three methods as being most important: *content*, *criterion*, and *construct*. *Content* validity is best understood by answering the question, "Does the collection of items on the test fairly represent all the possible questions that could be asked?" (p. 66). Furthermore, this type of validity seeks to determine if the number of content items is proportionally equal to the kinds of content covered in a course or body of work (Gall, Gall, & Borg, 2005). With the *criterion* method, validity is determined through the correlation of scores from the instrument being tested with an instrument already determined to be valid. Finally, in the same way *internal consistency* compares the scores of similar items within a construct to determine reliability, *construct* validity compares the correlation of similar items within a construct to knowledge of current literature.

Summary

This chapter provided an overview of the literature leading up to and surrounding the development of the Technology Integration Matrix (FCIT, 2007). A brief history of the development of learning theories and the introduction of computer technology into classrooms were explored. It was demonstrated how the TIM is a complex model—the result of fusing constructivist attributes of meaningful learning, distinct levels of technology integration, and cognitive process into a product for measuring teacher technology usage. Finally, best practices in questionnaire design were examined along with protocols for the development and field test of an instrument. Chapter Three presents the sample, how the instrument was developed, and describes the instrument in detail.

CHAPTER THREE

METHODS

This chapter covers the development of a multidimensional instrument to measure teacher technology use in terms of levels of technology integration and characteristics of learning environments. Individual persons involved in the expert panels and the pilot are indentified by their educational occupations. The use of expert panels and pilot participants in the design and development of the instrument regarding reliability and validity is presented in addition to the administration of the pilot instrument.

The goal of this study was to design, develop, and pilot a questionnaire based on the 25 indicators found in the Technology Integration Matrix (FCIT, 2007). Currently, while Florida educators have been able to establish teachers' profiles on the Matrix, being able to prescribe professional development at the teacher level based upon these results has been an entirely different issue. According to Roy Winkelman, the Matrix is currently better at gauging professional development in terms of buildings and organizations as a whole. An instrument with greater emphasis on gauging the practices of individual teachers could be useful (Personal communication, January 23, 2009). This chapter specifically addresses the survey development process relating to the measurement of the frequency of technology usage in terms of levels of integration in conjunction with characteristics found in the learning environment.

Research Design

This study employed a mixed methods research design because a combination of quantitative and qualitative approaches was utilized. The instrument development and content validity evaluation relied primarily on descriptive or qualitative input from expert panel members. The determination of reliability with regards to the integration level constructs, constructivist characteristics constructs, and individual questionnaire items relied on quantitative measures.

Population and Samples

To develop an instrument for identifying usage in terms of levels of integration and characteristics of the learning environment in order to prescribe professional development for individual teachers, two expert panels were formed to evaluate the format of the instrument and questionnaire items. The first panel included eleven experts and the second included 21 elementary and secondary teachers from two subgroups. Because this study centered on the Technology Integration Matrix, originally developed for public schools in Florida, the targeted population for the pilot consisted of Pre-K - 12 teachers in public schools.

First Expert Panel. The first panel of experts was comprised of three original developers of the Technology Integration Matrix. Two are technology leaders from the Florida Department of Education. One is the director of the Florida Center for Instructional Technology. The panel also consisted of 8 technology leaders in Kansas. One is a senior project manager and the other a project leader from the Advanced Learning Technologies (ALTEC) project at the University of Kansas Center for Research on Learning. One is the director of Graduate Studies in Education at MidAmerica Nazarene University. Three are technology leaders in the Olathe School District, and two are technology leaders from the Topeka School District.

Second Expert Panel. The second panel was comprised of elementary and secondary teachers representing the population of interest. Furthermore, this panel was divided into two subgroups. The first subgroup consisted of nine participants from the original 26 teachers in the Olathe District invited to serve on the panel. Six were secondary teachers from the Northwest High School Tech Team, while the other three were elementary teachers from Briarwood, Arbor Creek, and Tomahawk participating in the district pilot of Moodle. Teachers in this first subgroup had experience with the latest of SMART technologies, Classroom Performance System (CPS) clickers, Airliners, handheld devices, and online course delivery platforms. The second subgroup included teachers participating in ESOL endorsement training from MidAmerica Nazarene University. These 12 were invited to participate after the first subgroup had provided their feedback on the instrument. Five were elementary and five were secondary teachers in Olathe. One was an elementary teacher from the Kansas City, Kansas Public Schools and another was an elementary/secondary teacher from the Kansas City, Missouri Public Schools.

Pilot Sample. The pilot sample of 498 consisted of certified educators from Kansas schools and from one Florida school district. This included teachers from the rural settings of Beloit, Central Heights, Louisburg, and Spring Hill, the suburban settings DeSoto, Gardner-Edgerton, Lawrence, and Olathe, and the urban settings of Turner and Polk County. Eight respondents were students drawn from the technology-enhanced teaching graduate program and re-licensure classes at MidAmerica Nazarene University. These students are also classroom teachers. The thirteen respondents from Florida were from the Polk County Public Schools.

Development

The items of the TIMQ were developed to measure the frequency of activity regarding technology usage in the cells of the TIM. Each cell indicates the level of technology integration and the characteristic of the learning environment. While the headings of the columns in the TIM (see Figure 1 in Chapter One and/or Figure A1 in Appendix A) identify levels of integration from the perspective of the teacher, the 25 indicators identify technology usage in terms of student activity. Therefore, in the constructivist tradition of emphasizing student-centered classrooms, each instrument item was designed to begin with the statement, "Students in my classroom/classes…" This wording was used to represent the activities of students either in a single elementary classroom setting, an elementary classroom like exploratory or specials that see more than one class during the week, or in a secondary setting where each teacher has multiple classes of students.

Initial TIMQ Draft. The original survey draft (see Appendix B), developed between December 2008 and January 2009, consisted of 25 items corresponding to the 25 indicators found in the Technology Integration Matrix. Though multiple Likert rating scales (quality, importance, frequency, agreement, and likelihood) were considered for the items in the draft, a frequency scale was selected. Because researchers report scales with greater than seven ratings as having too many (O'Neill, 2007), five were selected for the initial draft of the instrument: *Never*, *Rarely*, *Sometimes*, *Often*, and *Always*.

TIMQ1 Draft. After a discussion of the initial draft of questions with a staff member from Baker University, it was found to be absent of direct wording from the indicators in the Matrix (P. Waterman, personal communication, February 27, 2009).

Consequently, the researcher constructed another draft to bring all wording into close alignment with each of the indicators. At the suggestion of the FCIT Director (R. Winkelman, personal communication, January 23, 2009) in order to check internal consistency reliability, the second draft included two items to measure each indicator totaling 50 questions in all. This draft was completed in early March 2009. It included 20 demographic questions designed to identify the technology "lay of the land" in various respondents' settings like types of school environments, accessibility, and support. Because respondents might have had differing views of what the ratings in the Likert frequency scale meant (i.e. Does *Always* mean everyday, every other day, or once a week?), the researcher redesigned the rating mechanism similar to a semantic differential scale with end-anchored points at ratings 1 and 5 to represent *Never* and *Frequently*, respectively. A semantic differential rating scale has the advantage of using polarities (endpoints)—often exact opposites—to show the direction of a response. This limits the subjectivity of responses found in other rating scale mechanisms. A semantic differential (Osgood, Suci, & Tannenbaum, 1957) can also show the intensity of a response based on its distance from the origin (i.e. 3 on a scale from 1 to 5). In this way, the scale eliminates the "risk of annoying or confusing the responder with hairsplitting differences between the response levels" (Frary, 1996, p.171).

This draft of the instrument, known as the Technology Integration Matrix Questionnaire 1 (TIMQ1), was available to the members of the first expert panel between March 30 and May 19, 2009 (see Appendix C). Expert panel members gave feedback on their perceptions of questions via this online draft, provided suggestions for improvements through an online forum, and discussed format considerations using a wiki. The initial structure of this online draft allowed the expert panel members to make selections as a typical Pre-K through 12 teacher would, but with several enhancements to collect typed feedback and rate the accuracy of how well each question measured the associated indicator in the TIM. Using “textarea” Web components, the kinds of typed feedback from panel members included alternate wording of questions, suggestions for clarity, and recommendations on the inclusion of examples. A “textarea” component is an entry box on a Web form used to collect text in paragraph format (see Figure 2).

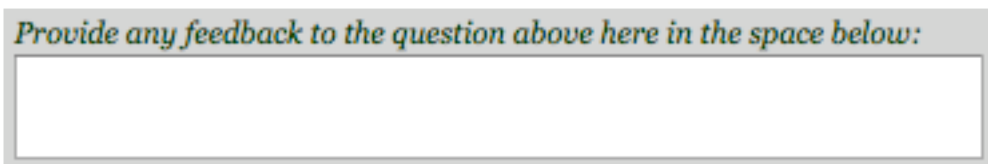

Figure 2. Textarea Web component for obtaining typed feedback about questionnaire items.

Panel members rated their level of agreement in terms of each question’s accuracy in measuring TIM indicators using a “dropdown list” Web component with the options *Strongly Agree*, *Agree*, *Neither Agree nor Disagree*, *Disagree*, and *Strongly Disagree* (see Figure 3). Indicator descriptions were added underneath each of the 50 questions in this draft to eliminate the need for panel members having to constantly look back at the Technology Integration Matrix and make comparisons (also refer to Appendix C). Wordsmith feedback was primarily given through the wiki (see Figure C1) where panel members were able work collaboratively making written revisions to the draft as a single document.

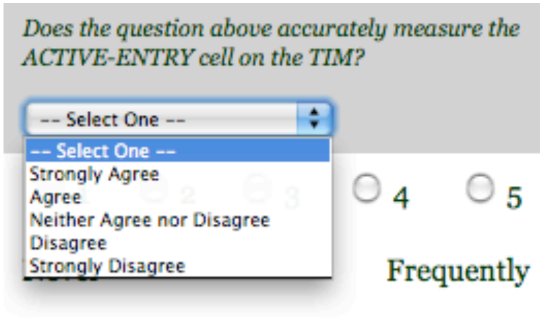

Figure 3. Dropdown list Web component for rating level of agreement regarding question accuracy.

The most crucial feedback regarding the highly technical kinds of integrative usage portrayed in the questions came from the discussion forum. Because respondents might not understand or know how to respond to these questions, Jenny Black (personal communication, April 3, 2009), Instructional Technology Program Specialist at the Florida Department of Education and an original developer of the TIM, suggested creating short examples (e.g., lessons using a WebQuest), to illustrate the kinds of tech usage for each survey item (see Figure C2).

Content Validity. The first panel of experts helped to establish content validity by determining if the survey questions accurately reflected the content in the TIM's 25 unique indicators. Content validity addresses "the extent to which a measurement reflects the specific intended domain of content (Carmines & Zeller, 1991, p. 20). Experts from the first panel were ideal for this task since several had been involved in the original development of the matrix. In fact, one developer's direct feedback confirmed that the researcher's questions do accurately portray each of matrix indicators.

TIMQ2 Draft. Relevant modifications were made based upon the feedback from these multiple online formats (see Appendix D). This included the development of examples to correspond with each indicator. Under consideration was the idea of providing links to relevant Web sites containing examples of technology usage for each of the 50 items. However, because links to sites other than the one containing the online instrument could have resulted in respondents getting lost and not completing the survey, this idea was abandoned. Therefore, short examples were constructed in the form of popup rectangles (see Figure 4) to appear when respondents moved their mouse cursors over designated examples. These examples were created after carefully examining the videos on the TIM Web site (FCIT, 2007) and from multiple kinds of technology integration experiences in the researcher's background.

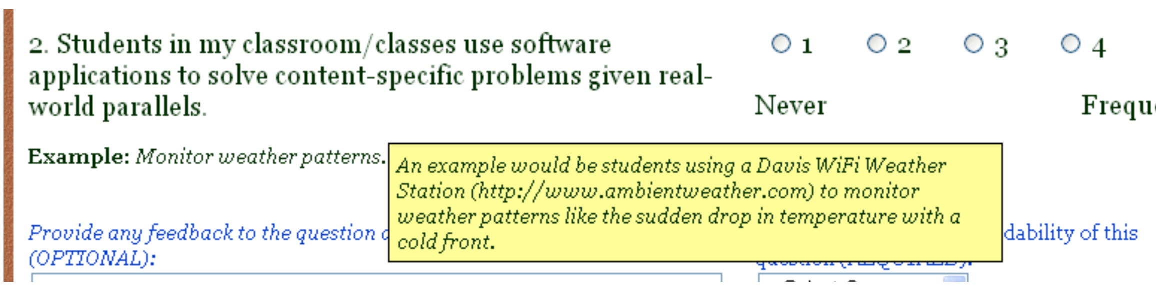

Figure 4. Short example popup rectangle.

Once this draft (see Appendix E), known as the Technology Integration Matrix Questionnaire 2 (TIMQ2), was completed in mid-August of 2009, the second panel representing the targeted population was invited to provide feedback regarding understandability. In the beginning of this stage, a nearly identical configuration (see Appendix F) for providing feedback was set up complete with access to the Moodle site forum, wiki tool, and online survey instrument with MySQL database. However, shortly after inviting members of the first subgroup in this panel, several expressed concern over the level of involvement and considered not taking part in the panel. Therefore, the researcher deemphasized involvement using the Moodle site and provided a link to the survey instrument in order for panel members to provide direct feedback regarding understandability.

The TIMQ2 retained the “textarea” Web components (similar to Figure 2) providing the opportunity for panel members to give additional feedback if desired. Unlike TIMQ1 where panel members were shown which items corresponded with which indicators on the TIM, TIMQ2 did not reveal the matrix indicators. Instead, this draft focused on two pieces of feedback. Panelists were asked to rate their level of understanding and their perception regarding other teachers' level of understanding for each question (see Figure 5). The rating options were *Understandable*, *No Opinion*, and *Not Understandable.* In an effort to minimize response error, a PHP Web script was written to randomize all 50 questions each time the survey instrument was accessed. The first subgroup in the second panel was told both understandability ratings for each question were required. The members of the second subgroup were asked in person to participate, but due to time constraints most were not able to complete all 50 items. However, because of the randomization feature, all items received at least one or more responses.

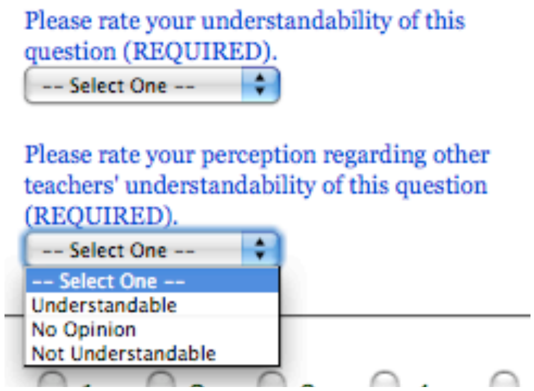

Figure 5. Dropdown list Web component to obtain panel member's perception of whether or not other teachers understood the survey item.

Feedback from TIMQ2 set the stage for development of the final draft for the pilot. Because complete responses were received from the first subgroup and because this group was comprised of technology literate teachers, item revisions were made based on their feedback. A majority of the nine responses for each item indicated that this subgroup understood the questionnaire statements and that they believed other teachers would understand these statements. An exact breakdown of the understandability responses from the subgroup ($n = 9$) is listed in Table 1.

All *No Opinion* and *Not Understandable* responses as well as responses with accompanying feedback were flagged for review. Because some feedback was not related to the understanding of certain questions, it was eliminated from the revision process. For example, one panel member typed, "It depends on the teacher's knowledge/exposure to tech." Another wrote, "I really don't know what they do beyond the school day." Some feedback offered additional ideas for the accompanying examples. For example, a panel member wrote, "Elementary teachers will probably need to have examples from their types of technology or programs on the computer." Another suggested providing an example that uses a "graphing calculator to analyze problems." One panel member typed, "The example really helped make it clear."

Overall, the feedback used for making revisions was related to wording and meaning. The researcher made revisions by referring to feedback given for the questions and examples for items Q5, Q7, Q15, Q18, Q20, Q24, Q26, Q32, Q33, Q35, Q38, Q41, Q45, Q46, Q47, Q48, Q49, and Q50. For example, one panel member typed, "Not sure what you mean by 'goal-directed activities'" and, "You need a hyphen between 'goal' and 'directed'." A panel member questioned, "How is your example inquiry-based?" Another comment referred to the meaning, "It still seems unclear." For the *No Opinion* and *Not Understandable* items Q10, Q25, Q29, and Q34 with no feedback, the researcher examined items and examples to detect the possibility of errors. No errors were found.

Table 1

Members' Understandability and Perception of Teachers' Understandability of Second Panel, Subgroup 1 (n = 9)

Question Sets	Understandable	No Opinion	Not Understandable
Panel Members' Understanding			
Q1, Q2, Q3, Q7, Q8, Q9, Q10, Q11, Q12,	9	0	0
Q13, Q14, Q15, Q16, Q17, Q20, Q21, Q22,	9	0	0
Q23, Q24, Q25, Q29, Q30, Q31, Q33, Q34,	9	0	0
Q36, Q37, Q38, Q39, Q40, Q41, Q42, Q49,	9	0	0
Q50	9	0	0
Q5, Q19, Q27, Q35, Q44, Q48	8	1	0
Q4, Q6, Q18, Q26, Q28, Q43	8	0	1
Q32, Q45, Q46, Q47	7	0	2
Perception of Teachers' Understanding			
Q1, Q2, Q3, Q8, Q11, Q20, Q21, Q22, Q23,	9	0	0
Q24, Q30, Q31, Q33, Q40, Q41	9	0	0
Q5, Q12, Q13, Q14, Q15, Q17,	8	1	0
Q25, Q29, Q34, Q38, Q39, Q50	8	1	0
Q7, Q9, Q35, Q36, Q37	8	0	1
Q27, Q32, Q48	7	2	0
Q42, Q43, Q47	7	0	2
Q4, Q10, Q18, Q19, Q28, Q44, Q49	7	1	1
Q6, Q16, Q45	6	1	2
Q26, Q46	5	1	3

Responses from the twelve members in the second subgroup were used to cross-reference the responses from the first subgroup. Responses regarding whether or not the subgroup members understood the questionnaire statements are listed in Table 2.

Table 2

Members' Understandability of Second Panel, Subgroup 2 (n ≤ 10)

Item	*N*	Understandable	No Opinion	Not Understandable
Q45	10	9	0	1
Q30	8	8	0	0
Q33	8	7	0	1
Q44	8	6	0	2
Q1, Q2, Q3, Q7, Q10, Q19, Q39, Q40	7	7	0	0
Q26	7	6	0	1
Q4, Q46	7	5	0	2
Q12, Q13, Q21, Q28, Q34, Q36, Q37,	6	6	0	0
Q41, Q43	6	6	0	0
Q27	6	5	0	1
Q47	6	4	0	2
Q6, Q9, Q14, Q15, Q18, Q22, Q24,	5	5	0	0
Q25, Q29, Q32, Q49	5	5	0	0
Q50	5	4	1	0
Q16, Q23	5	4	0	1
Q5, Q8, Q11, Q17, Q38	4	4	0	0
Q42	4	3	0	1
Q35	3	3	0	0
Q20	2	2	0	0
Q48	2	1	1	0
Q31	1	1	0	0

Responses as to whether or not members thought that other teachers would understand statements in the questionnaire are listed in Table 3. Though some of the items received as little as one understandability response, the responses from this subgroup reinforced the first subgroups responses which indicated a majority believed the questionnaire items were understandable. There were no instances where the second subgroup's responses did not reinforce the first subgroup's responses.

Table 3

Perception of Teachers' Understandability of Second Panel, Subgroup 2 (n ≤ 10)

Item	*n*	Understandable	No Opinion	Not Understandable
Q45	10	8	2	0
Q30	8	7	1	0
Q33	8	7	0	1
Q44	8	5	1	2
Q1, Q3, Q39	7	7	0	0
Q10	7	6	1	0
Q26, Q40	7	6	0	1
Q2, Q4, Q7	7	5	1	1
Q19	7	5	0	2
Q46	7	4	3	0
Q13, Q36, Q41	6	6	0	0
Q21, Q34, Q43	6	5	1	0
Q12, Q37	6	5	0	1
Q28	6	4	2	0
Q27, Q47	6	4	1	1
Q42	6	4	0	2
Q9, Q14, Q18, Q22, Q24, Q25	5	5	0	0
Q16, Q29, Q32	5	4	1	0
Q6, Q15, Q23	5	4	0	1
Q50	5	3	2	0
Q49	5	3	1	1
Q8, Q11	4	4	0	0
Q5, Q17, Q38	4	3	1	0
Q35	3	3	0	0
Q20, Q48	2	2	0	0
Q31	1	1	0	0

Final TIMQ3 Draft. The final instrument (see Appendix G), the Technology Integration Matrix Questionnaire 3 (TIMQ3), consisted of 12 demographic questions and 50 revised questions. The Web layout of this final version was graphically designed to give it an attractive and polished look in order to maintain the interest of respondents during the pilot. The pilot was conducted during the months of November 2009 to February 2010. Data was collected in a secure online form. Because the instrument was self-administered, respondents theoretically could have taken as long as desired. However, feedback from individual respondents and district leaders who promoted the survey reported the questionnaire taking typically 15 to 30 minutes to complete (M. Duncan, D. Lemke, M. Olson, & C. Ziegler, personal communication, December 2009). Respondents were only allowed to submit their data if all of the required demographics questions and 50 questions based on the TIM were completed. Therefore, no data from incomplete questionnaires was submitted to the MySQL database.

Data Analysis. Item analysis is commonly used to select the survey items in a pilot questionnaire that are to be used in the final version of an instrument (Rust & Golombok, 2009). Two types of item analysis were conducted on the data. Item total correlations were generated using Cronbach's alpha to determine which items best measured the five constructs of integration and the five constructs of constructivist characteristics. The other analysis used was parallel forms reliability. This type of analysis determines reliability based upon more than one form of an instrument. If the respondents receive the same scores on two or more administrations of the same type of test, then the forms are said to be reliable (Coaley, 2010). Because each indicator had two survey items associated with it, the questionnaire behaved as two parallel forms of the same instrument. Pearson product-moment correlations were generated for six different combinations of the two items (A and B) used to measure the 25 indicators of the TIM.

Instrumentation

The final version of the questionnaire contained twelve demographic items. Respondents were not asked to give their name in order to maintain anonymity. They were however asked to designate their affiliated school district (See Figure 6). An area was provided for respondents to list the subject(s) they teach. Checkboxes were provided for respondents to select grade level(s) they teach ranging from Pre - K through grade Twelve.

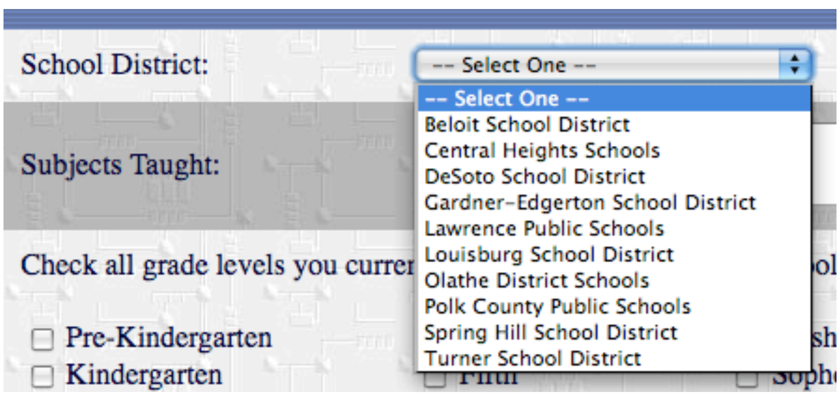

Figure 6. School district affiliation dropdown box.

A dropdown list allowed respondents to identify the number of students taught on a daily basis (see Figure 7). A series of survey items asked questions with the purpose of gauging the availability and accessibility of technology resources. These included the number of computers in a classroom, the number of these computers connected to the Internet, monthly and daily access to mobile and stationary computer labs, the kinds of technologies available in classrooms, and the kinds of technologies available within the building or within the district (also refer to Figure 7). Optional areas were provided for respondents to type technologies not listed in the classroom and building or district demographic item choices. The final survey item in the demographic section gauged the amount of technology professional development in which respondents participate in a year.

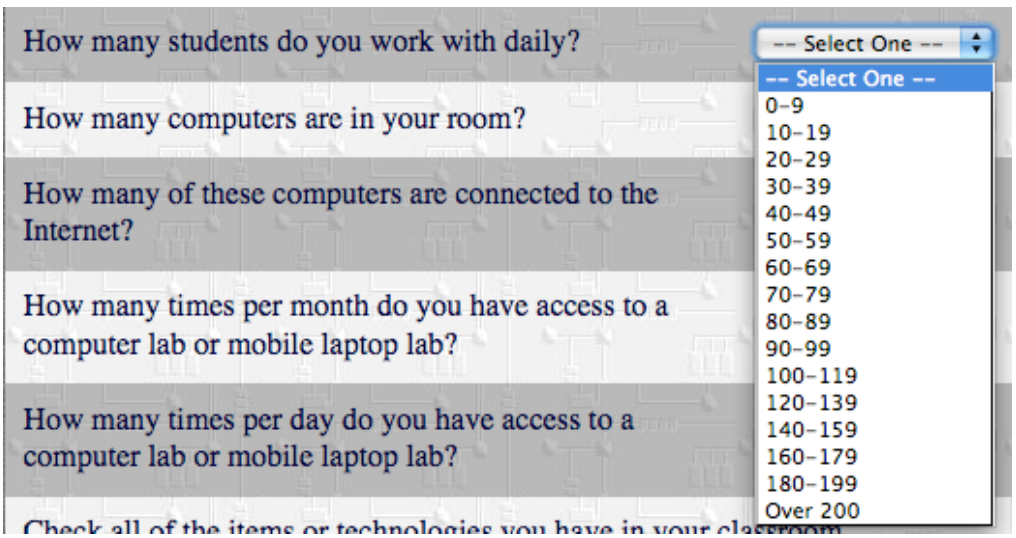

Figure 7. Number of student taught dropdown component.

In order to develop an internally consistent instrument, two questions were developed to measure each of the 25 indicators in the matrix. The resulting 50 questions were designed to measure the frequency of technology usage in teacher practices and are presented in groupings according to the characteristics of the learning environment to correspond numerically with the order in which the items were developed—*Active*, *Collaborative*, *Constructive*, *Authentic*, and *Goal Directed*. In many cases, because some of the indicator descriptions contained more than one component, these components were separated to form the two questions for measuring the same indicator.

Beginning with the *Active* group, survey items 1 and 2 address technology use at the *Entry* level in terms of drill, practice, and computer-based tutorials. The *Active-Entry* indicator in the TIM states, "Students use technology for drill and practice and computer based training." The resulting survey items 1 and 2 became, "Students in my classroom/classes are actively engaged using computer applications for basic skills drill and practice," and "Students in my classroom/classes are actively engaged using computer-based tutorials to learn basic skills."

The *Active-Adoption* indicator in the TIM states, "Students begin to utilize technology tools to create products, for example using a word processor to create a report." The resulting survey items 3 and 4 became, "Students in my classroom/classes are actively engaged using productivity tools like word processors to create reports," and, "Students in my classroom/classes are actively engaged using online productivity tools like Citation Machine or conversion charts to complete projects." Here, because it was difficult to break the original statement into two parts, a similar statement was posed to include online productivity tools with some basic examples built into the question.

The *Active-Adaptation* indicator in the TIM states, "Students have opportunities to select and modify technology tools to accomplish specific purposes, for example using colored cells on a spreadsheet to plan a garden." This was split into survey items 5 and 6 with regard to the student actions of selecting and modifying. The resulting statements were, "Students in my classroom/classes are actively engaged in selecting technology tools to complete specific tasks," and, "Students in my classroom/classes are actively engaged in adapting technology tools to complete specific tasks."

Because there was only one component in the description regarding the *Active-Infusion* indicator making it difficult to split into two questions, one survey item included a reference to software and hardware technology while the other referenced online technology. The *Active-Infusion* indicator in the TIM states, "Throughout the school day, students are empowered to select appropriate technology tools and actively apply them to the tasks at hand." The resulting survey items for 7 and 8 became, "Students from my classroom/classes are actively engaged using technology software and hardware tools throughout the school day," and, "Students in my classroom/classes are actively engaged using online technology tools throughout the school day."

Lastly, the *Active-Transformational* indicator in the TIM states, "Given ongoing access to online resources, students actively select and pursue topics beyond the limitations of even the best school library." The resulting survey items 9 and 10 became "Students in my classroom/classes are actively engaged in an ongoing manner using computer applications to learn beyond the confines of the school day," and, "Students in my classroom/classes are actively engaged in an ongoing manner using online technology tools to learn beyond the confines of the school day." Because the level of frequency is to be identified with regards to, "beyond the confines of the school day," one statement referred to computer applications while the other online technology tools.

In the *Collaborative* group, due to the short description for the *Collaborative-Entry* indicator, "Students primarily work alone when using technology," one survey item had to be constructed with regard to Internet tools and the other with regard to software applications. Consequently, survey item 11 reads, “Students in my classroom/classes work alone using Internet tools for comprehension,” and 12, “Students in my classroom/classes work individually using software applications to make meaning of their world.”

Regarding the *Collaborative-Adoption* indicator, because the description held enough content, it was possible to split portions of the statement. The indicator reads, “Students in my classroom/classes use communication tools like E-Mail to collaborate with others on assignments.” The resulting survey items 13 and 14 were, “Students in my classroom/classes use communication tools like E-Mail to collaborate with others on assignments,” and, “Students in my classroom/classes collaborate using digital tools to share documents and information with others on assignments.”

“Select and modify” were consistently used throughout the TIM to identify the *Adaptation* level of integration. The *Collaborative-Adaptation* indicator states, “Students have opportunities to select and modify technology tools to facilitate collaborative work.” Therefore, survey item 15 reads, “Students in my classroom/classes choose tools like chatting, blogs, or discussion forums to collaborate with others on assignments.” Survey item 16 reads, “Students in my classroom/classes configure or adapt technology tools in order to collaborate with others on assignments.”

Regarding the length of the *Collaborative-Infusion* indicator in the TIM, the statement “Throughout the day and across subject areas, students utilize technology tools to facilitate collaborative learning, ” was easily divided into two parts. The resulting survey items 17 and 18 read, “Students from my classroom/classes use technology tools to collaborate across disciplines,” and “Students from my classroom/classes use technology tools to collaborate throughout the school day." Based on these statements, if students are collaborating throughout the school day, they are likely also collaborating across disciplines.

Finally, the *Collaborative-Transformation* indicator in the TIM states, "Technology enables students to collaborate with peers and experts irrespective of time zone or physical distances." The resulting survey item 19 reads, "Students in my classroom/classes use communication tools like iChat, Skype, or instant messaging to collaborate with others within and beyond the confines of the school day," while survey item 20 reads, "Students in my classroom/classes use technology tools to post content online to collaborate with others within and beyond the confines of the school day." Here, two similar questions have been created with the key phrase of "collaborate with others within and beyond the confines of the school day," in order to measure the frequency regarding this indicator.

The TIM indicators within the third characteristic group begin with the *Constructive-Entry* indicator which states, "Technology is used to deliver information to students." Because this short description does not offer many choices, different kinds of technology capable of delivering content were used to generate survey items 21 and 22. Additionally, these items were written in a way to minimize the social desirability or the tendency to respond in a manner that seems most acceptable (Rust & Golombok, 2009). Item 21 reads, "Students in my classroom/classes experience technology through the teacher using presentation tools like PowerPoints, informative Web sites, Airliners, or SMART Board technologies." Item 22 reads, "Students in my classroom/classes experience technology through traditional instructional technologies like overhead projectors, white boards, audio players, or VHS/DVD players."

The *Constructive-Adoption* indicator in the TIM states, "Students begin to utilize constructive tools such as graphic organizers to build upon prior knowledge and construct meaning." Though the concepts of building on prior knowledge and constructing meaning work in tandem, both were written separately to form the next two survey items. Item 23 reads, "Students in my classroom/classes use technology tools to construct graphic organizers to illustrate concepts," while item 24 reads, "Students in my classroom/classes use technology tools to construct meaning based upon prior knowledge."

The statement, "Students have opportunities to select and modify technology tools to assist them in the construction of understanding," refers to the *Constructive-Adaptation* indicator in the TIM. Unlike the other indicators at the *Adaptation* level of integration, the two survey items for 25 and 26 were written in different ways, but mean basically the same. Item 25 reads, "Students in my classroom/classes construct meaning by selecting and adapting technology tools to gather information." Item 26 reads, "Students in my classroom/classes use inquiry-based technology tools to construct meaning."

The statement, "Students utilize technology to make connections and construct understanding across disciplines and throughout the day," refers to the *Constructive-Infusion* indicator in the TIM. Because this description presents two types of constructive outlets, "across disciplines" and "throughout the day," it was divided to form survey items 27 and 28. Item 27 reads, "Students from my classroom/classes use technology tools to construct meaning across several disciplines," while 28 reads, "Students from my classroom/classes use technology tools to make associations with other subject areas throughout the school day."

The *Constructive-Transformation* indicator in the TIM states, "Students use technology to construct, share, and publish knowledge to a worldwide audience." This description was divided into the act of creating or publishing and the act of sharing creations via the World Wide Web. The resulting survey items 29 and 30 read, "Students in my classroom/classes use technology tools to construct meaning through the creation of products like media, Podcasts, or electronic publications," and "Students in my classroom/classes use technology tools to construct media content for sharing with an extended or global audience via the Internet."

Within the *Authentic* grouping, the *Authentic-Entry* indicator in the TIM states, "Students use technology to complete assigned activities that are generally unrelated to real-world problems." Survey item 31 was constructed based on the authentic attribute presented in Jonassen et al. (2003). This item reads, "Students in my classroom/classes use technology tools to solve basic problems, which require only specific routines, steps, or memorization." Survey item 32 was written using much of the same language found in the indicator description, "Students in my classroom/classes use technology tools to solve problems generally unrelated to real-world situations."

The *Authentic-Adoption* indicator in the TIM states, "Students have opportunities to apply technology tools to some content-specific activities that are based on real-world problems." As in other survey item sets in the questionnaire, "technology tools" had to be presented in the form of software applications and online tools in order to form two items for this indicator. Item 33 reads, "Students in my classroom/classes use software applications to solve content-specific problems given real-world parallels," while 34 reads, "Students in my classroom/classes use online tools to apply solutions to authentic, real-world problems."

Because the description for the *Authentic-Adaptation* indicator in the TIM contains two actions—select and modify—wording from the indicator was used to generate two survey items. The indicator states, "Students have opportunities to select and modify technology tools to solve problems based on real-world issues." Based on these two actions, survey item 35 reads, "Students in my classroom/classes locate technology tools to solve real-world problems in a variety of ways," and item 36 reads, "Students in my classroom/classes adapt various technology tools to solve problems based on real-world scenarios."

The *Authentic-Infusion* indicator in the TIM states, "Students select appropriate technology tools to complete authentic tasks across disciplines." Survey item 37 uses similar wording: "Students from my classroom/classes select appropriate technology tools from several disciplines to solve real-world problems." In order to develop another item to measure the same indicator, survey item 38 was created based on a video example associated with this indicator (FCIT, 2007): "Students from my classroom/classes conduct research using appropriate technology and apply solutions to problems based on real-world situations."

In terms of the *Authentic-Transformation* indicator in the TIM, "By means of technology tools, students participate in outside-of-school projects and problem-solving activities that have meaning for the students and the community," the description was split to form two survey items. Item 39 reads, "Students in my classroom/classes use technology tools to participate in authentic, problem-solving projects outside of school." Item 40 reads, "Students in my classroom/classes use technology tools to solve real-world problems beyond the confines of the classroom that have meaning for the students or the community."

In the *Goal Directed* group, the statement, "Students receive directions, guidance, and feedback from technology, rather than using technology tools to set goals, plan activities, monitor progress, or self-evaluate," refers to the *Goal Directed-Entry* indicator in the TIM. As noted earlier, the items were written in an effort to minimize the social desirability implied in the original indicator description. Videos (FCIT, 2007) were referred to when creating these survey items. Item 41 reads, "Students in my classroom/classes receive automated feedback when using technology tools for drill and practice," and 42 reads, "Students in my classroom/classes receive differentiated feedback from computer-based training tools."

The *Goal Directed-Adoption* indicator in the TIM states, "From time to time, students have the opportunity to use technology to either plan, monitor, or evaluate an activity." This description was divided to form survey items 43 referring to the act of planning and 44 which refers to monitoring and evaluating. Item 43 reads, "Students in my classroom/classes use technology tools to create and plan educational goals," while 44 reads, "Students in my classroom/classes use technology tools to monitor and evaluate their activities."

As with other indicators at the *Adaptation* level, the verbs "select" and "modify" in the indicator description were used to form two survey items. The *Goal Directed-Adaptation* indicator in the TIM states, "Students have opportunities to select and modify the use of technology tools to facilitate goal-setting, planning, monitoring, and evaluating specific activities." Survey item 45 was written referring to the act of selection to read, "Students in my classroom/classes choose certain technology tools to assist with goal directed activities," while item 46 refers to the act of modification to read, "Students in my classroom/classes modify technology tools to meet specific requirements of goal directed activities."

The *Goal Directed-Infusion* indicator in the TIM states, "Students use technology tools to set goals, plan activities, monitor progress, and evaluate results throughout the curriculum." Emphasis on cross-curricular activities throughout the context of the school day was used to form survey items 47 and 48. Item 47 reads, "Students from my classroom/classes use appropriate software tools to manage goal directed activities throughout the school day." Item 48 reads, "Students from my classroom/classes use technology tools to manage goal directed activities across disciplines."

Finally, the statement, "Students engage in ongoing metacognative activities at a level that would be unattainable without the support of technology tools," refers to the *Goal Directed-Transformation* indicator in the TIM. Specific video examples from the TIM Web site were examined when developing survey items 49 and 50 (FCIT, 2007). Item 49 reads, "Students in my classroom/classes use technology tools like WIKIs, blogs, or forums to obtain feedback from multiple sources beyond the confines of the school day." Item 50 reads, "Students in my classroom/classes use technology tools to receive ongoing feedback for goals within and outside the contexts of the school day."

Data Collection Procedures. Upon approval by the Baker University Institutional Review Board regarding the protection of human subjects (see Appendices H and I), e-mail research requests (see Appendix J) were sent to two sets of expert panel members regarding the development of the instrument. An e-mail request was sent to district leaders and contacts in Kansas, Missouri, and Florida regarding the pilot of the instrument (see Appendix K). E-mail responses indicating approval for participating in the pilot were received from Beloit, Central Heights, DeSoto, Gardner-Edgerton, Louisburg, Spring Hill, and Turner districts in Kansas as well as technology teachers in Polk County Public Schools in Florida (See Appendix L). The largest two districts—Olathe and Lawrence—required the submittal of formal applications (See Appendix M).

E-mail was used as the medium for all correspondence with members of the expert panels and to participants in the pilot along with instructions for accessing the data collection site. Members from each of the panels as well as pilot respondents participated on a voluntary basis. Members of the pilot were assured their responses would be kept confidential in a secure database and their place of employment would be utilized solely for the purposes of sorting and aggregating data. Pilot members were also notified that by completing the questionnaire they were consenting to participate in the study and that their responses would not be linked back to them.

During the pilot stage, E-mail invitations with subsequent reminders (see Appendix N) were sent directly by the researcher to teachers in the Olathe Public Schools, Spring Hill School District and to current/former students in the MNU Graduate Studies in Education Programs. District representatives sent initial e-mail invitations with subsequent reminders from the researcher to teachers in the Lawrence Public Schools and Turner School District. All e-mail invitations and reminders were sent by district contacts to teachers at Central Heights Schools, DeSoto School District, Gardner-

Edgerton Schools, Louisburg School District, and Polk County Public Schools. Beloit teachers were invited during the last week of the TIMQ pilot. The subsequent correspondence in the form of four or five reminder e-mails over the course of the pilot served to increase the number of respondents.

Given the availability of today's online resources—in addition to the researcher's background in Web development—server-sided scripting, relational database management techniques, and Web technologies were employed to collect feedback from panel members and TIMQ responses from pilot participants. While posting the TIMQ instrument on a Web server was both convenient and provided access to participants via an Internet connection, it could have been a detriment to the development and pilot processes by allowing access to persons not associated with the study. Therefore, to preserve the originality and integrity of the instrument and its development, the researcher set up a Moodle server at http://moodle.rustymeigs.com (see Appendix D) assigning usernames and passwords to each expert panel member. Key codes were used in the final two versions (refer to Appendices E and G) of the TIMQ in order to restrict access to site visitors who had not received an invitation from the researcher.

The Moodle platform served as a collection tool on many levels. A forum was posted allowing panel members to offer suggestions, discuss ideas electronically from multiple locations and within the context of their own designated groups. A scripted form of the survey was set in a wiki for participants to make corrections and revisions to a single draft of the instrument. Furthermore, the Moodle platform allowed the researcher to view participants' online activity and input according to specific user accounts. This information was then utilized to make key revisions to the instrument.

Limitations

Lunenburg and Irby (2008) state, "limitations are factors that may have an effect on the interpretation of the findings or on the generalizability of the results" (p. 133). This study has the following limitations:

1. School districts that participated in the pilot were primarily from Kansas; therefore, the results may not be generalizable to all states.
2. Given the online nature of the reporting, there is potential that not every member gave an adequate amount of time and attention to their review of content validity.
3. Participants may answer questionnaire items in the way they believe the researcher wants them to respond; therefore, creating a potential threat to reliability analysis.

Summary

The research design for the study was presented in this chapter. The population and sample were described in terms of an expert panel, a second panel consisting of the targeted population, and the population that participated in the pilot of the TIMQ. Subgroups in the second panel were described and their different roles in determining the understandability of the TIMQ items were presented. The diverse backgrounds of pilot participants were addressed. The instrumentation was described in detail. The participants' roles in the development of the various drafts of the TIMQ was shared in addition to how data was collected. Finally, limitations were listed. The results of the study are presented in Chapter Four including descriptive statistics, content validity, internal consistency reliability, and parallel forms reliability.

CHAPTER FOUR

RESULTS

Introduction

As noted in Chapter One, this study posed four research questions concerning the development and pilot of an instrument for measuring the frequency of technology usage by teachers. The demographic attributes of the sample are addressed (i.e. type of district, subject and grade levels taught, technology availability, Internet access, and professional development) in the section on descriptive statistics. Findings from the last phase of the content validity evaluation regarding the final version of the Technology Integration Matrix Questionnaire (TIMQ) are addressed. Results from the pilot study are included from reliability tests using Cronbach's alpha for the five integration and five constructivist constructs. Results from the pilot study are presented from the parallel forms reliability tests conducted on data for each set of questions corresponding to the 25 indicators in the Technology Integration Matrix (TIM).

Descriptive Statistics

The pilot study sample (N = 498) consisted of Pre-Kindergarten through Twelfth Grade teachers in Kansas, Missouri, and Florida. The number of respondents per district is presented in Table 4. Among the ten districts participating in the study, two were urban (Polk County Schools and Turner School District), five were suburban (DeSoto School District, Gardner-Edgerton School District, Lawrence Public Schools, Olathe Public Schools, and Spring Hill School District), and three were rural (Beloit Schools, Central Heights Schools, and Louisburg School District). The designation of *MNU*

Graduate Students was given to current and former MidAmerica Nazarene University students who completed the questionnaire.

Table 4

Percent of Respondents from Participating Districts (N = 498)

District	*N*	% of Sample
Urban		
Polk County Public Schools	13	3
Turner School District	45	9
Suburban		
DeSoto School District	38	8
Gardner-Edgerton School District	12	2
Lawrence Public Schools	73	15
Olathe Public Schools	260	52
Spring Hill School District	21	4
Rural		
Beloit Schools	2	0.4
Central Heights Schools	13	3
Louisburg School District	14	3
Other		
MNU Graduate Students	7	1

The greatest number of responses came from districts where initial invitations were followed with four to five subsequent reminders. The best rates of return were from the Lawrence Public Schools and Olathe Public Schools which accounted for 333 of the respondents. The lowest rates of return were from smaller, rural districts with the exception of the Polk County Public School respondents. In this case, 21 technology teachers from this district expressed interest in participating at the invitation of an expert panel member from the Florida Department of Education.

Other descriptive statistics were calculated for the sample ($N = 498$) using Statistical Package for the Social Sciences, version 17.0. Respondents were asked to provide information according to the types of teaching in which they are involved. Data were organized into categories of *elementary*, *secondary*, and *both*. These placements were based on the school structure within each district. In the Beloit, Lawrence, Olathe, and Turner districts elementary schools consisted of grades Pre-K - 6. Secondary schools consisted of middle/junior high and senior high schools for grades 7-12. In the Central Heights, DeSoto, Louisburg, Polk County, and Spring Hill districts elementary schools consisted of grades Pre-K - 5. Secondary schools consisted of middle/junior high and senior high schools for grade 6-12. In the Gardner-Edgerton district elementary schools consisted of grades Pre-K - 4. Secondary schools consisted of middle schools and one high school for grades 5-12. Fourteen of the respondents taught subjects for both elementary and secondary within the Central Heights, Emporia, Lawrence, Louisburg, Olathe, Spring Hill, and Turner districts.

The elementary and secondary categories were further divided into subcategories of *core*, *non-core*, *special education*, *gifted*, *ELL*, and *library*. Core teachers in the elementary category consisted of those who teach all subjects including English, mathematics, reading, science, social studies, and writing. Core teachers in the secondary category included the subject areas of language arts, mathematics, reading, science, and social studies (See Table 5). Non-core teachers in the elementary category included the subject areas of art, computers, music, and physical education. Non-core teachers in the secondary category included the subject areas of art, business, computers, family and consumer science, foreign language, industrial technology, music, physical education, and other vocational studies.

Table 5

Teaching Types by Categories (N = 498)

Subject	Elementary	Secondary	Both
Core	171	144	0
Non-Core	24	68	8
Special Education	19	13	1
Gifted	9	5	3
ESL	4	1	0
Library	15	9	2
Substitute	0	1	1
Total	242	241	15

Respondents were asked the number of students they worked with on a daily basis (See Figure 8). The largest number of respondents (n = 174) reported having between 10 and 29 students daily. This group included respondents mostly in core elementary classrooms where all subjects were taught in addition to special education, gifted, and ELL groupings. The next largest number of respondents (n = 129) reported having between 100 and 139 students daily. Most of the respondents in this group included secondary teachers both core and non-core. However, several non-core elementary teachers reported working daily with between 100 and 139 students in the subject areas of art, computers, library, music, and physical education.

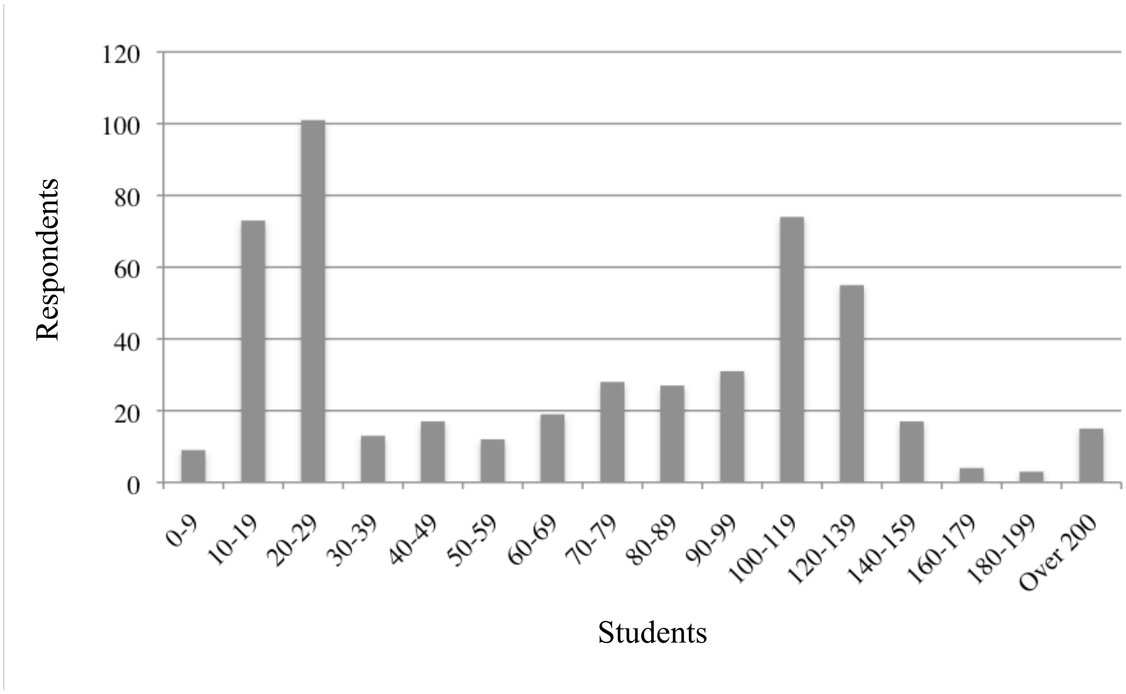

Figure 8. Number of students seen daily by respondents.

Data from the next six demographic questions were collected to determine the availability of technology and Internet connectivity. Results from this data are listed in Appendix O. Quantities of workstations and connectivity are listed in Tables O1 and O2. Both tables reveal that nearly all reported computer workstations in respondents' classrooms are connected to the Internet. Table O1 refers to specific quantities of workstation between 1 and 19. Table O2 refers to quantity sets of workstations: *20 – 24*, *25 – 29*, and *30 and Over*. In most cases, classrooms with computer workstations between 20 and over 30 were associated with librarians, business, computer, and vocational teachers. Classrooms with few or no computers typically referred to core elementary, secondary, and special education teachers.

Respondents were also asked about their monthly and daily access to computer labs both stationary and mobile. Nearly a fourth of the respondents reported having access to labs over 29 times during the month as indicated in Figure O1. Over a fourth reported having access a few times during the month to having no access at all. In terms of monthly access, over a fifth of the respondents reported no daily access to labs while another fifth reported access to labs at least once per day. One fifth reported having access to labs over seven times a day (See Figure O2).

In terms of access to instructional technology in classrooms and at the building or district level, respondents reported the greatest access to LCD projectors and DVD/VCR players. Respondents reporting no LCD projectors included most of the Turner participants and several Olathe participants. Over a third of the respondents indicated they had access to clickers, digital cameras, and document cameras at the classroom level while nearly three quarters of the respondents indicated having access to these items at the building or district levels.

The order of the questions was established by viewing the TIM from top to bottom and left to right. The researcher chose to organize the questionnaire items according to constructivist characteristic clusters while within each cluster the levels of integration represent the amount of intensity when moving from the left (lower levels) to the right (higher levels). Subsequently, the five tables below display the mean and standard deviation for each of the 50 questions according to the five constructivist clusters in the Matrix in addition to the indicator cell.

Table 6 shows the average frequency ratings (*M*) and standard deviations (*SD*) for the set of *Active* characteristic indicators. The lowest average rating (*M* = 2.19) was for the *Active-Transformation* indicator denoting that students seldom select and pursue topics beyond the confines of the best school library. The highest average rating (*M* = 3.14) was for the *Active-Adoption* indicator denoting that students begin to use technology tools to create products to a medium degree of frequency. Variability fluctuated between 1.22 and 1.52 (*SD*).

Table 6

Q1 – Q10 Item, Indicators, Means, and Standard Deviations (N = 498)

Item	Indicator Cell	*M*	*SD*
Q1	Active-Entry	2.92	1.39
Q2	Active-Entry	2.53	1.35
Q3	Active-Adoption	3.14	1.52
Q4	Active-Adoption	1.78	1.22
Q5	Active-Adaptation	2.44	1.34
Q6	Active-Adaptation	2.22	1.27
Q7	Active-Infusion	2.69	1.38
Q8	Active-Infusion	2.49	1.32
Q9	Active-Transformation	2.19	1.24
Q10	Active-Transformation	2.28	1.26

Table 7 shows the average frequency ratings (*M*) and standard deviations (*SD*) for the set of *Collaborative* characteristic indicators. The lowest average rating (*M* = 1.49) was for the *Collaborative-Transformation* indicator denoting that students seldom collaborate with peers and experts irrespective time difference and geographic boundaries. The highest average rating (*M* = 2.66) was for the *Collaborative-Entry* indicator denoting that to a medium degree of frequency students primarily work alone. Variability fluctuated between 1.01 and 1.34 (*SD*).

Table 7

Q11 – Q20 Items, Indicators, Means, and Standard Deviations (N = 498)

Item	Indicator Cell	*M*	*SD*
Q11	Collaborative-Entry	2.66	1.34
Q12	Collaborative-Entry	2.46	1.33
Q13	Collaborative-Adoption	2.00	1.32
Q14	Collaborative-Adoption	2.08	1.29
Q15	Collaborative-Adaptation	1.59	1.06
Q16	Collaborative-Adaptation	1.96	1.21
Q17	Collaborative-Infusion	2.20	1.26
Q18	Collaborative-Infusion	1.92	1.19
Q19	Collaborative-Transformation	1.49	1.01
Q20	Collaborative-Transformation	1.70	1.13

Table 8 shows the average frequency ratings (*M*) and standard deviations (*SD*) for the set of *Constructive* characteristic indicators. The lowest average rating (*M* = 1.69) was for the *Constructive-Transformation* indicator denoting that students rarely construct, publish, and share with global audiences. The highest average rating (*M* = 3.98) was for the *Constructive-Entry* indicator denoting that technology is frequently used to deliver information to students. The amount of variability fluctuated between 1.12 and 1.28 (*SD*).

Table 8

Q21 – Q30 Items, Indicators, Means, and Standard Deviations (N = 498)

Item	Indicator Cell	*M*	*SD*
Q21	Constructive-Entry	3.98	1.28
Q22	Constructive-Entry	3.94	1.18
Q23	Constructive-Adoption	2.35	1.23
Q24	Constructive-Adoption	2.50	1.26
Q25	Constructive-Adaptation	2.39	1.26
Q26	Constructive-Adaptation	2.16	1.23
Q27	Constructive-Infusion	2.21	1.21
Q28	Constructive-Infusion	2.41	1.25
Q29	Constructive-Transformation	1.90	1.27
Q30	Constructive-Transformation	1.69	1.12

Table 9 shows the average frequency ratings (*M*) and standard deviations (*SD*) for the set of *Authentic* characteristic indicators. The lowest average rating (*M* = 1.96) was for the *Authentic-Transformation* indicator denoting that students seldom participate in projects outside of school involving problem solving and having meaning for the greater community. The highest average ratings (*M* = 2.45) were found for two indicators. The *Authentic-Entry* indicator denoted that technology is used by students to complete tasks in a manner unrelated to real-world situations at a medium level of frequency. The *Authentic-Infusion* indicator denoted students select tools to complete real-world task across disciplines at a medium level of frequency. The amount of variability fluctuated between 1.17 and 1.32 (*SD*).

Table 9

Q31 – Q40 Items, Indicators, Means, and Standard Deviations (N = 498)

Item	Indicator Cell	*M*	*SD*
Q31	Authentic-Entry	2.46	1.27
Q32	Authentic-Entry	2.23	1.23
Q33	Authentic-Adoption	2.21	1.27
Q34	Authentic-Adoption	2.23	1.25
Q35	Authentic-Adaptation	2.19	1.24
Q36	Authentic-Adaptation	2.10	1.24
Q37	Authentic-Infusion	2.09	1.19
Q38	Authentic-Infusion	2.46	1.32
Q39	Authentic-Transformation	1.96	1.17
Q40	Authentic-Transformation	2.34	1.28

Table 10 shows the average frequency ratings (*M*) and standard deviations (*SD*) for the set of *Goal Directed* characteristic indicators. The lowest average rating (*M* = 1.61) was for the *Goal Directed-Transformation* indicator denoting that students rarely take part in metacognative activities dependent upon technology tools and resources. The highest average rating (*M* = 2.59) was found for the *Goal Directed-Entry* indicator denoting that students receive basic feedback about learning from technology tools at a level of medium frequency. The fluctuation of variability was between 1.08 and 1.37 (*SD*).

Table 10

Q41 – Q50 Items, Indicators, Means, and Standard Deviations (N = 498)

Item	Indicator Cell	*M*	*SD*
Q41	Goal Directed-Entry	2.59	1.37
Q42	Goal Directed-Entry	2.24	1.24
Q43	Goal Directed-Adoption	1.90	1.17
Q44	Goal Directed-Adoption	2.53	1.32
Q45	Goal Directed-Adaptation	2.34	1.30
Q46	Goal Directed-Adaptation	2.22	1.31
Q47	Goal Directed-Infusion	2.11	1.28
Q48	Goal Directed-Infusion	2.15	1.25
Q49	Goal Directed-Transformation	1.61	1.08
Q50	Goal Directed-Transformation	1.92	1.20

Overall, these findings appear to indicate little to medium frequency levels of usage for most of the activities described by the 25 indicators in the matrix. The highest average ratings—out of all the ratings—regarding the *Constructive-Entry* indicator suggests that technology is commonly used to deliver instruction to students. With the average ratings for the other 24 indicators showing low to medium levels of frequency, these data seem to corroborate Cuban's belief that a small percentage of teachers incorporate technology into instruction (Hargadan, 2006).

Content Validity

The last evaluation by the expert panel regarding the content validity of the final version of the TIMQ answered the first research question, "What evidence supports the content validity of items in the Technology Integration Matrix Questionnaire?" Because the methodology in Chapter Three focused on the development and pilot of the TIMQ, it was necessary at that time to conduct content validity evaluations from expert panel members in addition to obtaining feedback with regard to second panel members' understanding of each survey item.

Members from the first panel (*n* = 12) were asked to provide validity feedback on this final revision of the instrument via the researcher's Moodle site within the context of a database activity (see Appendix P). This activity provided panel members with 50 dichotomous questions regarding the accuracy and completeness of each measure: Q1 through Q50. "Textarea" components were provided to obtain typed feedback in case additional comments were warranted for each item in the questionnaire. Five sets of ten questions were grouped according to the constructivist characteristics and color-coded for panel members to locate easily as shown in Figure 9.

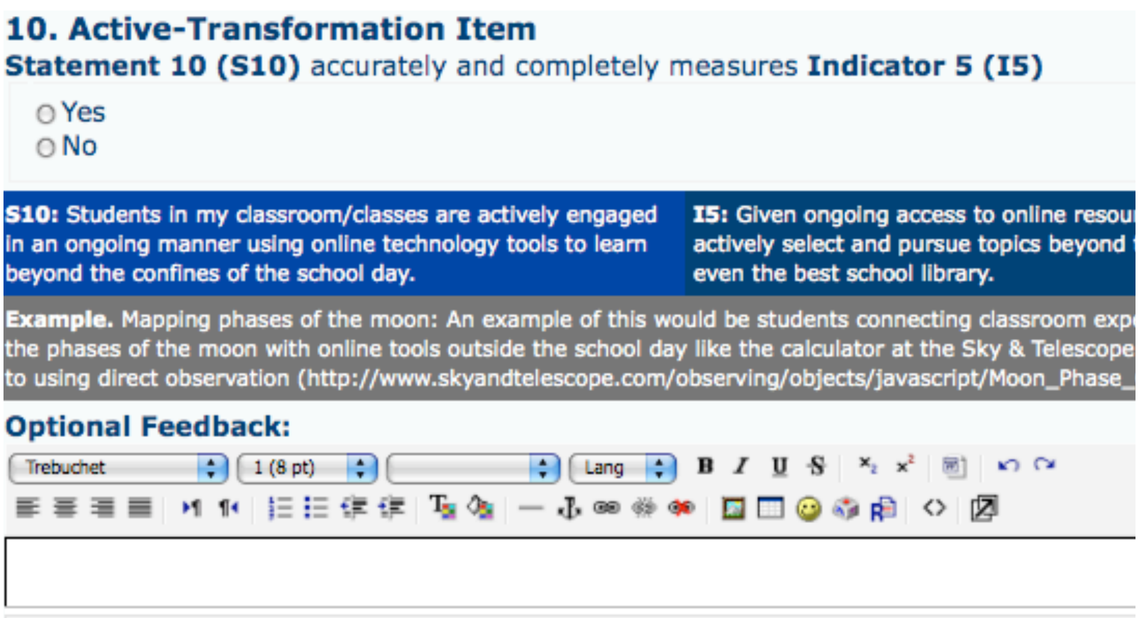

Figure 9. Dichotomous validity questions and "textarea" feedback components.

The feedback was obtained during mid-February to early March of 2010 from five of the twelve members who had participated in the initial development of the TIMQ in April 2009. Four responded, "Yes" to all 50 questions. From among these, one member noted that the example associated with the "4. Active-Adoption Item" needed to be rewritten, as it appeared to be missing words. A second member suggested rewording *Statement 21* while third and fourth members did not provide comments for any of the 50 items. A fifth member only answered "No" to *Statement 7* and *Statement 8* because these items portrayed students 'using" technology, but not "selecting" technology. Based on this evaluative feedback, all of the TIMQ items appear to be highly valid measures of the 25 indicators in the TIM.

Internal Consistency Reliability

The first battery of reliability tests was performed on the distinct constructs found in the TIM. Though the TIM is a multidimensional model, items were divided into single dimension sets first based on integration levels and then based on constructivist characteristics with subsequent testing for internal consistency reliability using Cronbach's alpha. According to Howitt & Cramer (2005), reliability coefficients of $\alpha \geq 0.80$ are considered acceptable.

Represented by the columns in the TIM model, the five constructs related to levels of technology integration included *Entry*, *Adoption*, *Adaptation*, *Infusion*, and *Transformation*. Because the matrix encompasses each of these levels according to five constructivist characteristics and because the researcher wrote two items to measure each cell denoted by the intersection of the integration levels and constructivist characteristics, each of the five constructs contained ten items. The other five constructs consisted of the characteristics of the learning environment including *Active*, *Collaborative*, *Constructive*, *Authentic*, and *Goal Directed* as represented by the rows in the TIM model. Each of the constructs (five characteristics and five integration levels) was measured by 10 items.

The second research question addressed the five integration constructs, "What do the Cronbach's alpha coefficients imply concerning the reliability of the integration level constructs in the Technology Integration Matrix Questionnaire?" All of the alphas used to address this question were above the acceptable coefficient 0.80. In fact, four of the five constructs appeared to be very reliable with coefficients greater than 0.90. Table 11 shows the coefficients generated for each construct in addition to the questionnaire items contained in the construct set. The *Entry* level items reliably measured the construct as exhibited by the coefficient's strength of $\alpha = 0.83$. The *Adoption* level items reliably measured the construct as exhibited by the coefficient's strength of $\alpha = 0.90$. The *Adaptation* level items reliably measured the construct as exhibited by the coefficient's strength of $\alpha = 0.93$. The *Infusion* level items reliably measured the construct as exhibited by the coefficient's strength of $\alpha = 0.93$. The *Transformation* level items reliably measured the construct as exhibited by the coefficient's strength of $\alpha = 0.91$.

Table 11

Integration Construct Correlations (N = 498)

Construct	Items	α
Entry	Q1, Q2, Q11, Q12, Q21, Q22, Q31, Q32, Q41, Q42	0.83
Adoption	Q3, Q4, Q13, Q14, Q23, Q24, Q33, Q34, Q43, Q44	0.90
Adaptation	Q5, Q6, Q15, Q16, Q25, Q26, Q35, Q36, Q45, Q46	0.93
Infusion	Q7, Q8, Q17, Q18, Q27, Q28, Q37, Q38, Q47, Q48	0.93
Transformation	Q9, Q10, Q19, Q20, Q29, Q30, Q39, Q40, Q49, Q50	0.91

The third research question addressed the five constructivist constructs, “What do the Cronbach’s alpha coefficients imply concerning the reliability of the constructivist characteristic constructs in the Technology Integration Matrix Questionnaire?” All of the alphas used to address this question were above the acceptable coefficient 0.80. Two out of the five constructs appeared to be very reliable with coefficients greater than 0.90. Table 12 shows the coefficients generated for each construct in addition to the questionnaire items contained in the construct set. The *Active* characteristic items reliably measured the construct as exhibited by the coefficient’s strength of $\alpha = 0.88$. The *Collaborative* characteristic items reliably measured the construct as exhibited by the coefficient’s strength of $\alpha = 0.91$. The *Constructive* characteristic items reliably measured the construct as exhibited by the coefficient’s strength of $\alpha = 0.86$. The *Authentic* characteristic items reliably measured the construct as exhibited by the coefficient’s strength of $\alpha = 0.93$. The *Goal Directed* characteristic items reliably measured the construct as exhibited by the coefficient’s strength of $\alpha = 0.89$.

Table 12

Constructivist Characteristic Construct Correlations (N = 498)

Construct	Items	α
Active	Q1 - Q10	0.88
Collaborative	Q11 – Q20	0.91
Constructive	Q21 - Q30	0.86
Authentic	Q31 - Q40	0.93
Goal Directed	Q41 - Q50	0.89

In addition to the alpha coefficients SPSS generated an inter-item correlation matrix for each of the five constructivist characteristic constructs and each of the five integration level constructs. An inter-item correlation indicates the strength of the relationship between each pair of items within a construct. If all of the items correlate with one another at a significant level, they are considered to be measuring the same underlying construct (Coaley, 2010). For the *Constructive* construct items Q23 through Q30 the inter-item correlations ranged from 0.404 to 0.638 indicating moderately strong relationships. However, the inter-item correlations between Q21 (*Students in my classroom/classes experience technology through the teacher using presentation tools like PowerPoints, informative Web sites, Airliners, or SMART Board technologies.*) and Q22 (*Students in my classroom/classes experience technology through traditional instructional technologies like overhead projectors, white boards, audio players, or VHS/DVD players.*) and the rest of the items ranged from -0.008 and 0.283 indicating weak relationships. These two items measured Indicator 11 (*Technology is used to deliver information to students.*) in the TIM. The inter-item correlation matrices for all integration level constructs and constructivist characteristics constructs are attached in Appendix Q, Tables Q1 through Q10.

Parallel Forms Reliability

Six configurations of parallel forms were constructed to obtain the second series of reliability calculations addressed in the fourth research question, "What do the parallel forms tests indicate regarding the reliability of the question sets measuring each indicator in the Technology Integration Matrix?" Because two items were written to measure each indicator in the TIM, these items were divided into parallel forms A and B. In the first configuration form A1 consisted of odd numbered items while the second form B1 consisted of even numbered items. To generate additional configurations for testing, column numbers 1 and 2 were randomly generated using the Excel RANDBETWEEN function for each indicator row in the A form column. The B column items were then filled in with the remaining item for each indicator row. Table 13 illustrates how the configurations for forms A3 and B3 were generated given the number of total rows for each form (25). The other four configurations of forms (A2/B2, A4/B4, A5/B5, and A6/B6) were assembled in a similar manner as seen in Table R1 and Table R2.

Table 13

Parallel Forms Configuration Example, Form A3/B3 (N = 498)

	Random Item	Remaining Item	Form	
Indicator	Column A	Column B	A3	B3
I1	2	1	Q2	Q1
I2	1	2	Q3	Q4
I3	2	1	Q6	Q5
I4	2	1	Q8	Q7
I5	1	2	Q9	Q10
I6	1	2	Q11	Q12
I7	2	1	Q14	Q13
I8	1	2	Q15	Q16
I9	2	1	Q18	Q17
I10	1	2	Q19	Q20

A Pearson correlation was generated to compare the parallel forms of the six A/B configurations. The correlation coefficient that was calculated between the forms A1 and B1 was statistically significant ($r_{A1\bullet B1} = 0.96$). The correlation coefficient that was calculated between the forms A2 and B2 was statistically significant ($r_{A2\bullet B2} = 0.96$). The correlation coefficient that was calculated between the forms A3 and B3 was statistically significant ($r_{A3\bullet B3} = 0.97$). The correlation coefficient that was calculated between the forms A4 and B4 was statistically significant ($r_{A4\bullet B4} = 0.96$). The correlation coefficient that was calculated between the forms A5 and B5 was statistically significant ($r_{A5\bullet B5} = 0.96$). Lastly, the correlation coefficient that was calculated between the forms A6 and B6 was statistically significant ($r_{A6\bullet B6} = 0.96$). All six configurations of parallel forms resulted in coefficients well above the established level of acceptability 0.80 (Howitt & Cramer, 2005) indicating very strong relationships between the forms. Furthermore, the two items measuring each of the indicators appear to be measuring the same underlying constructivist characteristic and integration level.

Summary

This chapter presented the descriptive statistics for the sample, the four research questions in conjunction with the results of the analyses of content validity, internal consistency reliability, and parallel forms reliability. An expert panel established the final phase of content validity acknowledging that each of the questionnaire items accurately and completely measures TIM indicators. Cronbach's alphas were used to test the TIM constructs for internal consistency reliability. Finally, Pearson correlations established parallel forms reliability. The interpretation of this data is presented along with major findings, implications for action, and recommendations for future research in Chapter Five.

CHAPTER FIVE

INTERPRETATION AND RECOMMENDATIONS

Introduction

In order to increase the frequency and levels of technology integration in schools and districts, leaders need an instrument to assess individual teacher practice. Once a profile has been established, school and district leaders will be able to collaborate with teachers to recommend professional development. Likewise, teachers will be able to reflect on their individual practice, become aware of ways they can increase the level of technology integration, and facilitate increased student engagement. Included in this chapter is an overview of the problem, the purpose of the study, the restatement of the research questions, and a review of the methodology. Additionally, the chapter includes the major findings, findings related to the literature, implications for action, recommendations for further research, and concluding remarks.

Study Summary

Overview of the Problem

The two dimensional Technology Integration Matrix (TIM) currently classifies educational technology usage in terms of levels of integration coupled with constructivist characteristics found in learning environments (FCIT, 2007). According to Roy Winkelman, while the Matrix is helpful when prescribing professional development from a building perspective, an instrument for measuring each of the indicators in the TIM could be useful in pinpointing technology usage practices of individual teachers (Personal communication, January 3, 2009). Having a profile that describes an individual's teaching practices regarding levels of integration and constructivist characteristics would allow a school leader to collaborate with a teacher in determining future professional development.

Purpose Statement and Research Questions

The purpose of this study was to develop and pilot a valid and reliable survey instrument for measuring the frequency of technology usage in classrooms according to levels of integration and constructivist environments. The TIMQ instrument is the first of its kind designed to measure levels of integration in tandem with characteristics of the learning environment as found within the 25 indicators of the TIM. In order to develop such an instrument, it was necessary to establish the instrument's content validity and reliability. Four research questions were developed to support this outcome:

1. What evidence supports the content validity of items in the Technology Integration Matrix Questionnaire?
2. What do the Cronbach's alpha coefficients imply concerning the reliability of the integration level constructs in the Technology Integration Matrix Questionnaire?
3. What do the Cronbach's alpha coefficients imply concerning the reliability of the constructivist characteristic constructs in the Technology Integration Matrix Questionnaire?
4. What do the parallel forms tests indicate regarding the reliability of the question sets measuring each indicator in the Technology Integration Matrix?

Review of the Methodology

The methodology included three phases of data collection from panelists and pilot respondents relating to the development of the TIMQ. The first phase consisted of feedback from expert panel members (TIM developers and Kansas technology experts) regarding the initial drafts of the questionnaire. This feedback was necessary to establish the validity of the TIMQ statements' measurement of each of the 25 indicators and determine the direction for continued development of the questionnaire. The second phase collected feedback from two subgroups regarding the understandability of each statement and the examples associated with each statement. The first subgroup (select Olathe teachers) provided feedback for each of the questionnaire items that led to revisions of the third draft of the TIMQ. The second subgroup (ESOL teacher candidates) provided feedback to reinforce draft changes. The third phase involved the pilot of the final version of the TIMQ. This draft of the TIMQ consisted of twelve demographic questions and 50 questionnaire items relating to the matrix indicators.

Major Findings

The major findings included here present the effective collaboration among original developers of the TIM, local technology experts, and the researcher to establish content validity. Statistical analysis included the use of Cronbach's alpha correlations and parallel test form correlations to establish internal consistency reliability.

Content Validity. Because the purpose behind the development of the TIMQ was to measure each of the indicators listed in the matrix, gathering input from the original developers of the TIM in addition to insight from local technology experts was critical to establishing content validity. Additionally, other technology experts provided wording considerations, grammatical corrections, criticism of questionnaire items regarding each item's effectiveness in measuring the indicators, and criticism as to whether or not the accompanying examples reflected questionnaire items.

Drafts of the instrument were consistently checked during each phase of the study regarding its content. After the pilot phase ended in February 2010, members of the expert panel were asked once again to provide feedback regarding the validity of the final version of the TIMQ's 50 questionnaire items in measuring the 25 TIM indicators. Five out of the original set of panel members (n = 12) were willing to participate. The number of "Yes" responses provided by these participants was nearly unanimous that each of the 50 items does accurately and completely measure the corresponding indicators. The only "No" responses were for items Q7 and Q8 where one panel member—an original developer of the TIM—felt the statements did not reflect the word "select" from Indicator 4 (I4). Here, students are cited as "using" technology rather than actively making choices regarding the types of technology they will use. Another panel member suggested replacing the word "experience" with "received instruction" for Q21.

With the exception of these minor wording modifications for three of the items and some of the accompanying examples, these results support the assertion that the 50 TIMQ items are adequate and highly valid measures of the indicators found in the matrix. Therefore, these findings serve as evidence to support the content validity of items in the TIMQ as posed by the Research Question 1.

Total Items Analysis Reliability. In order to prescribe individual technology professional development for teachers on an individual basis, a reliable instrument was needed to effectively gauge classroom practices in relation to the indicators in the matrix.

Furthermore, it needed to be relevant for use with diverse Pre-K - 12 teaching populations. Given the size of the sample (N = 498) with varied teaching assignments, grade levels, and classroom environments, establishing the reliability of the TIMQ would render it a viable tool for assessing educational technology practices in any Pre-K - 12 setting.

Because of the two-dimensional structure of the TIM, with each dimension containing five constructs, a set of ten tests of Cronbach's alpha were performed on the data. The first set of coefficients was generated for the integration level constructs as identified by the columns in the matrix: *Entry*, *Adoption*, *Adaptation*, *Infusion*, and *Invention*. All resulting coefficients were well above the established standard. The alphas for these constructs showed the measures for this dimension of the TIM to be highly reliable. This provided an answer to the query posed by the second research question regarding the implications of the resulting coefficients for the reliability of the TIMQ. While it was discovered that weak inter-item correlations existed between items Q21 and Q22 and the rest of the *Constructive* characteristic construct items (Q23 – Q30), other item pairs within the construct showed moderately strong positive relationships. One possible explanation is that Q21 and Q22 refer to the *Entry* level of the construct where the corresponding indicator in the TIM reads, "Technology is used to deliver information to students." Rather than referring to the presence of a *Constructive* characteristic, this indicator refers to its absence.

The second set of coefficients was generated for the constructivist characteristic constructs as identified by the rows in the matrix: *Active*, *Collaborative*, *Constructive*, *Authentic*, and *Goal Directed*. Once again, the resulting coefficients for these constructs were well above the established standard showing the measures for this dimension of the TIM to be highly reliable. This provided an answer to the query posed by the third research question regarding the implications of the resulting coefficients for the reliability of the TIMQ.

Parallel Forms Analysis Reliability. The final analysis performed on data from the pilot consisted of parallel forms reliability tests. Because the TIMQ's structure contained two items for measuring each indicator, the questionnaire was divided into six configurations of parallel forms. In the first configuration Form A addressed the odd numbered items while the second form B addressed the even numbered items. For the remaining five configurations the items remained associated with their indicators while being randomly shifted between columns A and B in order to present new configurations for conducting analyses. The Pearson product-moment calculations showed the six coefficients for six separate comparisons of the A and B 25 item forms, the two items per indicator appeared to reliably measure the 25 indicators resulting in a near perfect correlation. The parallel forms analyses reinforced the reliability of the measurement of the TIM indicators by each of the two TIMQ items.

Findings Related to the Literature

The design of the matrix model implies that teachers and students are involved with the integration of technology through five distinct stages or levels: *Entry*, *Adoption*, *Adaptation*, *Infusion*, and *Invention.* This involvement is defined by a natural progression from the basic *Entry* stage to the advanced *Invention* stage. The TIM design also implies that meaningful learning occurs in environments where *Active*, *Collaborative*, *Constructive*, *Authentic*, and *Goal Directed* characteristics are present.

FCIT researchers fused both the concept of levels of integration level with the characteristics found in constructivist environments as a way to show teaching practices involving technology usage (FCIT, 2007).

In alignment with constructivist thought, the TIM deemphasizes the actions of teachers and instruction while emphasizing the involvement of students in their own learning and the construction of meaning. In other words, the matrix model is considered a student-centered framework versus a teacher-centered instructional tool. As a result, this student-centered approach was incorporated into the language of the TIMQ, "Students in my class/classroom…" Findings from the literature revealed that a common instrument, known as LoTi, is used to diagnose levels of integration within educational practices. While the instrument is thought to be student-centered, Stager (2008) concludes the language used is mostly teacher-centered. The TIMQ, on the other hand, was developed to maintain the student-centered focus of the TIM.

The TIMQ was designed in an effort to gauge teacher technology usage. The Director of the FCIT—where the TIM was created—noted that an instrument to measure educational technology practices of individual teachers could be useful in prescribing professional development (R. Winkelman, personal communication, January 3, 2009). As an expert panel member in the beginning phase of the study, Winkelman stated that it was possible to obtain a profile of where a teacher fell on the matrix, yet difficult to pinpoint the exact nature of this profile with regards to professional development needs. As a result, the usefulness of the TIM in prescribing professional development was at the building or organizational level (R. Winkelman, personal communication, January 3, 2009).

Conclusions

Implications for Action

Based upon the results of this study, there are four areas in which there are implications for action. Those areas are revisions to the TIMQ, review of the TIM, use of the TIMQ in school districts, and use of the TIMQ in higher education.

Items Q7 (*Students from my classroom/classes are actively engaged using technology software and hardware tools throughout the school day.*) and Q8 (*Students in my classroom/classes are actively engaged using online technology tools throughout the school day.*) are recommended for minor modifications because it was perceived that students were "using" technology rather than both "using" and "selecting" technology. These revisions would reflect the wording of Indicator 4 (*Throughout the school day, students are empowered to select appropriate technology tools and actively apply them to the tasks at hand.*) in the TIM. The wording for Q21 (*Students in my classroom/classes experience technology through the teacher using presentation tools like PowerPoints, informative Web sites, Airliners, or SMART Board technologies.*) needs revising to say "received instruction" instead of "experience". Other minor modifications include some possible additions of examples as well as rewording for clarity.

The findings indicate that the Florida Center for Instructional Technology should consider reviewing the indicators for the *Entry* levels in the TIM. For example, Indicator 11 (*Technology is used to deliver information to students.*) should be reviewed because of the absence of the *Constructive* characteristic for the *Entry* level of integration.

Other actions warranted by the findings include the use of the TIMQ as a tool to gauge practices in local school districts. Districts encourage teaching practices that incorporate technology into instruction, yet many may be uncertain as to where to begin or not be equipped with staff to facilitate such activities. However, use of the TIMQ as an assessment tool goes beyond initial proficiency skills and into deeper kinds of learning. Because the matrix describes activities ranging from basic to complex within constructivist settings, results from completing the TIMQ can provide teachers with a glimpse of their current practices while giving district leaders direction with regard to professional development.

With the push for undergraduate teacher education programs to adequately prepare teachers with the skills for incorporating technology into instruction, the TIMQ could be used by practicum supervisors to assess students in the field. Additionally, there are implications regarding higher education. The TIMQ could be of benefit to graduate programs in education which include a technology component or have a complete emphasis on educational technology. The TIMQ could be used by program coordinators to determine if there is a difference in candidates' practices at the beginning of the program and the end of the program.

Recommendations for Future Research

After minor revisions are made to the TIMQ, the instrument could not only serve as a tool for measuring teacher technology usage practices, but also as an instrument for future studies involving the integrative levels and constructivist characteristics of the TIM. Future studies could explore relationships such as the one between technology access/Internet connectivity and the frequency of integrative activities in the classroom as presented in the TIM.

Another possibility is the development of two forms of the TIMQ. The questions would not change; however, the examples associated with each question would be different. One would include only examples appropriate for teachers at the secondary level. The other would include only examples at the elementary level.

While the current version of the TIMQ reveals the level of frequency for each of the indicators in the TIM, a method could be developed to provide specific feedback to teachers regarding individual integrative practices. For instance, overall scores could be generated for each of the five constructivist constructs and the five integration constructs. These scores could then be used to develop a profile highlighting teacher strengths as well as areas for improvement. As an extension to the current interactive nature of the TIMQ, a mechanism could be constructed to offer recommendations for this improvement. Such a version could provide respondents with tangible feedback including suggested training or professional development opportunities designed to encourage movement on to higher levels of integration.

While the pilot yielded statistically interesting data regarding the demographic portion of the TIMQ and how teachers responded to the 50 items that measure matrix indicators, future studies could focus on how a teacher's experience and working environment contribute to technology usage practices. For example, do teachers in rural areas with less technology tend to integrate technology within their classrooms at lower levels?

Since the beginning of this study the researcher has learned of recent developments from the FCIT regarding the TIM. Within the past year, researchers have developed a three-tiered system of indicators. One tier is from the perspective of the student, a second is from the perspective of the teacher, and the third relates the descriptors of the learning environment. Additionally, instruments now exist to measure the initial comfort levels of teachers with technology, basic technology skills/proficiencies, and perceptions. Their approach, according to Winkelman (Personal communication, March 16, 2010), has been to investigate multiple measures by triangulating the data in order to prescribe professional development. The TIMQ could be added to this set of instruments as an additional means for triangulating the data regarding the frequency of constructivist and integrative activities outlined in the TIM.

Concluding Remarks

The focus of this study was on the development and pilot of the TIMQ instrument. Four research questions formed the foundation for this endeavor having to do with content validity, reliability of integration level constructs, reliability of constructivist constructs, and parallel forms reliability. Through the efforts of an expert panel and a panel comprised of the targeted education population, the instrument was established as valid. Statistical tests of Cronbach's alpha were used to discover that the TIMQ items within the integration level constructs and the constructivist characteristic constructs are highly reliable. Finally, the analyses of multiple configurations of parallel forms of the instrument showed that each of the pairs of items reliably measured the corresponding indicators. Overall, the TIMQ was found to be a highly valid and reliable instrument for measuring constructivist activities involving the incorporation of technology into classroom settings. It fills a niche that does not currently have measurement tools for assessing levels of integration according to constructivist characteristics.

Works Cited

Anderson, L. W., & Krathwohl, D. R. (Eds.) (2001). *A taxonomy for learning, teaching, and assessing. A revision of Bloom's taxonomy of educational objectives*. New York, Longman.

Becker, H. J. (1985). *How schools use microcomputers: Summary of a 1983 national survey*. (ERIC Document Reproduction Service No. ED 257448)

Black, J. (Narrator). (2009) Introductory podcast to the inventory of teacher technology skills (MP4 recording). *Florida Innovates*. Podcast retrieved March 27, 2010 from <http://www.flinnovates.org/docs/ittsIntroPodcast.mp4>.

Bloom, B. S., Englehart, M. B., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (Eds.). (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain*. New York: McKay.

Brumfield, R. (2006, June, 06). Teacher development key to tech success. *eSchool News*, Retrieved March 8, 2007, from http://www.eschoolnews.com/news/showStory.cfm? ArticleID=6450.

Carmines, E. G. & Zeller, R. A. (1991). *Reliability and validity assessment*. Newbury Park: Sage Publications.

Churches, A. (2009, January 4). *Bloom's digital taxonomy: It's not about the tools, it's using the tools to facilitate learning.* Retrieved January 27, 2009 from http://edorigami.wikispaces.com/file/view/bloom%27s+Digital+taxonomy+v3.01.pdf.

Coaley, J, (2010). *An introduction to psychological assessment and psychometrics*. Thousand Oaks, CA: Sage Publications.

Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior, 11*, 671-684.

Cuban, L. (2001). *Oversold and underused: Computers in the classroom.* Cambridge, MA: Harvard University Press.

Dias, L. B. (1999).Integrating technology: Some things you should know. *Learning & Leading with Technology*. *27*(3), 10-21.

Driscoll, M. P. (1994). *Psychology of learning for instruction*. Boston: Allyn and Bacon.

Dwyer, D. C., Ringstaff, C., & Sandholtz, J. H. (1992). The evolution of teachers' instructional beliefs and practices in high access-to-technology classrooms, first–fourth year findings. Cupertino, CA: Apple Classrooms of Tomorrow.

FCIT. (2007). *Technology integration matrix*. Retrieved December 16, 2008, from http://fcit.usf.edu/matrix.

Forehand, M. (2005). *Bloom's taxonomy: Original and revised*. In M. Orey (Ed.), Emerging perspectives on learning, teaching, and technology. Retrieved December 19, 2009, from http://projects.coe.uga.edu/epltt.

Fowler, F. J. (1995). *Improving survey questions: Design and Evaluation*. Thousand Oaks, CA: Sage Publications.

Fowler, F. J. (2009). *Survey research methods* (4th ed.). Thousand Oaks, CA: Sage Publications.

Frary, R. B. (1996). *Brief guide to questionnaire development*. Washington, DC: ERIC Clearinghouse on Assessment and Evaluation (30 pages).

Gardner, H. (1999). *Intelligence reframed: Multiple intelligences for the 21st century*. New York: Basic Books.

Gall, J. P., Gall, M. D., & Borg, W. R. (2005). *Applying educational research: A practical guide,* (5th ed.). Boston: Pearson Education, Inc.

Getting an “A” on your report card: Maximize your tech investment. (2009, December 10) Retrieved December 23, 2009 from the *eSchool News* Web Site: http://www.eschoolnews.com/emails/eSN/121009ResourceCenter.htm

Hall, G. E., Loucks, S. F., Rutherford, W. L ., & Newlove, B. W. (1975). Levels of use of the innovation: A framework for analyzing innovation adoption. *Journal of Teacher Education, 26*(1), 52–56.

Hargadan, S. (Interviewer). (2006, September 7) Audio Webcast interview: Larry Cuban, author of "Oversold and Underused" (MP3 recording). *EdTechLive*. Podcast retrieved from <http://edtechlive.wikispaces.com/Recordings+List>.

840.

Hargadan, S. (Interviewer). (2006, September 27). Audio Webcast interview: David Thornburg, author of "Free and Open Source Software in Education" (MP3 recording). *EdTechLive*. Podcast retrieved from <http://audio.edtechlive.com/k12opensource1.mp3>.

Hollingdale, R. J. (Ed.). (1996). *Human, all too human: A book for free spirits.* Cambridge: University Press.

Howitt, D., & Cramer, D. (2005). *Introduction to research methods in psychology*. Essex, UK: Pearson.

Iran-Nejad, A., Marsh, G. E., & Clements, A. C. (1992). The figure and ground of constructive brain functioning: Beyond explicit memory processes. *Educational Psychologist, 27*, 473-492.

ISTE. (2009). *National educational technology standards*. Retrieved March 27, 2010, from http://fcit.usf.edu/matrix.

Jonassen, D. H., Howland, J., Moore, J, & Marra, R. M. (2003). *Learning to solve problems with technology: A constructivist perspective,* (2nd ed.). Upper Saddle River, New Jersey: Prentice-Hall.

Krathwohl, D. R. (2002). A revision of bloom's taxonomy: An overview. *Theory into Practice, 41* (4), 212-218.

Lever-Duffy, J., & McDonald, J. B. (2008). *Teaching and learning with technology* (3rd ed.). Boston: Pearson.

Marzano, R. J. (2000). *Designing a new taxonomy of educational objectives.* Thousand Oaks, CA: Corwin Press.

Marzano, R. J., & Kendall, J. S. (2007). *The new taxonomy of educational objectives* (2nd ed.). Thousand Oaks, CA: Corwin.

Merriam-Webster. (2010). *Merriam-Webster OnLine*. Retrieved March 27, 2010, from http://www.merriam-webster.com.

Moersh, C. (1995). Levels of technology implementation framework. *Learning & Leading with Technology. 23*. (3), 40-42.

Nassar-McMillan, S. C., & Borders, L. D. (2002). *Use of focus groups in survey item development*. The Qualitative Report, 7 (1). Retrieved February 26, 2009, from http://www.nova.edu/ssss/QR/QR7-1/index.html.

NCLB. (2001). *No Child Left Behind Act of 2001* (Public Law 107-110). Retrieved February 2, 2010, from http://www2.ed.gov/policy/elsec/leg/esea02/107-110.pdf

NSDC. (2010). *National Staff Development Web site*. Retrieved March 27, 2010, from http://www.nsdc.org/standfor/beliefs.cfm.

O'Neill, G. (2007, November 20). *Likert scale and surveys: Best practices*. Retrieved June 27, 2009, from http://intelligentmeasurement.wordpress.com/2007/11/20/likert-scale-surveys-best-practices.

Osgood, C.E., Suci, G.J., & Tannenbaum, P.H. (1957). *The measurement of meaning.* Urbana, USA: University of Illinois Press.

Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books.

Pitler, H., Hubbell, E., Kuhn, M., & Malenoski, K. (2007). *Using technology with classroom instruction that works*. Alexandria, VA: ASCD.

Punch, K. F. (2003). *Survey research: the basics.* London: Sage Publications Ltd.

Recesso, A., & Orrill, C. (2008). *Integrating technology into teaching: The technology & learning continuum.* Boston: Houghton Mifflin.

Roberts, C. M. (2004). *The dissertation journey*. Thousand Oaks, CA: Corwin Press.

Rust, J. & Golombok, S. (2009) *Modern psychometrics* (3rd Edition). London: Routledge.

Salkind, N. J. (2006). *Tests and measurements for people who think they hate tests and measurement*. Thousands Oaks, CA: Sage Publications.

Sandholtz, J. H., Ringstaff, C., & Dwyer, D. C. (1997). *Teaching with technology: Creating student-centered classrooms*. New York, NY: Teachers College Press.

Segaller, S. (1998). *Nerds 2.0.1: A brief history of the Internet.* New York, NY: TV Books.

Skinner, B. F. (1953). Science and human behavior. New York: Macmillan.

Sprague, D., & Dede, C. (1999). Constructivism in the classroom: If I teach this way, am I doing my job? *Learning & Leading with Technology*. *27*(1), 6-17.

Stager, G. (2008). *A new paradigm for evaluating the learning potential of an ed tech activity*. Los Angeles, CA: Pepperdine University.

Thomas, L. G., & Knezek, D. (1991). Facilitating restructured learning experiences with technology. *The Computing Teacher, 18*(6), 49–53.

Trotter, A. (2007, March). Getting up to speed. *Education Week, 26*(30), 10-12,14,16. Retrieved March 23, 2008, from Research Library database. (Document ID: 1252469331).

Wells, J., & Lewis, L. (2006), "Internet access in US public schools and classrooms: 1994-2005", National Center for Education Statistics, Washington, DC, Document NCES 2007-020.

Woolfolk, A. E. (1995). Educational psychology (6th ed.). Needham Heights, MA: Allyn & Bacon.

Zhao, Y., & Frank, K. A. (2003). Factors affecting technology uses in schools: An ecological perspective. *American Educational Research Journal, 40*(4), pp. 807-840.

Appendix A: TIM with Indicators and E-Mail Approval from FCIT

Technology Integration Matrix	Levels of Technology Integration into the Curriculum				
	Entry: The teacher uses technology to deliver curriculum content to students.	**Adoption:** The teacher directs students in the conventional use of tool-based software. If such software is available, this level is the recommended.	**Adaptation:** The teacher encourages adaptation of tool-based software by allowing students to select a tool and modify its use to accomplish the task at hand.	**Infusion**: The teacher creates a learning environment that infuses the power of technology tools throughout the day across subject areas.	**Transformation**: The teacher creates a rich learning environment in which students regularly engage in activities that would have been impossible to achieve without technology.
Characteristics of the Learning Environment					
Active: Students are actively engaged in using technology as a tool rather than passively receiving information from the technology.	**Indicator:** Students use technology for drill and practice and computer based training.	**Indicator:** Students begin to utilize technology tools to create products, for example using a word processor to create a report.	**Indicator:** Students have opportunities to select and modify technology tools to accomplish specific purposes, for example using colored cells on a spreadsheet to plan a garden.	**Indicator:** Throughout the school day, students are empowered to select appropriate technology tools and actively apply them to the tasks at hand.	**Indicator:** Given ongoing access to online resources, students actively select and pursue topics beyond the limitations of even the best school library.
Collaborative: Students use technology tools to collaborate with others rather than working individually at all times.	**Indicator:** Students primarily work alone when using technology.	**Indicator:** Students have opportunities to utilize collaborative tools, such as email, in conventional ways.	**Indicator:** Students have opportunities to select and modify technology tools to facilitate collaborative work.	**Indicator:** Throughout the day and across subject areas, students utilize technology tools to facilitate collaborative learning.	**Indicator:** Technology enables students to collaborate with peers and experts irrespective of time zone or physical distances.
Constructive: Students use technology tools to build understanding rather than simply receive information.	**Indicator:** Technology is used to deliver information to students.	**Indicator** Students begin to utilize constructive tools such as graphic organizers to build upon prior knowledge and construct meaning.	**Indicator:** Students have opportunities to select and modify technology tools to assist them in the construction of understanding.	**Indicator:** Students utilize technology to make connections and construct under-standing across disciplines and throughout the day.	**Indicator:** Students use technology to construct, share, and publish knowledge to a worldwide audience.
Authentic: Students use technology tools to solve real-world problems meaningful to them rather than working on artificial assignments.	**Indicator:** Students use technology to complete assigned activities that are generally unrelated to real-world problems.	**Indicator:** Students have opportunities to apply technology tools to some content-specific activities that are based on real-world problems.	**Indicator:** Students have opportunities to select and modify technology tools to solve problems based on real-world issues.	**Indicator**: Students select appropriate technology tools to complete authentic tasks across disciplines.	**Indicator:** By means of technology tools, students participate in outside-of-school projects and problem-solving activities that have meaning for the students and the community.
Goal Directed: Students use technology tools to set goals, plan activities, monitor progress, and evaluate results rather than simply completing assignments without reflection.	**Indicator:** Students receive directions, guidance, and feedback from technology, rather than using tech-nology tools to set goals, plan activities, monitor progress, or self-evaluate.	**Indicator:** From time to time, students have the opportunity to use technology to either plan, monitor, or evaluate an activity.	**Indicator:** Students have opportunities to select and modify the use of technology tools to facilitate goal-setting, planning, monitoring, and evaluating specific activities.	**Indicator:** Students use technology tools to set goals, plan activities, monitor progress, and evaluate results throughout the curriculum.	**Indicator:** Students engage in ongoing metacognative activities at a level that would be unattainable without the support of technology tools.

Figure A1. Technology Integration Matrix with Indicators

From: FCIT. (2007). *Technology integration matrix*. Retrieved December 16, 2008, from http://fcit.usf.edu/matrix. Used with permission of the Florida Center for Instructional Technology.

From: Roy Winkelman <royw@mac.com>
To: Rusty Meigs <rmeigsonw@olatheschools.com>
Date: 12/18/2008 11:35 AM
Subject: Re: Permission to Use the Technology Integration Matrix

Dear Mr. Meigs,

The Florida Center for Instructional Technology is pleased to grant you permission to utilize our TIM model in your research and to develop a related instrument based on the TIM for non-commercial purposes.

Best wishes on your study!

Regards,
Roy Winkelman
Director, Florida Center for Instructional Technology
College of Education, University of South Florida

On Dec 16, 2008, at 4:24 PM, Rusty Meigs wrote:

Dear Dr. Winkelman,

My name is Rusty Meigs. I recently contacted Dr. Takacs about receiving written permission to use the Technology Integration Matrix in my upcoming research study. Dr. Takacs contacted me at 4:00 PM EST and said I should get in touch with you. While working on my dissertation at Baker University in Overland Park, Kansas--concerning technology integration involving K-12 settings--I've come across the Technology Integration Matrix a number of times. All of my research so far has led back to a study from Apple Classrooms of Tomorrow (Dwyer, Ringstaff, & Sandholtz, 1997), where levels of integration are broken into categories of entry, adoption, adaptation, appropriation, and invention.

Helping teachers integrate technology into classroom instruction has been a passion of mine for some time. Because my goal is to address factors that influence levels of technology integration by K-12 public school teachers, I am very interested in using the TIM model to either develop an instrument to gauge such levels or to use it in conjunction with an instrument already out there. I would be grateful if you could provide me with written permission to use this model in my study. I would also be interested in obtaining any instruments you may know of which gauge teacher integration levels according to the model. My district currently has a technology proficiency checklist they would like me to use in conjunction with a levels of integration instrument to administer to all certified staff, K-12, in early February.

Thank you in advance for any assistance you can provide in this matter.

My mobile phone number is (913) 548-7307 and my work number is (913)

780-7150 with the extension 2409 in case you need to contact me in person for further information about my study.

Sincerely, Rusty.

Rusty Meigs, M.Ed.
e-Communication Instructor
Olathe Northwest High School
21300 College Boulevard
Olathe, KS 66061

Phone: 913.780.7150 ext. 2409
FAX: 913.780.7159

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Appendix B: Initial Draft of the Technology Integration Matrix Questionnaire
(Submitted to FCIT on January 6, 2009)

Technology Integration Questions

1. (ACTIVE-ENTRY) Students in my classroom use technology tools like interactive games to construct rudimentary knowledge (i.e. phonics, multiplication tables, periodic table elements).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

2 (ACTIVE-ADOPTION). Students in my classroom use technology tools to create products like presentations, reports, or diagrams.

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

3. (ACTIVE-ADAPTATION) Students in my classroom increase their understanding by selecting and/or modifying technology tools to plan and organize specific tasks (i.e. create a map, develop a trip itinerary, produce a flow chart, etc.).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

4. (ACTIVE-INFUSION) Students in my classroom use technology tools to collect information from a variety of sources and assemble these into culminating projects (i.e. produce a documentary, participate in a WebQuest, develop a guide for saving a species, create a magazine, etc.).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

5. (ACTIVE-TRANSFORMATION) Students in my classroom decide which technology tools to use and fine-tune to develop methods and allocate resources for solving problems or meeting objectives (i.e. construct a virtual field trip, build a tutorial Developing a spreadsheet to store variables, compose a database to track changes in climate, etc.).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

6. (COLLABORATIVE-ENTRY) Students in my classroom work chiefly on an individual basis when using technology.

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

7. (COLLABORATIVE-ADOPTION) Students in my classroom use electronic conduits like E-Mail to collaborate.

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

8. (COLLABORATIVE-ADAPTATION) Students in my classroom use prescribed online tools to collaborate (i.e. Wikis, Blogs, chatting, discussion forums, etc.).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

9. (COLLABORATIVE-INFUSION) Students in my classroom select and adapt online collaborative tools to communicate throughout the school day (i.e. Wikis, Blogs, chatting, discussion forums, etc.).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

10. (COLLABORATIVE-TRANSFORMATION) Students in my classroom utilize collaborative tools to communicate with other students and/or outside experts beyond the confines of a regular class period.

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

11 (CONSTRUCTIVE-ENTRY). Students in my classroom experience technology usage in the form of the teacher-created instruction (i.e. bell-work, informational Web sites, presentations, instructional supports, or enhanced lessons).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

12 (CONSTRUCTIVE-ADOPTION). Students in my classroom use technology tools like Kidspiration to organize learning into charts, graphs, and diagrams (i.e. Venn diagrams, concept maps, storyboards, Frayer model maps, KWL charts, flow charts etc.).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

13 (CONSTRUCTIVE-ADAPTATION). Students in my classroom utilize technology tools to assemble findings from inquiry-focused lessons for illustration or in a presentation format (i.e. deliver researched subjects, concept extensions, etc.).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

14 (CONSTRUCTIVE-INSFUSION). Students in my classroom utilize technology to formulate projects incorporating subjects across disciplines (i.e. presentations, instructional supports, or enhanced lessons).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

15 (CONSTRUCTIVE-TRANFORMATION). Students in my classroom use technology tools to research, build, and display learning to an extended or global audience (i.e. Web sites, audio/video Podcasts, Wordpress site, RSS feeds, etc.).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

16 (AUTHENTIC-ENTRY). Students in my classroom use technology tools for drill and practice exercises to develop common cognitive skills (i.e. memorize math facts, practice reading skills, etc.).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

17 (AUTHENTIC -ADOPTION). Students in my classroom use technology tools to meet specific objectives based on real-world content (i.e. read maps, visualize patterns, graph statistics, etc.).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

18 (AUTHENTIC -ADAPTATION). Students in my classroom select and adapt technology tools in order to solve problems based on real-world issues (i.e. erosion, supply and demand economics, alternative energy, etc.).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

19 (AUTHENTIC -INSFUSION). Students in my classroom select appropriate technology tools from various of subject areas to construct solutions to authentic, real life problems.

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

20 (AUTHENTIC -TRANFORMATION). Students in my classroom use technology tools to research and participate in activities outside the classroom to solve real-world problems (i.e. promote recycling, end world hunger, assist developing countries, advocate healthy living, etc.).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

21 (GOAL DIRECTED-ENTRY). Students in my classroom use technology tools, which provide choices and feedback for learning specific skills.

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

22 (GOAL DIRECTED-ADOPTION). Students in my classroom use technology tools to organize, track, and assess goals associated with specific classroom content.

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

23 (GOAL DIRECTED-ADAPTATION). Students in my classroom have the opportunity to choose and adapt technology tools for setting goals, planning, monitoring, and reflecting.

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

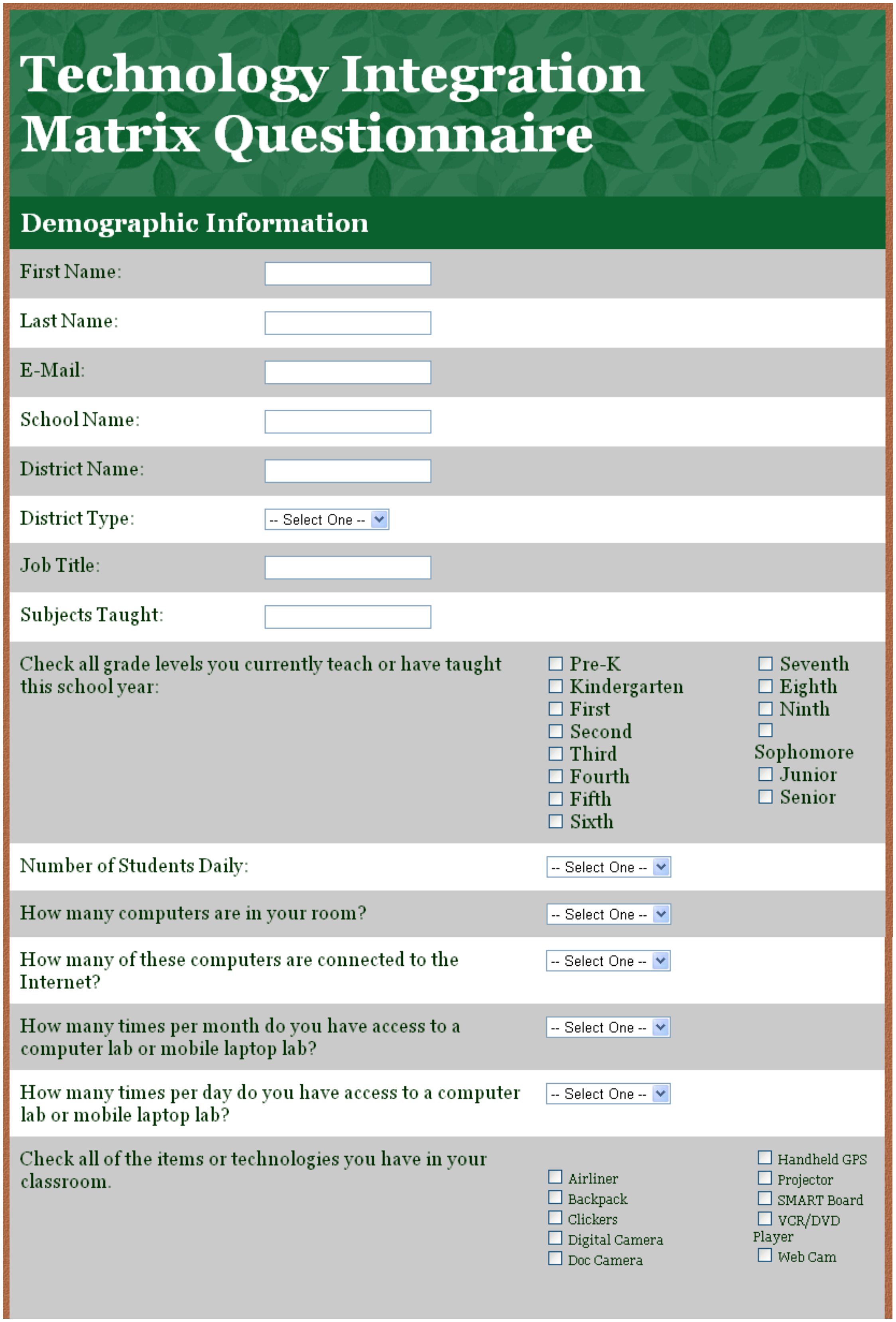
24 (GOAL DIRECTED-INSFUSION). Students in my classroom allocate technology tools to chart, observe, evaluate, and meet goals across multiple subjects.

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

25 (GOAL DIRECTED -TRANFORMATION). Students in my classroom arrange technology tools regularly to achieve content outcomes through feedback from multiple sources (i.e. Wikis, blogs, forums, etc.).

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

Appendix C: First Draft of the Technology Integration Matrix Questionnaire (TIMQ1)
(Submitted to First Expert Panel on April 14, 2009)



Technology Integration Matrix Questionnaire

Demographic Information

First Name: ______

Last Name: ______

E-Mail: ______

School Name: ______

District Name: ______

District Type: -- Select One --

Job Title: ______

Subjects Taught: ______

Check all grade levels you currently teach or have taught this school year:

- ☐ Pre-K
- ☐ Kindergarten
- ☐ First
- ☐ Second
- ☐ Third
- ☐ Fourth
- ☐ Fifth
- ☐ Sixth
- ☐ Seventh
- ☐ Eighth
- ☐ Ninth
- ☐ Sophomore
- ☐ Junior
- ☐ Senior

Number of Students Daily: -- Select One --

How many computers are in your room? -- Select One --

How many of these computers are connected to the Internet? -- Select One --

How many times per month do you have access to a computer lab or mobile laptop lab? -- Select One --

How many times per day do you have access to a computer lab or mobile laptop lab? -- Select One --

Check all of the items or technologies you have in your classroom.

- ☐ Airliner
- ☐ Backpack
- ☐ Clickers
- ☐ Digital Camera
- ☐ Doc Camera
- ☐ Handheld GPS
- ☐ Projector
- ☐ SMART Board
- ☐ VCR/DVD Player
- ☐ Web Cam

Type in any items or technologies you have in your classroom not shown on this list.

Check all of the items or technologies to which you have access in your building or district.

- ☐ Airliner
- ☐ Backpack
- ☐ Clickers
- ☐ Digital Camera
- ☐ Doc Camera
- ☐ Handheld GPS
- ☐ Projector
- ☐ SMART Board
- ☐ VCR/DVD Player
- ☐ Web Cam

Type in any items or technologies not shown on this list but to which you have access in your building or district.

Describe the frequency and what types of professional development opportunities regarding educational technology occur in your building or district:

Provide any feedback to the demographic questions above here in the space below:

Section A

1. Students in my classroom/classes are actively engaged using computer applications for basic skills drill and practice.
(ACTIVE-ENTRY Indicator: *Students use technology for drill and practice and computer based training.*)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never — Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the ACTIVE-ENTRY cell on the TIM?

-- Select One --

2. Students in my classroom/classes are actively engaged using computer-based tutorials to learn basic skills.
(ACTIVE-ENTRY Indicator: *Students use technology for drill and practice and computer based training.*)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never — Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the ACTIVE-ENTRY cell on the TIM?

-- Select One --

3. Students in my classroom/classes are actively engaged using productivity tools like word processors to create reports.
(ACTIVE-ADOPTION Indicator: *Students begin to utilize technology tools to create products, for example using a word processor to create a report.*)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the ACTIVE-ADOPTION cell on the TIM?

-- Select One --

4. Students in my classroom/classes are actively engaged using online productivity tools like Citation Machine or conversion charts to complete projects.
(ACTIVE-ADOPTION Indicator: *Students begin to utilize technology tools to create products, for example using a word processor to create a report.*)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the ACTIVE-ADOPTION cell on the TIM?

-- Select One --

5. Students in my classroom/classes are actively engaged in selecting technology tools to complete specific tasks.
(ACTIVE-ADAPTATION Indicator: *Students have opportunities to select and modify technology tools to accomplish specific purposes, for example using colored cells on a spreadsheet to plan a garden.*)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the ACTIVE-ADAPTATION cell on the TIM?

-- Select One --

6. Students in my classroom/classes are actively engaged in modifying technology tools to complete specific tasks.
(ACTIVE-ADAPTATION Indicator: *Students have opportunities to select and modify technology tools to accomplish specific purposes, for example using colored cells on a spreadsheet to plan a garden.*)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the ACTIVE-ADAPTATION cell on the TIM?

-- Select One --

7. Students from my classroom/classes are actively engaged using technology software and hardware tools throughout the school day.
(ACTIVE-INFUSION Indicator: *Throughout the school day, students are empowered to select appropriate technology tools and actively apply them to the tasks at hand.*)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the ACTIVE-INFUSION cell on the TIM?

-- Select One --

8. Students in my classroom/classes are actively engaged using online technology tools throughout the school day.
(ACTIVE-INFUSION Indicator: *Throughout the school day, students are empowered to select appropriate technology tools and actively apply them to the tasks at hand.*)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the ACTIVE-INFUSION cell on the TIM?

-- Select One --

9. Students in my classroom/classes are actively engaged in an ongoing manner using computer applications to learn beyond the confines of the school day.
(ACTIVE-INVENTION Indicator: *Given ongoing access to online resources, students actively select and pursue topics beyond the limitations of even the best school library.*)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the ACTIVE-INVENTION cell on the TIM?

-- Select One --

10. Students in my classroom/classes are actively engaged in an ongoing manner using online technology tools to learn beyond the confines of the school day.
(ACTIVE-INVENTION Indicator: *Given ongoing access to online resources, students actively select and pursue topics beyond the limitations of even the best school library.*)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the ACTIVE-INVENTION cell on the TIM?

-- Select One --

Section B

11. Students in my classroom/classes work alone using Internet tools for comprehension.
(COLLABORATIVE-ENTRY Indicator: *Students primarily work alone when using technology.*)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the COLLABORATIVE-ENTRY cell on the TIM?

-- Select One --

12. Students in my classroom/classes work individually using software applications to make meaning of their world.
(COLLABORATIVE-ENTRY Indicator: *Students primarily work alone when using technology.*)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the COLLABORATIVE-ENTRY cell on the TIM?

-- Select One --

13. Students in my classroom/classes use E-Mail to collaborate with others on assignments.
(COLLABORATIVE-ADOPTION Indicator: ***Students have opportunities to utilize collaborative tools, such as email, in conventional ways.***)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the COLLABORATIVE-ADOPTION cell on the TIM?

-- Select One --

14. Students in my classroom/classes collaborate using digital tools to share documents and information with others on assignments.
(COLLABORATIVE-ADOPTION Indicator: ***Students have opportunities to utilize collaborative tools, such as email, in conventional ways.***)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the COLLABORATIVE-ADOPTION cell on the TIM?

-- Select One --

15. Students in my classroom/classes choose tools like chatting, blogs, or discussion forums to collaborate with others on assignments.
(COLLABORATIVE-ADAPTATION Indicator: ***Students have opportunities to select and modify technology tools to facilitate collaborative work.***)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the COLLABORATIVE-ADAPTATION cell on the TIM?

-- Select One --

16. Students in my classroom/classes configure or adapt technology tools in order to collaborate with others on assignments.
(COLLABORATIVE-ADAPTATION Indicator: ***Students have opportunities to select and modify technology tools to facilitate collaborative work.***)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the COLLABORATIVE-ADAPTATION cell on the TIM?

-- Select One --

17. Students from my classroom/classes use technology tools to collaborate across disciplines.
(COLLABORATIVE-INFUSION Indicator: Throughout the day and across subject areas, students utilize technology tools to facilitate collaborative learning.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the COLLABORATIVE-INFUSION cell on the TIM?

-- Select One --

18. Students from my classroom/classes use technology tools to collaborate throughout the school day.
(COLLABORATIVE-INFUSION Indicator: Throughout the day and across subject areas, students utilize technology tools to facilitate collaborative learning.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the COLLABORATIVE-INFUSION cell on the TIM?

-- Select One --

19. Students in my classroom/classes use communication tools like iChat, Skype, or instant messaging to collaborate with others within and beyond the confines of the school day.
(COLLABORATIVE-INVENTION Indicator: Technology enables students to collaborate with peers and experts irrespective of time zone or physical distances.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the COLLABORATIVE-INVENTION cell on the TIM?

-- Select One --

20. Students in my classroom/classes use technology tools to post content online to collaborate with others within and beyond the confines of the school day.
(COLLABORATIVE-INVENTION Indicator: Technology enables students to collaborate with peers and experts irrespective of time zone or physical distances.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the COLLABORATIVE-INVENTION cell on the TIM?

-- Select One --

Section C

21. Students in my classroom/classes experience technology through the teacher's use of presentation tools like PowerPoints, informative Web sites, Airliners, or SMART Board technologies.
(COSTRUCTIVE-ENTRY Indicator: Technology is used to deliver information to students.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the CONSTRUCTIVE-ENTRY cell on the TIM?

-- Select One --

22. Students in my classroom/classes experience technology through traditional instructional technologies like overhead projectors, white boards, audio players, or VHS/DVD players.
(COSTRUCTIVE-ENTRY Indicator: Technology is used to deliver information to students.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the CONSTRUCTIVE-ENTRY cell on the TIM?

-- Select One --

23. Students in my classroom/classes use technology tools to construct graphic organizers to illustrate concepts.
(COSTRUCTIVE-ADOPTION Indicator: Students begin to utilize constructive tools such as graphic organizers to build upon prior knowledge and construct meaning.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the CONSTRUCTIVE-ADOPTION cell on the TIM?

-- Select One --

24. Students in my classroom/classes use technology tools to construct meaning based upon prior knowledge.
(COSTRUCTIVE-ADOPTION Indicator: Students begin to utilize constructive tools such as graphic organizers to build upon prior knowledge and construct meaning.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the CONSTRUCTIVE-ADOPTION cell on the TIM?

-- Select One --

25. Students in my classroom/classes construct meaning by selecting and adapting technology tools to gather information.
(COSTRUCTIVE-ADAPTATION Indicator: Students have opportunities to select and modify technology tools to assist them in the construction of understanding.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the CONSTRUCTIVE-ADAPTATION cell on the TIM?

-- Select One --

26. Students in my classroom/classes use inquiry-based technology tools to construct meaning.
(COSTRUCTIVE-ADAPTATION Indicator: Students have opportunities to select and modify technology tools to assist them in the construction of understanding.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the CONSTRUCTIVE-ADAPTATION cell on the TIM?

-- Select One --

27. Students from my classroom/classes use technology tools to construct meaning across several disciplines.
(COSTRUCTIVE-INFUSION Indicator: Students utilize technology to make connections and construct understanding across disciplines and throughout the day.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the CONSTRUCTIVE-INFUSION cell on the TIM?

-- Select One --

28. Students from my classroom/classes use technology tools to make associations with other subject areas throughout the school day.
(COSTRUCTIVE-INFUSION Indicator: Students utilize technology to make connections and construct understanding across disciplines and throughout the day.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the CONSTRUCTIVE-INFUSION cell on the TIM?

-- Select One --

29. Students in my classroom/classes use technology tools to construct meaning through the creation of products like media, Podcasts, or electronic publications.
(COSTRUCTIVE-INVENTION Indicator: Students use technology to construct, share, and publish knowledge to a worldwide audience.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the CONSTRUCTIVE-INVENTION cell on the TIM?

-- Select One --

30. Students in my classroom/classes use technology tools to construct media content for sharing with an extended or global audience via the Internet.
(COSTRUCTIVE-INVENTION Indicator: Students use technology to construct, share, and publish knowledge to a worldwide audience.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the CONSTRUCTIVE-INVENTION cell on the TIM?

-- Select One --

Section D

31. Students in my classroom/classes use technology tools to solve basic problems, which require only specific routines, steps, or memorization.
(AUTHENTIC-ENTRY Indicator: Students use technology to complete assigned activities that are generally unrelated to real-world problems.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the AUTHENTIC-ENTRY cell on the TIM?

-- Select One --

32. Students in my classroom/classes use technology tools to solve problems generally unrelated to real-word situations.
(AUTHENTIC-ENTRY Indicator: Students use technology to complete assigned activities that are generally unrelated to real-world problems.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the AUTHENTIC-ENTRY cell on the TIM?

-- Select One --

33. Students in my classroom/classes use software applications to solve content-specific problems given real-world parallels.
(AUTHENTIC-ADOPTION Indicator: Students have opportunities to apply technology tools to some content-specific activities that are based on real-world problems.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the AUTHENTIC-ADOPTION cell on the TIM?

-- Select One --

34. Students in my classroom/classes use online tools to apply solutions to authentic, real-world problems.
(AUTHENTIC-ADOPTION Indicator: Students have opportunities to apply technology tools to some content-specific activities that are based on real-world problems.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the AUTHENTIC-ADOPTION cell on the TIM?

-- Select One --

35. Students in my classroom/classes locate technology tools to solve real-world problems in variety of ways.
(AUTHENTIC-ADAPTATION Indicator: Students have opportunities to select and modify technology tools to solve problems based on real-world issues.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the AUTHENTIC-ADAPTATION cell on the TIM?

-- Select One --

36. Students in my classroom/classes adapt various technology tools to solve problems based on real-world scenarios.
(AUTHENTIC-ADAPTATION Indicator: Students have opportunities to select and modify technology tools to solve problems based on real-world issues.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the AUTHENTIC-ADAPTATION cell on the TIM?

-- Select One --

37. Students from my classroom/classes select appropriate technology tools from several disciplines to solve real-world problems.
(AUTHENTIC-INFUSION Indicator: Students select appropriate technology tools to complete authentic tasks across disciplines.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the AUTHENTIC-INFUSION cell on the TIM?

-- Select One --

38. Students from my classroom/classes conduct research using appropriate technology and apply solutions to problems based on real-world situations.
(AUTHENTIC-INFUSION Indicator: Students select appropriate technology tools to complete authentic tasks across disciplines.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the AUTHENTIC-INFUSION cell on the TIM?

-- Select One --

39. Students in my classroom/classes use technology tools to participate in authentic, problem-solving projects outside of school.
(AUTHENTIC-INVENTION Indicator: By means of technology tools, students participate in outside-of-school projects and problem-solving activities that have meaning for the students and the community.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the AUTHENTIC-INVENTION cell on the TIM?

-- Select One --

40. Students in my classroom/classes use technology tools to solve real-world problems beyond the confines of the classroom that have meaning for the students or the community.
(AUTHENTIC-INVENTION Indicator: By means of technology tools, students participate in outside-of-school projects and problem-solving activities that have meaning for the students and the community.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the AUTHENTIC-INVENTION cell on the TIM?

-- Select One --

Section E

41. Students in my classroom/classes receive automated feedback when using technology tools for drill and practice.
(GOAL DIRECTED-ENTRY Indicator: Students receive directions, guidance, and feedback from technology, rather than using technology tools to set goals, plan activities, monitor progress, or self-evaluate.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the GOAL DIRECTED-ENTRY cell on the TIM?

-- Select One --

42. Students in my classroom/classes receive differentiated feedback from computer-based training tools.
(GOAL DIRECTED-ENTRY Indicator: Students receive directions, guidance, and feedback from technology, rather than using technology tools to set goals, plan activities, monitor progress, or self-evaluate.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the GOAL DIRECTED-ENTRY cell on the TIM?

-- Select One --

43. Students in my classroom/classes use technology tools to create and plan educational goals.
(GOAL DIRECTED-ADOPTION Indicator: From time to time, students have the opportunity to use technology to either plan, monitor, or evaluate an activity.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the GOAL DIRECTED-ADOPTION cell on the TIM?

-- Select One --

44. Students in my classroom/classes use technology tools to monitor and evaluate their activities.
(GOAL DIRECTED-ADOPTION Indicator: From time to time, students have the opportunity to use technology to either plan, monitor, or evaluate an activity.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the GOAL DIRECTED-ADOPTION cell on the TIM?

-- Select One --

45. Students in my classroom/classes choose certain technology tools to assist with goal directed activities.
(GOAL DIRECTED-ADAPTATION Indicator: Students have opportunities to select and modify the use of technology tools to facilitate goal-setting, planning, monitoring, and evaluating specific activities.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the GOAL DIRECTED-ADAPTATION cell on the TIM?

-- Select One --

46. Students in my classroom/classes modify technology tools to meet specific requirements of goal directed activities.
(GOAL DIRECTED-ADAPTATION Indicator: Students have opportunities to select and modify the use of technology tools to facilitate goal-setting, planning, monitoring, and evaluating specific activities.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the GOAL DIRECTED-ADAPTATION cell on the TIM?

-- Select One --

47. Students from my classroom/classes use appropriate software tools to manage goal directed activities throughout the school day.
(GOAL DIRECTED-INFUSION Indicator: Students use technology tools to set goals, plan activities, monitor progress, and evaluate results throughout the curriculum.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the GOAL DIRECTED-INFUSION cell on the TIM?

-- Select One --

48. Students from my classroom/classes use Web-based tools to manage goal directed activities across disciplines.
(GOAL DIRECTED-INFUSION Indicator: Students use technology tools to set goals, plan activities, monitor progress, and evaluate results throughout the curriculum.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the GOAL DIRECTED-INFUSION cell on the TIM?

-- Select One --

49. Students in my classroom/classes use technology tools like WIKIs, blogs, or forums to obtain feedback from multiple sources beyond the confines of the school day.
(GOAL DIRECTED-INVENTION Indicator: Students engage in ongoing metacognative activities at a level that would be unattainable without the support of technology tools.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never — Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the GOAL DIRECTED-INVENTION cell on the TIM?

-- Select One --

50. Students in my classroom/classes use technology tools to received ongoing feedback for goals within and outside the contexts of the school day.
(GOAL DIRECTED-INVENTION Indicator: Students engage in ongoing metacognative activities at a level that would be unattainable without the support of technology tools.)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never — Frequently

Provide any feedback to the question above here in the space below:

Does the question above accurately measure the GOAL DIRECTED-INVENTION cell on the TIM?

-- Select One --

Submit

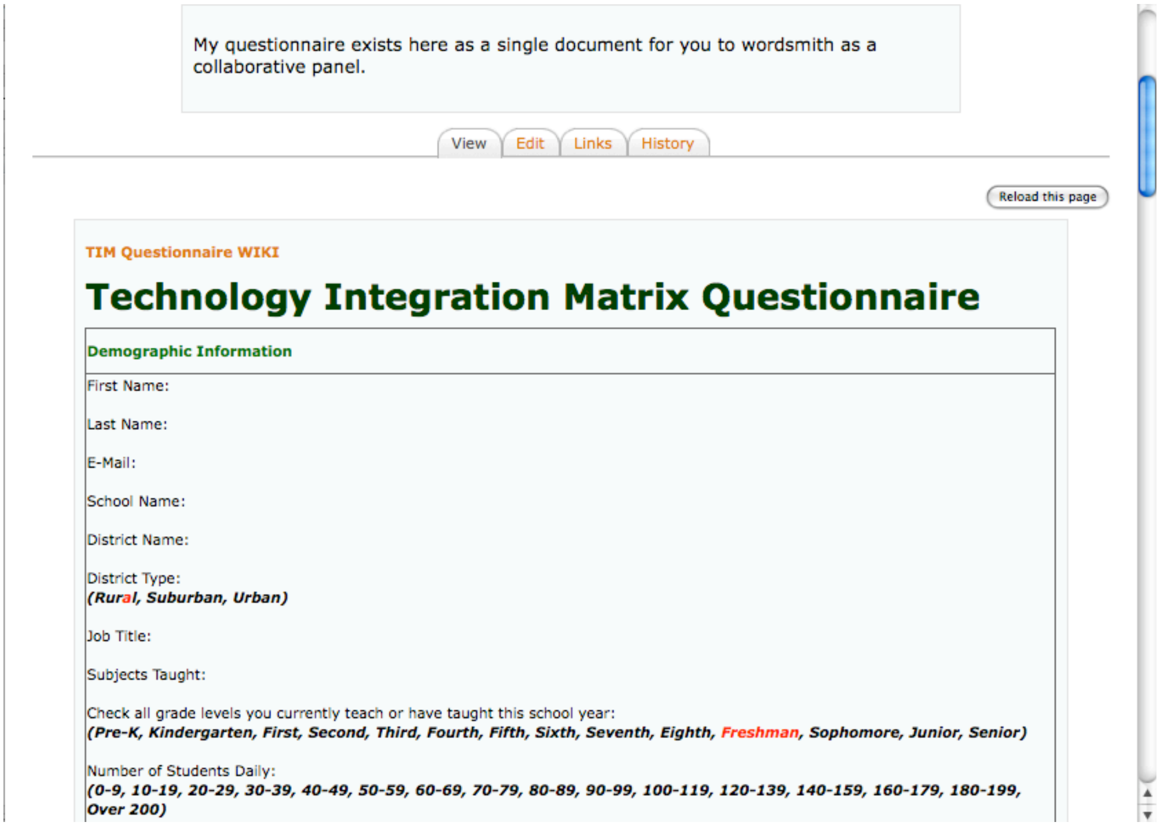


Figure C1. Wordsmith feedback via a wiki on the researcher's Moodle site.

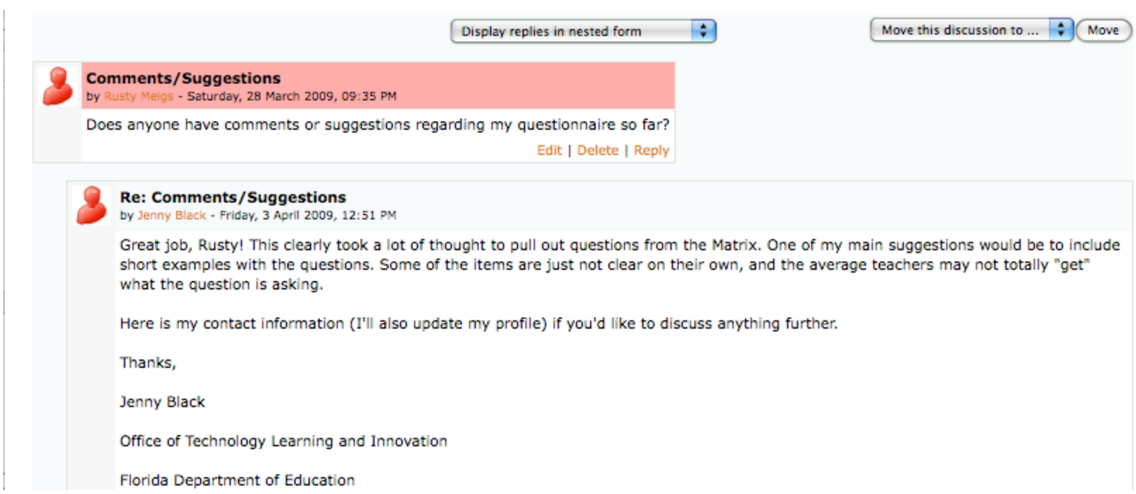
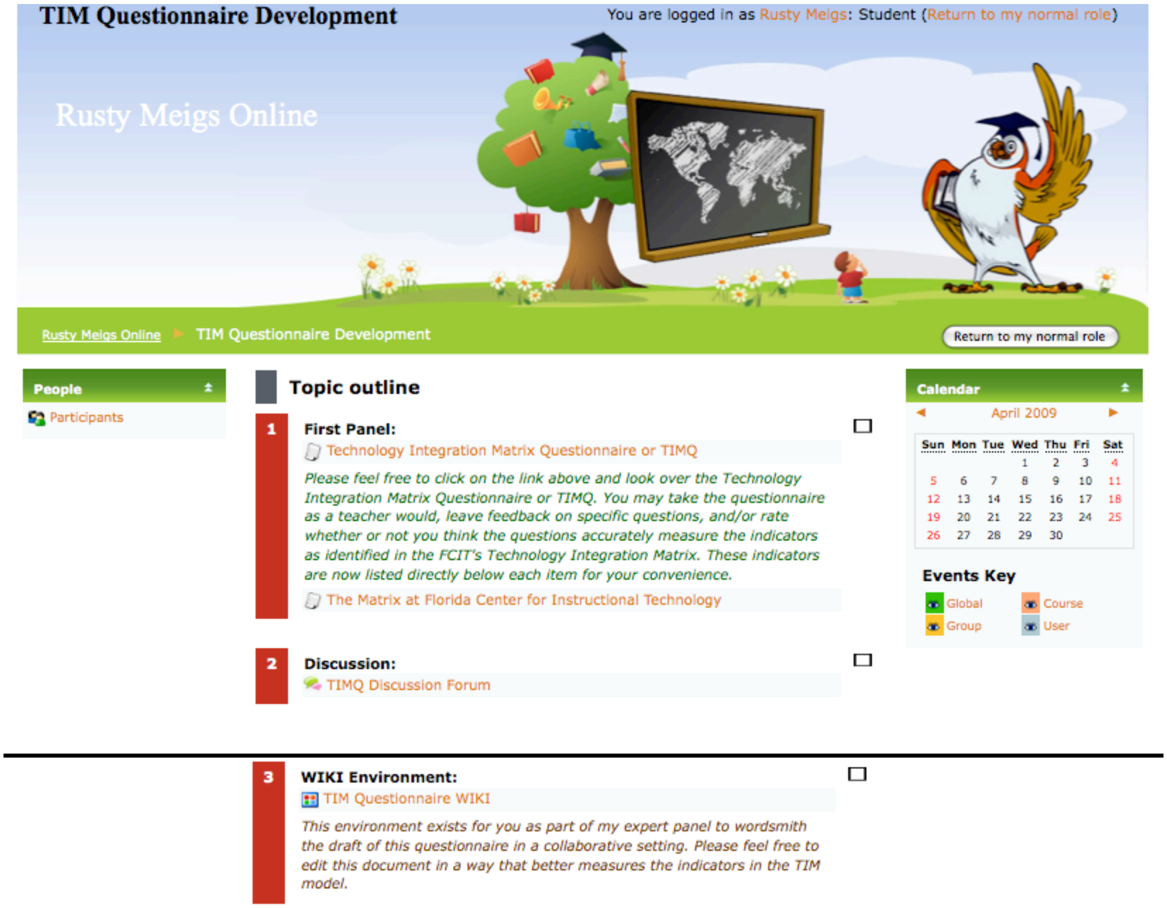


Figure C2. Discussion on the researcher's Moodle site.

Appendix D: Moodle Configuration for the First Panel


TIM Questionnaire Development
You are logged in as Rusty Meigs: Student (Return to my normal role)
Rusty Meigs Online
Rusty Meigs Online ▸ TIM Questionnaire Development
Return to my normal role
People
Participants
Topic outline
1
First Panel:
Technology Integration Matrix Questionnaire or TIMQ
Please feel free to click on the link above and look over the Technology Integration Matrix Questionnaire or TIMQ. You may take the questionnaire as a teacher would, leave feedback on specific questions, and/or rate whether or not you think the questions accurately measure the indicators as identified in the FCIT's Technology Integration Matrix. These indicators are now listed directly below each item for your convenience.
The Matrix at Florida Center for Instructional Technology
2
Discussion:
TIMQ Discussion Forum
3
WIKI Environment:
TIM Questionnaire WIKI
This environment exists for you as part of my expert panel to wordsmith the draft of this questionnaire in a collaborative setting. Please feel free to edit this document in a way that better measures the indicators in the TIM model.
Calendar
April 2009
Sun Mon Tue Wed Thu Fri Sat
1 2 3 4
5 6 7 8 9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29 30
Events Key
Global
Course
Group
User

Appendix E: Second Draft of the Technology Integration Matrix Questionnaire (TIMQ2)
(Submitted to Second Expert Panel on Aug. 23, 2009)

Welcome to the Technology Integration Matrix Questionnaire!

Please enter the keycode provided on the researcher's Moodle site: [ ]

[submit]

Technology Integration Matrix Questionnaire

Instructions:

Thank you in advance for taking part in this study. As a member of the technology leadership panel, you can provide me with feedback regarding the level of understandability for each of the 50 questions just below the "Demographic Information" section as well as feedback regarding any of the items in the demographic section. The instrument is completely functional and has been written to survey teacher respondents. While you are certainly welcome to fill out the demographic questions as well as the 50 questionnaire items just as a teacher would, this is not required in order to submit your feedback.

I have highlighted the text of all items I am requesting from you, a panel member, in blue. Please provide feedback by rating the extent to which you understand each of the 50 questions just below the "Demographic Information" section and to what extent you think others will understand each of the items. Selecting your name in the "Panel Information" section and marking understandability ratings for each of the questions is required and you will be prompted to click the [BACK] button on your Web browser if any of these items have not been completed. Once complete, you will be allowed to submit your feedback. Pressing the [Submit] button serves as your consent to participate in this study.

You may E-Mail me at rmeigsec@olatheschools.com if you have any questions. Thank you.

Panel Information

Please select your name from the list. While the questionnaire below is anonymous for pilot members, I am requesting panel members like yourself select their names for any follow-up purposes regarding the understandability of demographic and matrix question items.

Panel Member Name (REQUIRED):	-- SELECT YOUR NAME --

Demographic Information

*Please complete all of the demographic questions below. *Note it is not necessary to answer the questions asking your input about technology items not found in the checkbox lists..*

District Name:	
District Type:	-- Select One --
Subjects Taught:	

Check all grade levels you currently teach or have taught this school year:	☐ Pre-K ☐ Kindergarten ☐ First ☐ Second ☐ Third ☐ Fourth ☐ Fifth ☐ Sixth	☐ Seventh ☐ Eighth ☐ Freshman ☐ Sophomore ☐ Junior ☐ Senior
Number of Students Daily:	-- Select One --	
How many computers are in your room?	-- Select One --	
How many of these computers are connected to the Internet?	-- Select One --	
How many times per month do you have access to a computer lab or mobile laptop lab?	-- Select One --	
How many times per day do you have access to a computer lab or mobile laptop lab?	-- Select One --	
Check all of the items or technologies you have in your classroom.	☐ Airliner ☐ Backpack ☐ Clickers ☐ Digital Camera ☐ Doc Camera	☐ Handheld GPS ☐ Projector ☐ SMART Board ☐ VCR/DVD Player ☐ Web Cam
*Type in any items or technologies you have in your classroom not shown on this list.		
Check all of the items or technologies to which you have access in your building or district.	☐ Airliner ☐ Backpack ☐ Clickers ☐ Digital Camera ☐ Doc Camera	☐ Handheld GPS ☐ Projector ☐ SMART Board ☐ VCR/DVD Player ☐ Web Cam
*Type in any items or technologies not shown on this list but to which you have access in your building or district.		
Describe the frequency and the type of professional development opportunities regarding educational technology occur in your building or district:		

Provide any feedback to the demographic questions above here in the space below (OPTIONAL):

Technology Integration Matrix Questions

Please complete all 50 questions below. To see a detailed description for each example, simply position or hover your your mouse cursor over the underlined text and a popup box will appear.

1. Students in my classroom/classes modify technology tools to meet specific requirements of goal directed activities.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never — Frequently

Example: *Organizing research.*

An example would be a student setting up multiple tables in a database to organize sources in order to perform queries for quick retrieval while writing a paper on healthcare.

Provide any feedback to the ques...
(OPTIONAL):

...erstandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

2. Students in my classroom/classes use software applications to solve content-specific problems given real-world parallels.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never — Frequently

Example: *Monitor weather patterns.*

An example would be students using a Davis WiFi Weather Station (http://www.ambientweather.com) to monitor weather patterns like the sudden drop in temperature with a cold front.

Provide any feedback to the question ...
(OPTIONAL):

...dability of this

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

3. Students in my classroom/classes choose tools like chatting, blogs, or discussion forums to collaborate with others on assignments.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never — Frequently

Example: *Identifying characters in a story.*

An example of this would be students in an online classroom choosing to blog, instant message, or post threads to a discussion forum in order to identify the protagonist, antagonist, and other characters in a story.

Provide any feedback to the question above ...
(OPTIONAL):

...y of this

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

4. Students in my classroom/classes use technology tools to solve problems generally unrelated to real-word situations.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Pronounce Spanish words.*

An example would be students using electronic flash cards online to learn the basic pronunciation of Spanish words at a site like Online Spanish Help (http://www.onlinespanishhelp.com)

Provide any feedback to the question a
(OPTIONAL):

dability of this

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

5. Students in my classroom/classes are actively engaged using computer-based tutorials to learn basic skills.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Completing a tutorial.*

An example would be a student completing an online lesson at America's Past Internet Tutorial (http://tutorial.teachtci.com) over the U.S. Bill of Rights.

Provide any feedback to the quest
(OPTIONAL):

rstandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

6. Students in my classroom/classes use technology tools to construct meaning through the creation of products like media, Podcasts, or electronic publications.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Creating a PSA.*

An example would be students constructing a public service announcement (PSA) about bullying in GarageBand and publishing it to iTunes U (http://education.apple.com/itunesu).

Provide any feedback to the
(OPTIONAL):

understandability of this
IRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

7. Students from my classroom/classes select appropriate technology tools from several disciplines to solve real-world problems.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never — Frequently

Example: *Colonizing the moon.*

An example would be students playing differing roles in cooperative groups to create a plan for colonizing the moon. One student may act as the scientist and research NASA's Web site to figure out how life could be sustained. Another student may use a spreadsheet to tabulate the costs of financing the project, etc.

Provide any feedback to the ques (OPTIONAL):

erstandability of this).

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

8. Students in my classroom/classes use inquiry-based technology tools to construct meaning.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never — Frequently

Example: *Completing patterns.*

An example would be students using their prediction skills to fill in the missing pieces of patterns housed in electronic templates.

Provide any feedback to the question above here in the space below (OPTIONAL):

Please rate your understandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

9. Students in my classroom/classes are actively engaged using productivity tools like word processors to create reports.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never — Frequently

Example: *Writing a report.*

An example of this would be a student using a word processor to write a narrative about key battles of the Civil War.

Provide any feedback to the question above here in the space below (OPTIONAL):

Please rate your understandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

10. Students from my classroom/classes use technology tools to collaborate throughout the school day.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Describing electrical circuits..*

An example would be a group of students meeting in an online classroom environment during seminar, enrichment, study hall, or other free periods to develop a set of parallel and series circuit problems for physics classmates to troubleshoot and discuss.

Provide any feedback to the question abo
(OPTIONAL):

ility of this

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

11. Students in my classroom/classes use technology tools to monitor and evaluate their activities.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Learning vocabulary.*

An example would be students keeping a daily journal in an online learning management system reflecting on vocabulary words, their meaning, and example sentences where the words are used.

Provide any feedback to the ques
(OPTIONAL):

rstandability of this
).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

12. Students from my classroom/classes are actively engaged using technology software and hardware tools throughout the school day.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Creating a broadcast.*

An example of this would be students using multiple computer applications and hadware in a thematic unit to produce a video. Students may use scanners, image editing software, audio clips, and video programs to complete a project.

Provide any feedback to the ques
(OPTIONAL):

rstandability of this
).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

13. Students in my classroom/classes use communication tools like iChat, Skype, or instant messaging to collaborate with others within and beyond the confines of the school day.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Example: *Promoting alternative energies.*

An example would be students collaborating via Skype (http://skype.com), a video conferencing tool, to come up with ideas for alternative sources of fuel.

Provide any feedback to the question above
(OPTIONAL):

...ty of this question (REQUIRED).
-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).
-- Select One --

---

15. Students in my classroom/classes use technology tools to construct meaning based upon prior knowledge.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Example: *Identifying marketing strategies.*

An example would be students recording prior knowledge about advertising strategies in an online forum. This would be followed by what they want to learn and finally by what they have actually learned in typical K-W-L fashion.

Provide any feedback to the question above
(OPTIONAL):

...y of this
-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).
-- Select One --

---

16. Students in my classroom/classes use technology tools to receive ongoing feedback for goals within and outside the contexts of the school day.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never Frequently

Example: *Using a blog.*

An example would be students reading through a series of books by one author and posting key points and reflections regarding each of the books to a WordPress blog. Students may invite feedback from their peers, students from another school, or perhaps even invite the author herself if she still living.

Provide any feedback to
(OPTIONAL):

...our understandability of this ...QUIRED).
-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).
-- Select One --

---

17. Students in my classroom/classes are actively engaged using online productivity tools like Citation Machine or conversion charts to complete projects.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Citing sources.* *An example would be a student using the Citation Machine allows to give credit to sources in MLA by typing pertinent information into an electronic template (http://citationmachine.net).*

Provide any feedback to th

(OPTIONAL):

r understandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

18. Students in my classroom/classes construct meaning by selecting and adapting technology tools to gather information.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Analyzing the Titanic disaster.* *An example would be students using the Internet-based resources found in a WebQuest about the Titanic to construct a model demonstrating the greatest cause for the large loss of life.*

Provide any feedback to the question abou

(OPTIONAL):

ility of this

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

19. Students in my classroom/classes use technology tools to create and plan educational goals.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Managing a schedule.* *An example would be a student using a digital calendar to plan stages of work on a science project and record the task completed.*

Provide any feedback to the ques

(OPTIONAL):

rstandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

20. Students in my classroom/classes use technology tools to participate in authentic, problem-solving projects outside of school.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Ending genocide.*

An example would be students researching the holocaust through language arts and social studies lessons to determine the reasons behind such a tragic time period. Then, students could investigate current cases of genocide like Darfur or Rwanda via the Web. Students could e-mail public leaders to promote an end to such violence.

Provide any feedback to the ... (OPTIONAL):

...understandability of this ...RED).

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

21. Students in my classroom/classes receive differentiated feedback from computer-based training tools.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Get typing feedback.*

An example would be students using a Web site that diagnoses typing skills and gives differentiated feedback based on speed, number of errors, etc. (http://www.typingweb.com).

Provide any feedback to the que... (OPTIONAL):

...erstandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

22. Students in my classroom/classes work individually using software applications to make meaning of their world.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Discovering plant cells.*

An example of this would be students indvidually following each slide of a PowerPoint covering the basic building blocks of plant life.

Provide any feedback to the questi... (OPTIONAL):

...tandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

23. Students in my classroom/classes use E-Mail to collaborate with others on assignments.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *A group project*

An example of this would be a group of students--each student with particular tasks--communicating via e-mail like gaggle.net to compile a presentation on the different cultures around the world.

Provide any feedback to the
(OPTIONAL):

understandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

24. Students in my classroom/classes experience technology through traditional instructional technologies like overhead projectors, white boards, audio players, or VHS/DVD players.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Video about sea anemones.*

An example would be students viewing a DVD to discover how anemones live and many times protect other sea creature.

Provide any feedback to the question above here in the space below (OPTIONAL):

Please rate your understandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

25. Students in my classroom/classes receive automated feedback when using technology tools for drill and practice.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Applying laws of motion.*

An example would be students making choices in a game called Order Up to get visual feedback about how the concepts of gravity and projectile motion work (http://www.iknowthat.com).

Provide any feedback to the question
(OPTIONAL):

ndability of this

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

26. Students in my classroom/classes are actively engaged in modifying technology tools to complete specific tasks.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Adapting a drawing program.*

An example would be a student using a vector program like Adobe Illustrator to map out and depict geometric shapes and angles visually.

Provide any feedback to the question above here in the space below (OPTIONAL):

Please rate your understandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

27. Students in my classroom/classes use technology tools to construct media content for sharing with an extended or global audience via the Internet.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Constructing a virtual tour.*

An example would be students designing a Web site with pages and short descriptions for each planet in the solar system. Students could create an illustration of the system in a drawing program and then construct an image map for visitors to easily click on the planet about which they wish to read.

Provide any feedback to the question a... (OPTIONAL):

...ability of this

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

28. Students in my classroom/classes are actively engaged in selecting technology tools to complete specific tasks.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Using a spreadsheet.*

An example of this would be a student choosing the automated attributes of Excel to create an interactive crossword puzzle.

Provide any feedback to the question above here in the space below (OPTIONAL):

Please rate your understandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

29. Students in my classroom/classes choose certain technology tools to assist with goal directed activities.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Monitoring plant growth.*

An example would be a student creating a table in Google Docs (http://docs.google.com) to monitor plant growth, watering, amount of sunlight, and temperature from day to day.

Provide any feedback to the question
(OPTIONAL):

...ndability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

30. Students from my classroom/classes use technology tools to construct meaning across several disciplines.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Building a house.*

An example would be students designing a house for a shop class using a CAD program while also using a spreadsheet--as learned in a computer applications course--to calculate the costs of materials and supplies.

Provide any feedback to the
(OPTIONAL):

...understandability of this ...RED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

31. Students in my classroom/classes use technology tools to solve real-world problems beyond the confines of the classroom that have meaning for the students or the community.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Creating a brochure*

An example would be students researching the characteristics of tornados at the Weather Channel site (http://www.weather.com) and using the Interactive Twister (an online simulator at http://whyfiles.org/013tornado/3.html) to predict the path of tornados as well as determine the amount of destruction caused by different sizes on the Fujita scale. The students would then come up with various solutions for keeping people protected during a storm to publish in an electr

Provide any feedback to the que
(OPTIONAL):

...erstandability of this ...).

...eption regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

32. Students in my classroom/classes experience technology through the teacher using presentation tools like PowerPoints, informative Web sites, Airliners, or SMART Board technologies.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Diagramming sentences.* *An example would be students learning how sentences go together from a teacher modeling the concept on the screen using an Airliner or other SMART presention technology tool.*

Provide any feedback to the question (OPTIONAL):

ndability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

33. Students in my classroom/classes use technology tools like WIKIs, blogs, or forums to obtain feedback from multiple sources beyond the confines of the school day.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Utilizing an LMS.* *An example would be students maintaining personal calendars, monitoring grades, evaluating progress, and responding to feedback from teachers for all their classes using a learning management system (LMS) like Moodle (http://moodle.org).*

Provide any feedback to the (OPTIONAL):

nderstandability of this RED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

34. Students in my classroom/classes configure or adapt technology tools in order to collaborate with others on assignments.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Creating a guide.* *An example of this would be students setting up a collectively managed Web site at a location like PB Works (http://pbworks.com) and then collaboratively creating pages explaining the steps in the Scientific Method.*

Provide any feedback to the (OPTIONAL):

nderstandability of this RED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

35. Students in my classroom/classes work alone using Internet tools for comprehension.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never — Frequently

Example: *Develop map-reading skills.* *At the Sheppard Software site students can learn to identify countries by clicking and dragging each while an audio file pronounces the name (http://sheppardsoftware.com).*

Provide any feedback to the question ab… (OPTIONAL):

…ability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

36. Students in my classroom/classes use technology tools to post content online to collaborate with others within and beyond the confines of the school day.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never — Frequently

Example: *Sharing cultures.* *An example would be students in New York sharing cultures with students in New Delhi via a blog (http://wordpress.org).*

Provide any feedback to the question above here in the space below (OPTIONAL):

Please rate your understandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

37. Students in my classroom/classes use technology tools to construct graphic organizers to illustrate concepts.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never — Frequently

Example: *illustrating cause and effect.* *An example would be students arranging types of pollution along with the negative effects of each using a graphic organizing tool like Kidspiration, Inspiration, or CMap.*

Provide any feedback to the question ab… (OPTIONAL):

…ability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

38. Students in my classroom/classes are actively engaged using online technology tools throughout the school day.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Producing a magazine.*

An example of this would be students utilizing multiple online resources throughout the day to research on the Internet, e-mail experts in the field, and write articles in GoogleDocs.

Provide any feedback to the questi... (OPTIONAL):

...standability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

39. Students in my classroom/classes adapt various technology tools to solve problems based on real-world scenarios.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Designing rain gardens.*

An example would be students using a computer drawing program or 3D modeling program to design a rain garden to capture runoff water from parking lots, roofs, and walkway which can often result in erosion, pollution, or flooding.

Provide any feedback to the questio... (OPTIONAL):

...tandability of this ...

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

40. Students from my classroom/classes use technology tools to make associations with other subject areas throughout the school day.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Creating a timeline.*

An example would be students using a mapping tool like Inspiration to create a timeline regarding the advent of the locomotive its impact on Westward Expansion. This could be tied to science lesson where students study how steam is used to power engines and then they create an interactive game to illustrate the process using a freeware software tool like Game Maker (http://www.yoyogames.com).

Provide any feedback to the qu... (OPTIONAL):

...derstandability of this ...ED).

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

41. Students in my classroom/classes locate technology tools to solve real-world problems in variety of ways.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Protecting wildlife.*

An example would be students selecting video podcast media to create a vodcast educating others about the endangered Burrowing Owl guidelines for protecting it.

Provide any feedback to the qu... (OPTIONAL):

...derstandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

42. Students in my classroom/classes use technology tools to solve basic problems, which require only specific routines, steps, or memorization.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Evaluating expressions.*

An example would be students using the Order of Operations to solve problems through online games like the ones at the Math Playground site (http://www.mathplayground.com)

Provide any feedback to the questio... (OPTIONAL):

...tandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

43. Students in my classroom/classes use online tools to apply solutions to authentic, real-world problems.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Track hurricanes.*

An example would be students plotting the paths of hurricanes with information from the Hurricane Strike! Web Site (http://deved.meted.ucar.edu/hurrican/strike) applying latitude and longitude. This may be accomplished at a SMART Board using mobile Airliner writing pads.

Provide any feedback to the q... (OPTIONAL):

...nderstandability of this ...RED).

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

44. Students in my classroom/classes are actively engaged in an ongoing manner using computer applications to learn beyond the confines of the school day.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Keeping a financial ledger.*

An example of this would be students using spreadsheets to learn about personal finance and sharing about related experiences using spreadsheets outside the classroom.

Provide any feedback to the question

(OPTIONAL):

dability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

45. Students from my classroom/classes conduct research using appropriate technology and apply solutions to problems based on real-world situations.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Preventing crocodile attacks.*

An example would be students using online tools and resources like United Streaming (http://streaming.discoveryeducation.com) to research crocodiles and their migration patterns. Students could create solutions for humans avoiding crocodile attacks by observing migration patterns on Web sites that display satellite data.

Provide any feedback to the question abo

(OPTIONAL):

bility of this

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

46. Students from my classroom/classes use technology tools to manage goal directed activities across disciplines.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Compiling a portfolio.*

An example would be students submitting and organizing their work for various classes in an online portfolio like Mahara (http://mahara.org)--even cataloging work over multiple years of school.

Provide any feedback to the quest

(OPTIONAL):

rstandability of this

).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

47. Students in my classroom/classes are actively engaged using computer applications for basic skills drill and practice.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Develop math skills.*

An would be students developing basic skills through solving problems in Math Baseball at the Math Arcade (http://www.funbrain.com).

Provide any feedback to the qu

(OPTIONAL):

derstandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

48. Students in my classroom/classes are actively engaged in an ongoing manner using online technology tools to learn beyond the confines of the school day.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Mapping phases of the moon.*

An example of this would be students connecting classroom experiences regarding the phases of the moon with online tools outside the school day like the calculator at the Sky & Telescope Web site in addition to using direct observation (http://www.skyandtelescope.com/observing/objects/javascri

Provide any feedback to the question abo

(OPTIONAL):

bility of this

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

49. Students from my classroom/classes use technology tools to collaborate across disciplines.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Researching energy.* *An example would be students researching alternative sources of fuel for a science class, but collaborating in an online environment with the automotive instructor and/or students.*

Provide any feedback to the que... (OPTIONAL):

...erstandability of this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

---

50. Students in my classroom/classes collaborate using digital tools to share documents and information with others on assignments.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Never Frequently

Example: *Sharing resources about dinosaurs.* *An example of this would be students using network or file-sharing capabilities to learn about different types of dinosaurs in a cooperative or jigsaw type structure.*

Provide any feedback to the question above he... (OPTIONAL):

...f this question (REQUIRED).

-- Select One --

Please rate your perception regarding other teachers' understandability of this question (REQUIRED).

-- Select One --

Submit

Appendix F: Moodle Configuration for the Second Panel

TIM Questionnaire Development

You are logged in as Rusty Meigs: Student (Return to my normal role)

Rusty Meigs Online

Rusty Meigs Online ▸ TIM Questionnaire Development

Return to my normal role

People

Participants

Topic outline

1 **Second Panel:**

Panel Members take the Technology Integration Matrix Questionnaire here!

1. You will need to click on the Technology Integration Matrix Questionnaire 2 (TIMQ2) link here in Section 1 to provide feedback concerning the understandability of each of the questions for the TIMQ.
2. First, you need the following keycode to access the questionnaire: **TeCHiNT**
3. Highlight the text **TeCHiNT** and press [Ctrl]+[C] on a PC or [Cmd]+[C] on a Mac to copy it to the clipboard.
4. Then, after clicking on the Technology Integration Matrix Questionnaire 2 (TIMQ2) link, click the curser inside the ***"Please enter the keycode provided on the researcher's Moodle site:"*** text entry box.
5. Finally, press [Ctrl]+[V] on a PC or [Cmd]+[V] on a Mac to paste the keycode and then click [Submit].
6. The **TIMQ2** will be available for you to give feedback from Tuesday, September 15, until midnight on Monday, September 28.

Technology Integration Matrix Questionnaire 2 (TIMQ2)

2 **WIKI Environment:**

TIM Questionnaire WIKI

This environment exists for you as part of my second panel to help wordsmith the draft of this questionnaire in a collaborative setting.

3 **Discussion:**

TIMQ Discussion Forum

4 **Resources:**

The Matrix at Florida Center for Instructional Technology

Calendar

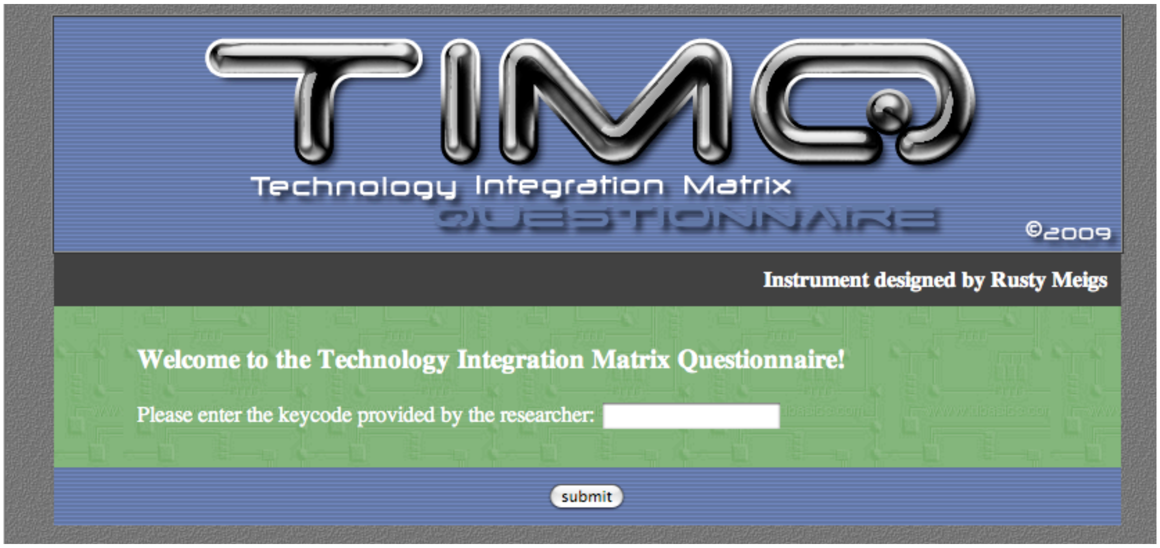
September 2009

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

Events Key

Global Course
Group User

Appendix G: Final Draft of the Technology Integration Matrix Questionnaire (TIMQ3)
(Submitted Nov. 11, 2009)



TIMQ
Technology Integration Matrix
QUESTIONNAIRE
©2009

Instrument designed by Rusty Meigs

Welcome to the Technology Integration Matrix Questionnaire!

Please enter the keycode provided by the researcher:

submit

TIMQ
Technology Integration Matrix
QUESTIONNAIRE
©2009

Instrument designed by Rusty Meigs

Just as the matrix in the popular Sci-Fi trilogy did not represent a perfect world, the Technology Integration Matrix Questionnaire does not represent a perfect instrument for measuring levels of integration in school classrooms. However, with your help it can become a perfected survey instrument. Therefore, I invite you to complete the required portions of the instrument below. Thank you in advance for taking time to complete this survey!

Instructions: The demographic section contains twelve items and the matrix questions section contains 50 questions. The questionnaire takes approximately 20-25 minutes to complete. In order to collect viable data, it is necessary you answer all items in the questionnaire with the exception of the two optional items in the demographic section. You will be prompted to click the **[BACK]** button on your Web browser if any of the required items are left unanswered. Pressing the**[Submit]** button serves as your consent to participate in this study.

DEMOGRAPHIC INFORMATION
Please complete all twelve questions below. It is not necessary to answer the questions asking your input about technology items not found in the checkbox lists.

School District: -- Select One --

Subjects Taught:

Check all grade levels you currently teach or have taught this school year:

- ☐ Pre-Kindergarten
- ☐ Kindergarten
- ☐ First
- ☐ Second
- ☐ Third
- ☐ Fourth
- ☐ Fifth
- ☐ Sixth
- ☐ Seventh
- ☐ Eighth
- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☐ Senior

How many students do you work with daily? -- Select One --

How many computers are in your room? -- Select One --

How many of these computers are connected to the Internet? -- Select One --

How many times per month do you have access to a computer lab or mobile laptop lab? -- Select One --

How many times per day do you have access to a computer lab or mobile laptop lab? -- Select One --

Check all of the items or technologies you have in your classroom.

- ☐ Airliner
- ☐ Backpack
- ☐ Clickers
- ☐ Digital Camera
- ☐ Doc Camera
- ☐ Handheld GPS
- ☐ Interwrite Mobi
- ☐ Interwrite Tablet
- ☐ Mimio Tablet
- ☐ Projector
- ☐ SMART Board
- ☐ VCR/DVD Player
- ☐ Web Cam
- ☐ None

(OPTIONAL) Type in any items or technologies you have in your classroom not shown on this list.

Check all of the items or technologies to which you have access in your building or district.

- ☐ Airliner
- ☐ Backpack
- ☐ Clickers
- ☐ Digital Camera
- ☐ Doc Camera
- ☐ Handheld GPS
- ☐ Interwrite Mobi
- ☐ Interwrite Tablet
- ☐ Mimio Tablet
- ☐ Projector
- ☐ SMART Board
- ☐ VCR/DVD Player
- ☐ Web Cam
- ☐ None

(OPTIONAL) Type in any items or technologies not shown on this list but to which you have access in your building or district.

How many times per year do you take part in technology professional development opportunities in your building or district? -- Select One --

TECHNOLOGY INTEGRATION MATRIX QUESTIONS
Please complete all 50 questions below. To see a detailed description for each example, simply position or hover your mouse cursor over the underlined text and a popup box will appear.

1. Students in my classroom/classes are actively engaged using computer applications for basic skills drill and practice. ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Developing math skills*. Never — Frequently

2. Students in my classroom/classes use technology tools to post content online to collaborate with others within and beyond the confines of the school day. ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Sharing cultures*. Never — Frequently

3. Students in my classroom/classes use online tools to apply solutions to authentic, real-world problems. ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Tracking hurricanes*. Never — Frequently

4. Students in my classroom/classes use communication tools like E-Mail to collaborate with others on assignments.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Understanding diverse cultures*.	Never				Frequently
5. Students from my classroom/classes are actively engaged using technology software and hardware tools throughout the school day.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Creating a broadcast*.	Never				Frequently
6. Students from my classroom/classes use technology tools to manage goal directed activities across disciplines.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Compiling a portfolio*.	Never				Frequently
7. Students in my classroom/classes use technology tools to solve basic problems, which require only specific routines, steps, or memorization.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Evaluating expressions*.	Never				Frequently
8. Students in my classroom/classes are actively engaged in adapting technology tools to complete specific tasks.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Adapting a drawing program*.	Never				Frequently
9. Students in my classroom/classes collaborate using digital tools to share documents and information with others on assignments.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Sharing resources about dinosaurs*.	Never				Frequently
10. Students from my classroom/classes use technology tools to make associations with other subject areas throughout the school day.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Creating a timeline*.	Never				Frequently
11. Students in my classroom/classes are actively engaged using online productivity tools like Citation Machine or conversion charts to complete projects.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Citing sources*.	Never				Frequently
12. Students in my classroom/classes construct meaning by selecting and adapting technology tools to gather information.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Analyzing the Titanic disaster*.	Never				Frequently

13. Students in my classroom/classes use technology tools to receive ongoing feedback for goals within and outside the contexts of the school day.

Example: _Using a blog_.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

14. Students in my classroom/classes use technology tools to construct media content for sharing with an extended or global audience via the Internet.

Example: _Constructing a virtual tour_.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

15. Students in my classroom/classes are actively engaged using online technology tools throughout the school day.

Example: _Producing a magazine_.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

16. Students in my classroom/classes configure or adapt technology tools in order to collaborate with others on assignments.

Example: _Creating a guide_.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

17. Students in my classroom/classes are actively engaged using computer-based tutorials to learn basic skills.

Example: _Completing a tutorial_.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

18. Students in my classroom/classes use technology tools like WIKIs, blogs, or forums to obtain feedback from multiple sources beyond the confines of the school day.

Example: _Utilizing a learning management system_.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

19. Students from my classroom/classes use technology tools to collaborate throughout the school day.

Example: _Describing electrical circuits_.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

20. Students in my classroom/classes modify technology tools to meet specific requirements of goal directed activities.

Example: _Organizing research_.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Never — Frequently

21. Students in my classroom/classes experience technology through traditional instructional technologies like overhead projectors, white boards, audio players, or VHS/DVD players.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Watching a video about sea life*.	Never				Frequently
22. Students in my classroom/classes adapt various technology tools to solve problems based on real-world scenarios.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Designing rain gardens*.	Never				Frequently
23. Students in my classroom/classes use technology tools to construct meaning through the creation of products like media, Podcasts, or electronic publications.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Creating a PSA*.	Never				Frequently
24. Students in my classroom/classes use technology tools to solve problems generally unrelated to real-word situations.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Pronouncing Spanish words*.	Never				Frequently
25. Students in my classroom/classes work individually using software applications to make meaning of their world.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Discovering plant cells*.	Never				Frequently
26. Students from my classroom/classes conduct research using appropriate technology and apply solutions to problems based on real-world situations.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Preventing crocodile attacks*.	Never				Frequently
27. Students in my classroom/classes use communication tools like iChat, Skype, or instant messaging to collaborate with others within and beyond the confines of the school day.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Promoting alternative energies*.	Never				Frequently
28. Students in my classroom/classes choose certain technology tools to assist with goal directed activities.	○ 1	○ 2	○ 3	○ 4	○ 5
Example: *Monitoring plant growth*.	Never				Frequently

29. Students in my classroom/classes use technology tools to monitor and evaluate their activities.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Learning vocabulary*.

Never Frequently

30. Students in my classroom/classes receive automated feedback when using technology tools for drill and practice.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Applying laws of motion*.

Never Frequently

31. Students in my classroom/classes are actively engaged in selecting technology tools to complete specific tasks.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Using a spreadsheet*.

Never Frequently

32. Students from my classroom/classes select appropriate technology tools from several disciplines to solve real-world problems.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Colonizing the moon*.

Never Frequently

33. Students in my classroom/classes use technology tools to create and plan educational goals.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Managing a schedule*.

Never Frequently

34. Students in my classroom/classes use technology tools to participate in authentic, problem-solving projects outside of school.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Ending genocide*.

Never Frequently

35. Students from my classroom/classes use appropriate software tools to manage goal directed activities throughout the school day.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Maintaining a calendar*.

Never Frequently

36. Students in my classroom/classes are actively engaged in an ongoing manner using computer applications to learn beyond the confines of the school day.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Keeping a financial ledger*.

Never Frequently

37. Students in my classroom/classes use technology tools to construct graphic organizers to illustrate concepts. **Example:** *Illustrating cause and effect*.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 Never Frequently
38. Students in my classroom/classes use inquiry-based technology tools to construct meaning. **Example:** *Constructing models*.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 Never Frequently
39. Students in my classroom/classes choose tools like chatting, blogs, or discussion forums to collaborate with others on assignments. **Example:** *Identifying character roles in a story*.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 Never Frequently
40. Students in my classroom/classes use technology tools to solve real-world problems beyond the confines of the classroom that have meaning for the students or the community. **Example:** *Creating a brochure*	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 Never Frequently
41. Students in my classroom/classes receive differentiated feedback from computer-based training tools. **Example:** *Receiving feedback about typing*.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 Never Frequently
42. Students in my classroom/classes use software applications to solve content-specific problems given real-world parallels. **Example:** *Monitoring weather patterns*.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 Never Frequently
43. Students in my classroom/classes experience technology through the teacher using presentation tools like PowerPoints, informative Web sites, Airliners, or SMART Board technologies. **Example:** *Diagramming sentences*.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 Never Frequently
44. Students in my classroom/classes are actively engaged in an ongoing manner using online technology tools to learn beyond the confines of the school day. **Example:** *Mapping phases of the moon*.	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 Never Frequently

45. Students in my classroom/classes use technology tools to construct meaning based upon prior knowledge.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Identifying marketing strategies*.

Never Frequently

46. Students from my classroom/classes use technology tools to collaborate across disciplines.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Researching energy*.

Never Frequently

47. Students in my classroom/classes are actively engaged using productivity tools like word processors to create reports.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Writing a report*.

Never Frequently

48. Students in my classroom/classes work alone using Internet tools for comprehension.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Develop map-reading skills*.

Never Frequently

49. Students in my classroom/classes locate technology tools to solve real-world problems in a variety of ways.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Protecting wildlife*.

Never Frequently

50. Students from my classroom/classes use technology tools to construct meaning across several disciplines.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Example: *Building a house*.

Never Frequently

Submit

Appendix H: Institutional Review Board Request

BAKER UNIVERSITY
SCHOOL OF EDUCATION
GRADUATE DEPARTMENT

Proposal for Research
Submitted to the Baker University Institutional Review Board

I. Research Investigator(s) (Students must list faculty sponsor first)

Department(s) **School of Education Graduate Department**

Name Signature

1. Susan Rogers ________________, Major Advisor

2. Brad Tate ________________, Advisor

3. Dan Falvey University Committee Member

4. Christy Ziegler External Committee Member

Rusty Meigs ________________, Principal investigator

Phone (913) 548-7307

Email rmeigsec@olatheschools.com

Address 1520 S. 6th St. E.

Louisburg, KS 66053

Expected Category of Review: ___Exempt _X_Expedited ___Full

II. Protocol Title

The Development and Field Test of the Technology Integration Matrix Questionnaire

III. Summary
The following summary must accompany the proposal. Be specific about exactly what participants will experience, and about the protections that have been included to safeguard participants from harm. Careful attention to the following may help facilitate the review process:

In a sentence or two, please describe the background and purpose of the research.

The Technology Integration Matrix developed by the Florida Center for Instructional Technology was designed as a two dimensional model to represent five levels (columns) of technology integration, five types (rows) of constructivist environments, and 25 indicators representing the cells where the columns and rows meet. Because no instrument had been developed to reliably measure these indicators and because the model had primarily been used to evaluate entire buildings, the purpose of this study was to construct, modify, and test an instrument to measure indicators of technology integration by individual teachers.

Briefly describe each condition or manipulation to be included within the study.

This study doesn't involve any conditions or manipulations.

What measures or observations will be taken in the study? If any questionnaire or other instruments are used, provide a brief description and attach a copy.

The attached Technology Integration Matrix Questionnaire was created as the measurement instrument for this study. The instrument consists of several demographic questions for obtaining data regarding a teacher's school district, technology equipment availability, Internet accessibility, and professional development. Next, 50 questions have been developed to measure the 25 indicators represented by the intersecting cells of the five levels of technology integration and the five types of constructivist learning environments as represented in the model. To check for internal consistency, two questions have been written to measure each indicator.

Because this study focuses on the development and field testing of a technology integration instrument, measurements and observations will be made concerning the questionnaire's validity and reliability. An expert panel will provide feedback regarding content validity. A K-12 tech leaders' panel will provide feedback regarding understandability. Construct validity will be determined through the use of a factor analysis on the field test data from a pilot sample of district teachers. Finally, a Cronbach's Alpha will be run on the field test data to check for reliability.

Will the subjects encounter the risk of psychological, social, physical or legal risk? If so, please describe the nature of the risk and any measures designed to mitigate that risk.

There is no psychological, social, physical, or legal risk involved because the questions in the instrument relate to educational technology and are noninvasive in nature.

Will any stress to subjects be involved? If so, please describe.

Stress will not be involved because the questions in the instrument relate to educational technology and are noninvasive in nature.

Will the subjects be deceived or misled in any way? If so, include an outline or script of the debriefing.

There is no debriefing, and subjects will not be deceived or misled in any way.

Will there be a request for information which subjects might consider to be personal or sensitive? If so, please include a description.

General demographic questions like the type of school district (rural, suburban, or urban), equipment availability, and Internet access will be asked of the subjects. None of these questions, however, are considered to be of a personal or sensitive nature.

Will the subjects be presented with materials which might be considered to be offensive, threatening, or degrading? If so, please describe.

Subjects will not be presented with materials which might be considered to be offensive, threatening, or degrading.

Approximately how much time will be demanded of each subject?

There are demographic questions and 50 questions designed to measure the 25 indicators in the Technology Integration Matrix. Therefore, it is estimated, respondents will take no more than 45 minutes to complete the questionnaire electronically.

Who will be the subjects in this study? How will they be solicited or contacted? Provide an outline or script of the information which will be provided to subjects prior to their volunteering to participate. Include a copy of any written solicitation as well as an outline of any oral solicitation.

The first set of subjects will be an expert panel. This group will consist of the original developers of the Technology Integration Matrix, educational technology leaders from the Advanced Learning Technologies (ALTEC) project at the University of Kansas Center for Research on Learning, district technology leaders from Topeka, and Olathe District Schools. They will be contacted via an invitational E-Mail using the script below:

> I would like to invite you to serve on an expert panel regarding my dissertation on technology integration. I am currently doing my research on the development of a questionnaire to measure levels of technology integration (entry, adoption, adaptation, infusion, invention) across five constructivist environments (active, collaborative, constructive, authentic, goal directed) according to the 25 indicators found in the Technology Integration Matrix (TIM) located at http://fcit.usf.edu/matrix.
>
> I have received permission to use this model from Dr. Roy Winkelman, the Director of the Florida Center for Instructional Technology out of the University

of South Florida. In fact, he made an effort to get in touch with me about developing an instrument since none currently exists. His new model is being used extensively throughout Florida's K-12 schools as well as in districts across the nation. Even so, most constituents are only able to use the model for measuring integration at the building level and not at the individual teacher level. That is where the Technology Integration Matrix Questionnaire or TIMQ I created comes into play.

The instrument is made up of several demographic questions and then 50 questions to measure the 25 indicators in the TIM. I set up my own Web hosting account at rustymeigs.com and installed my own Moodle Server at moodle.rustymeigs.com. I created a form in PHP & MySQL for respondents to submit electronically during the pilot testing stage. Right now the form has additional entry areas for feedback as well as places for you to rate how well you think my questions measure levels of frequency for the indicators. I placed the draft text in a WIKI for you to help wordsmith the document collaboratively. And finally, there is a discussion forum thread where you can converse about the draft with me and other panel members.

I would be grateful if you would join me in this groundbreaking study for the development of this unique instrument. Once I have received your feedback I will be sending the revised instrument on to the next K-12 tech leadership panel to check for understandability. Finally, the polished questionnaire will be sent to K-12 public educators in Kansas and Missouri for field testing. The great part about all of this is that the panel discussions and interactions can be carried out completely online and at your convenience. Thank you in advance if you are able to assist me in this exciting endeavor!

If you go to moodle.rustymeigs.com, you can each log in with the usernames and passwords below. You will be asked to change your password once you get in. Please let me know if you have any trouble logging in or have any other questions. Thank you.

The second set of subjects will be a K-12 tech leaders' panel. This panel will consist of secondary educators from the Tech Leadership Team at Olathe Northwest High School and elementary educators from across the Olathe District Schools involved in the pilot of the Moodle learning management system. They will be contacted via invitational E-Mail using the following script:

I would like to invite you to serve on a K-12 tech panel regarding my dissertation on technology integration. I am currently doing my research on the development of a questionnaire to measure levels of technology integration (entry, adoption, adaptation, infusion, invention) across five constructivist environments (active, collaborative, constructive, authentic, goal directed) according to the 25 indicators found in the Technology Integration Matrix (TIM) located at http://fcit.usf.edu/matrix.

I received permission to use this model from Dr. Roy Winkelman, the Director of the Florida Center for Instructional Technology out of the University of

South Florida. The model is being used extensively throughout Florida's K-12 schools as well as in districts across the nation. Even so, most constituents are only able to use the model for measuring integration at the building level and not at the individual teacher level. That is where the Technology Integration Matrix Questionnaire or TIMQ I created comes into play. The instrument is made up of several demographic questions and then 50 questions to measure the 25 indicators in the TIM. I would be grateful if you could provide input or suggestions regarding the demographics questions and then item-by-item feedback regarding the understandability of the 50 questions.

For your convenience, I set up a Web hosting account at rustymeigs.com and installed a Moodle Server at moodle.rustymeigs.com. I created a form in PHP & MySQL for respondents to submit data electronically during the pilot testing stage. Right now the form has additional entry areas for feedback as well as places for you to rate the understandability of the questions. Text regarding the latest draft of the instrument is located in a WIKI for you to help wordsmith the document collaboratively. And finally, there is a discussion forum thread where you can converse about the latest draft with me and other panel members.

I would be grateful if you would join me in this groundbreaking study for the development of this unique instrument. Once I have received your feedback and made changes the polished questionnaire will be sent to K-12 public educators in Kansas and Missouri for pilot testing. The unique part about all of this is that the panel discussions and interactions can be carried out completely online and at your convenience. Thank you in advance if you are able to assist me in this exciting endeavor. If you go to moodle.rustymeigs.com, you can each log in with the usernames and passwords below. You will be asked to change your password once you get in. Please let me know if you have any trouble logging in or have any other questions. Thank you.

The pilot study subjects will consist of K-12 public school teachers in all subject areas. The pilot will include teachers from Olathe District Schools, Gardner-Edgerton School District, Louisburg School District, Central Heights School District, Kansas City, Kansas School District, the Lee's Summit School District, and the Raymore-Peculiar School District. Pilot subject will be contacted via invitational E-Mail using the following script:

Dear Teacher:

I would like to invite you to participate in the pilot of a questionnaire instrument on technology integration. The instrument was created to measure levels of technology integration within various learning environments as outlined in a model known as the Technology Integration Matrix created at the Florida Center for Instructional Technology (FCIT) out of the University of South Florida.

Your participation in this pilot by completing the questionnaire located at the following URL, http://timq.net, is not only appreciated, but will aid in the development of a unique tool designed to measure technology usage and integration in individual teachers' classrooms. The goal behind creating such an instrument along with its subsequent field test is to provide teachers with a tool to gauge their technology integration practices and offer insights for future improvements regarding these practices. Additionally, you will find the FCIT's Technology Integration Matrix a valuable resource for incorporating technology into classroom instruction.

I thank you in advance for taking time out to provide input concerning the pilot of this instrument.

Sincerely,
Rusty Meigs.

While steps will be taken to insure that each subject's participation is voluntary? What if any inducements will be offered to the subjects for their participation?

Subjects' participation is voluntary. Participants will be invited to participate via a cover letter or E-Mail introduction. Possible inducements might be sharing the data with respondents in the pilot.

How will you insure that the subjects give their consent prior to participating? Will a written consent form be used? If so, include the form. If not, explain why not.

No consent form will be used because the questionnaire is to be administered electronically. E-Mail and the online instructions to the pilot subjects will state: "Completing the questions and then submitting this questionnaire serves as your consent to participating in this study."

Will any aspect of the data be made a part of any permanent record that can be identified with the subject? If so, please explain the necessity.

No aspect of the data will be made part of any permanent record.

Will the fact that a subject did or did not participate in a specific experiment or study be made part of any permanent record available to a supervisor, teacher or employer? If so, explain.

The fact that a subject did or did not participate in a specific experiment or study will not be made part of any permanent record.

What steps will be taken to insure the confidentiality of the data?

The anonymous surveys will be submitted electronically. Names of the pilot participants will not be used.

If there are any risks involved in the study, are there any offsetting benefits that might accrue to either the subjects or society?

There are no risks involved in this study.

Will any data from files or archival data be used? If so, please describe.

No data from files or archival data will be used.

Appendix I: Institutional Review Board Approval

01 September 2009

Rusty Meigs
1520 S. 6^{th} St. E.
Louisburg, KS 66053

1858
BAKER
UNIVERSITY

Dear Mr Meigs:

The Baker University IRB has reviewed your research project application (M-0072-0809-0901) and approved this project under Exempt Review. As described, the project complies with all the requirements and policies established by the University for protection of human subjects in research. Unless renewed, approval lapses one year after approval date.

The Baker University IRB requires that your consent form must include the date of approval and expiration date (one year from today). Please be aware of the following:

1. At designated intervals (usually annually) until the project is completed, a Project Status Report must be returned to the IRB.
2. Any significant change in the research protocol as described should be reviewed by this Committee prior to altering the project.
3. Notify the OIR about any new investigators not named in original application.
4. Any injury to a subject because of the research procedure must be reported to the IRB Chair or representative immediately.
5. When signed consent documents are required, the primary investigator must retain the signed consent documents for at least three years past completion of the research activity. If you use a signed consent form, provide a copy of the consent form to subjects at the time of consent.
6. If this is a funded project, keep a copy of this approval letter with your proposal/grant file.

Please inform Office of Institutional Research (OIR) or myself when this project is terminated. As noted above, you must also provide OIR with an annual status report and receive approval for maintaining your status. If your project receives funding which requests an annual update approval, you must request this from the IRB one month prior to the annual update. Thanks for your cooperation. If you have any questions, please contact me.

Sincerely,

Marc L Carter, PhD
Chair, Baker University IRB

CC: Susan Rogers

P.O. Box 65, Baldwin City
Kansas 66006-0065
785-594-6451 • fax 785-594-2522
www.bakeru.edu

Appendix J: E-Mail Invitations to Panel Members

Rusty Meigs - Technology Integration Dissertation

From: Rusty Meigs
To: Carolyn Good; Connie Smith; Denise Griffey; Gretchen Sherk; jana@alt...
Date: 4/15/2009 3:01 PM
Subject: Technology Integration Dissertation

I would like to invite you to serve on an expert panel regarding my dissertation on technology integration. I am currently doing my research on the development of a questionnaire to measure levels of technology integration (entry, adoption, adaptation, infusion, invention) across five constructivist environments (active, collaborative, constructive, authentic, goal directed) according to the 25 indicators found in the **Technology Integration Matrix** (**TIM**) located at http://fcit.usf.edu/matrix/.

Not only have I received permission to use this model from Dr. Roy Winkelman, the Director of the **Florida Center for Instructional Technology** out of the **University of South Florida**, he made an effort to get in touch with me about developing an instrument since none currently exists. The model is being used extensively throughout Florida's K-12 schools as well as in districts across the nation. Even so, most constituents are only able to use the model for measuring integration at the building level and not at the individual teacher level. That is where the **Technology Integration Matrix Questionnaire** or **TIMQ** I created comes into play. I have already received positive feedback from one of the original developers of the model from the **Florida Department of Education**, but could certainly use your expert input.

The instrument is made up of several demographic questions and then 50 questions to measure the 25 indicators in the TIM. I set up my own Web hosting account at rustymeigs.com and installed my own **Moodle Server** at moodle.rustymeigs.com. I created a form in PHP & MySQL for respondents to submit electronically during the field testing stage. Right now the form has additional entry areas for feedback as well as places for you to rate how well you think my questions measure levels of frequency for the indicators. I placed the draft text in a WIKI for you to help wordsmith the document collaboratively. And finally, there is a discussion forum thread where you can converse about the draft with me and other panel members.

I would be grateful if you would join me in this groundbreaking study for the development of this unique instrument at all possible, I would like to get some feedback from you in the next couple of weeks so I can get revisions out to t more panels by the end of April or first of May and finally a polished questionnaire out to the masses in Kansas and Missouri for field testing before everyone leaves for Summer Break. The great part about all of this is that the panel discussions and interactions can be carried out completely online and at your convenience. Thank you in advance if are able to assist me in this exciting endeavor!

If you go to moodle.rustymeigs.com, you can each log in with the usernames and passwords below. You will be ask to change your password once you get in. Please let me know if you have any trouble logging in or have any other questions. Thank you!

Username **Password**

Rusty Meigs, M.Ed.
e-Communication Instructor
Olathe Northwest High School
21300 College Boulevard
Olathe, KS 66061

Phone: 913.780.7150 ext. 2409
FAX: 913.780.7159

From: Rusty Meigs [mailto:rmeigsec@olatheschools.com]
Sent: Monday, September 14, 2009 7:01 PM
To: Amber Dawkins; Amy Osipik; Angie Hedges; Anthony Snethen; Bruce Wellman; Chad Ralston; David Sinha; Diane Johnson; Drew Keiter; Greg Smith; Gwen Poss; Jennifer Addington; Jon Krug; Josh Anderson; Kate Thompson; Kevin Hulsen; Kim Dahl; Linda Armstrong; Liz Anderson; Melinda Robino; Michelle Anderson; Ron Spalding; Rosie Garrett; Sarah Williams; Sharen Miller; Tamara Colburn; Terri Clark; Theresa Carter
Subject: Tech Leadership Panel Request

Dear ONW Tech Leadership Team and District Moodle Participants,

I would like to invite you to serve on a K-12 tech panel regarding my dissertation on technology integration. I am currently doing my research on the development of a questionnaire to measure levels of technology integration (entry, adoption, adaptation, infusion, invention) across five constructivist environments (active, collaborative, constructive, authentic, goal directed) according to the 25 indicators found in the Technology Integration Matrix (TIM) located at *http://fcit.usf.edu/matrix.*

I received permission to use this model from Dr. Roy Winkelman, the Director of the Florida Center for Instructional Technology out of the University of South Florida. The model is being used extensively throughout Florida's K-12 schools as well as in districts across the nation. Even so, most constituents are only able to use the model for measuring integration at the building level and not at the individual teacher level. That is where the Technology Integration Matrix Questionnaire or TIMQ I created comes into play. The instrument is made up of several demographic questions and then 50 questions to measure the 25 indicators in the TIM. I would be grateful if you could provide input or suggestions regarding the demographics questions and then item-by-item feedback regarding the understandability of the 50 questions.

For your convenience, I set up a Web hosting account at rustymeigs.com and installed a Moodle Server at moodle.rustymeigs.com. I created a form in PHP & MySQL for respondents to submit data electronically during the pilot testing stage. Right now the form has additional entry areas for feedback as well as places for you to rate the understandability of the questions. Text regarding the latest draft of the instrument is located in a WIKI for you to help wordsmith the document collaboratively. And finally, there is a discussion forum thread where you can converse about the latest draft with me and other panel members.

I would be grateful if you would join me in this groundbreaking study for the development of this unique instrument. Once I have received your feedback and made changes the polished questionnaire will be sent to K-12 public educators in Kansas and Missouri for pilot testing. The unique part about all of this is that the panel discussions and interactions can be carried out completely online and at your convenience. Thank you in advance if you are able to assist me in this exciting endeavor.

If you go to **moodle.rustymeigs.com**, you can each log in with the usernames and passwords below. You will be asked to change your password once you get in. Once you've changed your password, click on the **Dissertation** link and then the **TIM Questionnaire Development** link to enter the course. Follow the instructions in the **TIMQ2:** Section 1 to proceed. The **TIMQ2** will be available for you to give feedback from Tuesday, September 15, until midnight on Monday, September 28. Please let me know if you have any trouble logging in or any other questions. Thank you.

Sincerely, Rusty.

Moodle Usernames & Passwords

Rusty Meigs, M.Ed.
Senior Web Architect
Olathe District Schools

Appendix K: E-Mail Research Request

From: Rusty Meigs
To: bestp@usd416.org
Date: 10/30/2009 3:19 PM
Subject: Technology Integration Research Request
CC: zoellners@usd416.org

Dear Dr. Best,

As a doctoral student at Baker University, I am currently working on my Clinical Research Study concerning technology integration. After a decade of supporting teachers in their efforts to integrate technology within classroom settings, I continue to witness the need for implementation of best practices. Consequently, I am working with the Florida Center for Instructional Technology and the Florida Department of Education to conduct groundbreaking research on a survey instrument I created to measure integration based on their model: the Technology Integration Matrix or TIM. The Matrix is unique in that it measures levels of integration in different types of learning environments. While the model is currently being used to measure integrative practices of entire school buildings across the nation, my survey instrument, the Technology Integration Matrix Questionnaire (TIMQ), was designed to measure teaching practices individually.

I would like to invite teachers in your district to participate in the pilot of this survey instrument. As your district seeks to remain current regarding best practices in teaching with technology, please consider the benefit of having your teachers take part in this online pilot. Not only can they gain ideas for implementing integration activities into their own classrooms (based on real-world examples I developed for each question), they would be helping to refine an instrument your district could use in the future to measure technology practices. The questionnaire is completely anonymous, takes approximately 20-25 minutes to complete online, and the data collected from this pilot will be used solely for the purpose of determining the instrument's quality. This version will not be used to evaluate teachers' performance in the classroom. Though several area school districts are allowing all of their staff to take part, I need as many completed surveys as possible to determine the reliability of the instrument.

If you are willing to allow teachers in your district participate, please respond to this E-Mail indicating you grant permission. Once I have received this permission, I will be sending a letter of invitation with guidelines and dates the survey is open for you to share with your teaching staff. Ideally, I would like to send this survey instrument out to your staff as early as next week, the first week in November. To view a working copy of this instrument, please go to http://moodle.rustymeigs.com/timq3.php. Type in **tech2009** for the key code. Please let me know if you have any questions and thank you in advance for considering this request.

Sincerely, Rusty.

Rusty Meigs, M.Ed.
Senior Web Architect
Olathe District Schools

Appendix L: E-Mail Research Approval Letters

From: jharrison@usd273.org
Sent: Friday - February 5, 2010 1:02 PM
To: Rusty Meigs [mailto:rmeigsec@olatheschools.com]
Subject: Re: Research

I think both principals sent your invitation out before noon today. You may contact them directly if you have the time. I thought the list serve would help you with your timeline.

>>> "Joe Harrison" <jharrison@usd273.org> 2/5/2010 9:24 AM >>>
I am touching base with my principals this morning. I think we will be able to give our teachers the opportunity to participate. Do you want us to send your invitation out on our list serve?
I am touching base with my principals this morning. I think we will be able to give our teachers the opportunity to participate. Do you want us to send your invitation out on our list serve?

Dr. Joe Harrison
Superintendent
USD 273
Beloit, Kansas 67420

From: "Robert Stegner" <rstegner@usd288.org>
To: "Rusty Meigs" <rmeigsec@olatheschools.com>
Date: 11/24/2009 8:28 AM
Subject: RE: Technology Integration Research Invitation

Rusty,

Sorry for the delay, I have been a little swamped the past couple weeks!!! Anyway, I just sent the email off to my superintendent for approval which "Should" be a formality and then it will go out to the teachers before lunch today.

Is there any way to get the results after you have compiled them?

Thanks

Robert Stegner
Technology Director
Central Heights USD 288

From: Jeff Mildner <JMildner@usd232.org>
To: "'Rusty Meigs'" <rmeigsec@olatheschools.com>
Date: 12/4/2009 11:29 AM
Subject: RE: Additional Info About Tech Integration Questionnaire
CC: Ron Wimmer <RWimmer@usd232.org>, "Earl A. Martin" <EMartin@usd232.org>

Rusty,

We would like to participate in this study. Could we have access to the instrument so we can see the questions you are asking?

Thanks,

Jeff Mildner
Director of Technology
De Soto USD 232

From: "Christy Ziegler" <ZieglerC@usd231.com>
To: "Rusty Meigs" <rmeigsec@olatheschools.com>
Date: 11/2/2009 11:51 AM
Subject: Re: Technology Integration Research Request

Let me know when you're ready to have teachers start completing.

cz

Christy Ziegler, Ph.D.
Director of Educational Services

Gardner Edgerton USD 231
231 E. Madison/PO Box 97
Gardner, KS 66030

From: "Pam Best" <BestP@usd416.org>
To: <prvs=15616139c7=rmeigsec@olatheschools.com>, "Rusty Meigs" <rmeigsec@ol...
Date: 11/6/2009 3:11 PM
Subject: Re: Technology Integration Research Request

Rusty,

We are interested in participating in your survey. Let us know what the next step is.

Pam

Dr. Pam Best
Assistant Superintendent
Louisburg - USD 416
29020 Mission Belleview Road
Louisburg, KS 66053

From: "Phil Elliott" <Elliott@usd230.org>
To: "Rusty Meigs" <rmeigsec@olatheschools.com>
Date: 12/8/2009 11:00 AM
Subject: Re: Technology Integration Research Request

Rusty, I got approval today, the only requirement is that it is optional. How would you like to go about distributing it? Would you like me to send it out?

Just let me know what your plans are so I can prepare everyone.

Thanks,

Phil Elliott
Director of Technology
Spring Hill Schools, USD 230
304 S Webster St.
Spring Hill KS, 66083

From: "Sedler, Michelle" <Sedlerm@turnerusd202.org>
To: "'Rusty Meigs'" <rmeigsec@olatheschools.com>
Date: 11/2/2009 9:45 AM
Subject: RE: Technology Integration Research Request

Rusty…

Thanks for considering Turner USD 202 for your research study. I would be happy to assist in promoting the survey for you. I can't guarantee how much participation you will receive, but I will definitely send it out for you. I'm assuming this will all be electronic with no paper including the letter and invite – correct?

Michelle H. Sedler
Superintendent of Schools
Turner USD 202
800 S. 55th St.
Kansas City, KS 66106

From:cristie.devane@polk-fl.net [mailto:cristie.devane@polk-fl.net]
Sent: Wednesday, January 20, 2010 4:03 PM
To: Black, Jenny
Cc: virginia.richard@polk-fl.net; marcia.hall@polk-fl.net
Subject: RE: Tech Research Invitation: TIM Questionnaire

Jenny,

Thanks for including us on this study and we're in the process of surveying our tech coaches to see how many would like to participate. As soon as we have the results, I'll send you the number that will be participating which should be early next week.

Cristie DeVane, Sr. Manager
School Technology Services Department
Information Systems & Technology Division
Polk County Schools

"The mission of Polk County Public Schools is to ensure rigorous, relevant learning experiences for our students that result in high achievement."

From: Black, Jenny [mailto:Jenny.Black@fldoe.org]
Sent: Friday, January 08, 2010 4:01 PM
To: Jeni Brewin-Columbia; Don Manderson; bridgess@mail.gcps.k12.fl.us; Aaron Wiley-GilchristSTAR; Melissa Harts ; Christy English; Betina Hurst; Patti Elkin -Lee; Kim Edington; Delores Noechel-Okaloosa; shawna.may@okee.k12.fl.us; Perreault, George O.; Cheryl Stepp-Osceola; Jay Feliciani-Pasco; DeVane, Cristie T.; Marsha Cruce; Vickie Beagle-Santa Rosa; Greene, Jimmy; Andy Howard-Walton
Cc: Kemker, Kate
Subject: Tech Research Invitation: TIM Questionnaire

A PhD candidate in Kansas has created a questionnaire to gauge teachers' technology integration practices based on Florida's Technology Integration Matrix (TIM). He is looking for research participants for his dissertation study. If you would like to involve some of your classroom teachers in this study, please respond and let me know how many teachers you will send out the invitation to. Mr. Meigs has prepared a sample email with instructions to send out, which I'll send along if you decide to participate.

At the completion of the study, Mr. Meigs will prepare a report for your district which will show aggregate data for the district organized by grade level and subject taught.

Participation in this study is voluntary. You can preview the tool at http://timq.rustymeigs.com/test.php, Passcode: tech2010.

Florida's research team is also preparing additional tools to use with the TIM and more information about these tools will be coming out in the near future.

Contact me with any questions.

Thanks,

Jenny Black
Office of Technology Learning and Innovation
Florida Department of Education

Appendix M: Lawrence and Olathe Formal Requests and Approvals

APPLICATION TO CONDUCT RESEARCH IN LAWRENCE PUBLIC SCHOOLS

Name **Rusty Meigs** Local Address **1520 S. 6th St. E., Louisburg, KS 66053**

Email Address **rpmeigsec@olatheschools.com**

Date **November 20, 2009** Department **Web Services** Phone **W: (913) 780-8183; Cell: (913) 548-7307**

IRB (Protection of Human Subjects of Research) approval number **M-0072-0809-0901**

Date granted **September 1, 2009**

State briefly the purposes of the study and summarize the procedures to be employed including unique educational values to the Lawrence schools.

The purpose of the study was to develop an instrument capable of measuring levels of technology integration in Constructivist classroom environments with a subsequent field test of the instrument to determine its reliability. While the Technology Integration Matrix model developed by the Florida Center for Instructional Technology refers these indicators and can be used to observe schools at the organization level, this researcher created a questionnaire to measure these indicators at the individual teacher level.

Procedures:

1. **Upon approval by the Lawrence Public School District, an invitational e-mail will be sent to all certified teaching staff providing aWeb URL and access keycode for staff to complete at their convenience.**
2. **Teachers agreeing to participate should be able to complete the anonymous survey instrument in approximately 20-25 minutes.**
3. **Completed respondent data is collected instantaneously in a MySQL database. These results will be provided to the district upon request.**

Benefits to the district include teachers increasing their awareness of technology integration practices by hovering over the examples associated with each of the questions, using the tool as a self-evaluative instrument for measuring their integrative practices in the classroom developing subsequent professional growth goals, and reaching higher levels of technology integration in classroom practices once a more comprehensive instrument is developed following the study.

School(s) and/or grades(s) to be involved **All Lawrence Schools**

Number of pupils or subjects involved **approx. 900 teachers** Grade levels(s) **Pre-K - 12**

Starting date **Early December**

Amount of pupil/subject time required **20-25 minutes per teacher** Ending date **Dec. 18, 2009**

Date project report available **Feb. 1, 2010**

By signing below the researcher agrees:

◊ to respect the highly confidential nature of the information collected.
◊ to reimburse the district for any additional district staff time required to complete the project.
◊ that data collected in connection with an approved study may not be used for purposes other than those state on this application form.
◊ To obtain specific approval prior to publication of such research (other than as specified in this proposal).

Date Approved ________ Signature of Applicant *Rusty Meigs* ________

Date Denied ________ Signature of Sponsoring Staff ________

Signature of Department Chairperson ________

____

Dr. Terry McEwen

Director Assessment, Research, and School Improvement

Rev. 07/07

APPLICATION TO CONDUCT RESEARCH IN LAWRENCE PUBLIC SCHOOLS

RESEARCH APPLICATION INSTRUCTIONS

Submit to the Director of Assessment, Research, and School Improvement:

◊ An endorsement letter from the sponsoring staff person (from the researcher's institution, i.e., university professor)
◊ An endorsement letter from the chairperson of the department (from the researcher's institution)
◊ the completed *Application to Conduct Research in Lawrence Public Schools* form
◊ a copy of the approval letter from the university's IRB (Institutional Review Board)
◊ a draft of permission letter for parents (if students are to be involved)
◊ a brief statement of the purpose of the study
◊ the process to be used for selection of subjects
◊ the procedures to be employed
◊ the analysis of data employed
◊ specimens of all tests, questionnaires, or forms to be used in collecting data
◊ the attendance site(s) and grade level(s) proposed to research
◊ the amount of pupil/subject time required
◊ the approximate number of pupils/subjects to participate
◊ the projected beginning and ending dates

Written notice will be given as to acceptance or denial of each research project. Upon notification of approval, it will be the researcher's responsibility to obtain permission from building principals to conduct research at each participating attendance site.

NO CONTACT SHALL BE MADE WITH INDIVIDUAL STUDENTS, TEACHERS, OR PRINCIPALS UNTIL THE APPLICATION HAS BEEN REVIEWED AND APPROVED BY THE DIRECTOR OF ASSESSMENT, RESEARCH, AND SCHOOL IMPROVEMENT.

The permission form signed by each participating principal must be returned to the director of assessment, research, and school improvement prior to the beginning of the project.

At the conclusion of the project, the researcher will submit to the director of assessment, research, and school improvement:
◊ access to a copy of all data and information collected upon request
◊ a summary or extract of the resulting article, research reports, thesis, or dissertation, indicating findings, conclusions, and implications
◊ an abstract, one or two brief paragraphs, of the total project that could be circulated to interested staff.

Return completed application to: Dr. Terry McEwen, Director
Assessment, Research, and School Improvement
Lawrence Public Schools
110 McDonald Drive
Lawrence, Kansas 66044

BAKER UNIVERSITY
SCHOOL OF EDUCATION

November 20, 2009

Dr. Terry McEwen, Director
Assessment, Research, and School Improvement
Lawrence Public Schools
110 McDonald Drive
Lawrence, Kansas 66044

Dear Dr. McEwen:

As the major advisor for Rusty Meigs, I am writing this letter of endorsement for his clinical research study *The Development and Field Test of the Technology Integration Matrix Questionnaire.* Rusty's work is truly innovative and the resulting questionnaire will be a valuable tool for teachers to assess their level of technology integration. The inclusion of teachers from Lawrence Public Schools during the field testing phase of his research will enhance his study.

Sincerely,

Susan K Rogers

Susan K. Rogers, Ph.D.
Associate Professor

BAKER UNIVERSITY
SCHOOL OF EDUCATION

November 23, 2009

Dr. Terry McEwen, Director
Assessment, Research, and School Improvement
Lawrence Public Schools
110 McDonald Drive
Lawrence, Kansas 66044

Dear Dr. McEwen:

As the Chair of the Graduate Department, I am writing this letter of endorsement for Rusty Meigs to conduct a clinical research study, *The Development and Field Test of the Technology Integration Matrix Questionnaire.* Rusty's study has been approved by his major advisor and committee and found to be worthy. Responses from teachers from Lawrence Public Schools during the field testing phase of his research will greatly enhance his study.

Sincerely,

Harold B. Frye

Harold B. Frye, Ed.D.
Chair

From: "Terry McEwen" <TMcEwen@usd497.org>
To: "Rusty Meigs" <rmeigsec@olatheschools.com>
Date: 12/3/2009 11:19 AM
Subject: Re: Technology Integration Research Request
CC: "Rick Doll" <RDoll@usd497.org>

Rusty,
We have completed our review of your research proposal. You will be receiving an official approval letter via US Mail, but I did want to add something for you to put in your "E mail blast" to teachers that won't be in your approval letter - be sure to mention in an early sentence that you have school district approval to conduct your survey.

Also, emphasize that participation is voluntary (I know that is your plan - but just making sure that line is in your E mail to them).

Best of luck.
We would like to see a summary of your results when you have completed the entire project. This should be interesting!

TM

Terry O. McEwen, Ph.D.
Division Director of Assessment, Research, and School Improvement
Lawrence Public Schools - USD 497
110 McDonald Drive
Lawrence, KS 66044

Unified School District 233

Research Application Request-Internal

INSTRUCTIONS:

Please provide the following information so that your project can be considered in relation to district criteria. Allow a minimum of two (2) weeks for completion of the review process.

PLEASE NOTE: Your final application should include submission of the following requirements:
(1) the on-line application,

(2) a copy of your Human Experimentation Committee project review and approval (if applicable), and

(3) a letter from your academic advisor/committee indicating that your research project has been reviewed and approved.

Requirements #2 and #3 can be scanned and sent through email to bgrahamec@olatheschools.com, inserted into the on-line application in word format, or sent in hard copy format to Bev Graham at the Education Center, 14160 Black Bob Road, Olathe, KS 66063.

1. Applicant(s) Name:

Rusty Meigs

2. Position:

Senior Web Architect

3. School/Location:

Education Center

Other Location (please specify):

4. Telephone:

(913) 780-8183

5. email address:

rmeigsec@olatheschools.com

6. Project Title:

Technology Integration Matrix Questionnaire Field Test

7. The proposed research is for:

Ed.D.

Other (please describe):

8. Anticipated Dates:

Beginning Date:	November 16th, 2009
Ending Date:	December 11th, 2009
Date Final Report Available:	December 22nd, 2009

9. Participant Description:

Number of schools involved in the study:	54
Number of teachers involved in the study:	3500
Number of students involved in the study:	0

10. Has the project been submitted to a Human Experimentation Committee?

No

Yes

11. If no, please explain why your project has not been submitted to a committee on human experimentation.

12. Either paste a copy of the letter from the Human Experimentation Committee regarding your study (word format) below, email a scanned copy to bgrahamec@olatheschools.com, or send a hard copy to Bev Graham at the Education Center.

Copy submitted.

13. Brief review of the literature:

In light of greater technology access and connectivity in today's classrooms, experts warn little has changed in terms of the number of teachers integrating technology into classrooms (Hargadan, 2006). In order for schools to increase the number of teachers integrating technology into their classrooms, school and district leaders must be able to measure teacher practices on an individual basis. To achieve such an outcome, it is necessary to have an instrument, which can measure levels of technology integration within constructivist environments.

This chapter addresses literature relating to the history technology and the development of a continuum on which this levels fall. The evolution of constructivist theory and the identification of the various learning environments in which children create their own understanding of the world around them is covered. Literature surrounding the creation, development, and research regarding the Technology Integration Matrix as well as its multidimensional use of both levels of integration across constructivist environments is discussed. Finally, reference works on best practices in survey and instrument design are explored.

The Evolution of a Continuum of Technology Integration Levels
Sandholtz, J. H., Ringstaff, C., & Dwyer, D. C. (1997). Teaching with technology: Creating student-centered

14. Major research questions:

Based on the need for the development of this instrument, two research questions directing the study were established:
1. What are the characteristics of reliable and valid survey items in measuring levels of technology integration by classroom teachers?
2. What are the characteristics of reliable and valid survey items in measuring the five constructivist learning environments facilitated by classroom teachers?

15. Methodology:

A draft instrument of 75 questions was developed. The first 50 questions were expected to measure the 25 indicators framed in the Technology Integration Matrix was developed based upon the researcher's examination of two original works from which the Matrix was derived (Sandholtz, Ringstaff, & Dwyer, 1997; Jonassen, Howland, Moore, & Marra, 2003). Another 25 questions were designed to gather pertinent demographics data concerning subject(s) taught, grade level(s), classroom computer access, classroom Internet access, and other peripheral technologies such as projectors, printers, scanners, document cameras, Airliners, and SMART Boards.

The design of this study centered on the establishment of two panels of experts representing technology leaders and veteran teachers established in the art of integrating technology in the classroom. The first panel included original developers of the Matrix, university educational technology professors, and technology leaders from a couple of school districts. The second panel included technology leadership committee members from Olathe Northwest High School and tech savvy elementary teachers involved in an Olathe District Schools Moodle study during the fall of 2009.

16. Method Summary:

The method covers the development of a multidimensional instrument to measure the intersections of five levels of technology integration and five constructivist environments. Individual persons involved in the focus groups and the pilot are indentified. Using focus groups in the development of the instrument for validity and reliability is discussed along with the pilot administration of the instrument.

In spite of great advances in technology availability and ubiquitous Internet access across the nation's schools over the past two decades, and though utilization of technology embedded into curriculum by educators is on the rise, researchers like Larry Cuban argue the number of educators truly implementing technology in practice and quality accounts for a very low percentage (2006). The goal of this study was to design and field test a questionnaire based on the 25 indicators found in the Technology Integration Matrix. Up until this study, the Matrix was primarily used to evaluate integration in constructivist environments at the building level and not with individual teachers. The study specifically addressed the characteristics of reliable and valid survey items in measuring levels of technology integration across constructivist learning environments facilitated by classroom teachers.

17. Research Design/Data Analysis:

The design of this study consisted of the development of a survey instrument, the refining of this instrument, followed by a field test of this instrument. While the development stage relied primarily on descriptive or qualitative input from focus groups, the reliability of the TIMQ was quantitative in nature. A factor analysis will be conducted on data from the pilot sample using the five integration levels and then the five constructivist levels to check for construct validity. A Cronbach's Alpha will be run on data from the pilot to check for reliability.

18. Perceived Benefits of the Project:

1. Teachers can gain ideas on technology integration by hovering over the examples associated with each questions.
2. Teachers may later use the tool as a self-evaluative instrument for measuring their integrative practices in the classroom and develop subsequent professional growth goals.
3. A more comprehensive instrument may be developed from this initial instrument designed to give teachers specific feedback on ways they can reach higher levels of integration in their classroom practices.

19. Project Dissemination Plan:

After Olathe District Schools Committee Approval:

1. Send a letter of invitation via e-mail to all certified staff on November 16 or sooner (per committee approval) within the district to participate in the field test.
2. Provide a keycode for accessing the survey online along with instructions for completing required information and questions.
3. Send a weekly reminder e-mail up to December 11th when the study closes.
4. A factor analysis will be conducted on data from the pilot sample using the five integration levels and then the five constructivist levels to check for construct validity. A Cronbach's Alpha will be run on data from the pilot to check for reliability. All analysis will occur using SPSS.
5. Results of study will be shared with the district.

20. Briefly describe how this research project supports Olathe District curriculum, a district goal, and/or individual school's improvement plan.

The district is currently engaged in assessing teacher technology proficiencies as part of the following initiative: "The Olathe District, supported financially by our community, has made the use of technology as a work and learning tool a priority. In order to clearly articulate expectations, the Educator Personal Technology Use Standards were developed."

The development and field test of the Technology Integration Matrix Questionnaire (TIMQ) goes a step further by measuring levels of technology integration within constructivist environments. The Educator Personal Technology Use Standards do not necessarily measure technology integration but technology usage. These are two different tools with different purposes.

While the goal of this field test is to establish a quality instrument for measuring technology integration, it could later be used by teachers as a self-evaluative tool for measuring their integrative practices in the classroom to develop professional growth goals. This falls within the Instructional Technology Mission Statement: "The mission of the Olathe District Schools Instructional Technology Department is to provide assistance to teachers and staff with integrating technology into the curriculum."

21. Please provide a letter from your faculty advisor/committee indicating that the research project has been reviewed and the researcher has met all requirements necessary to conduct the proposed research. You can either paste an electronic copy of the letter (word format) into this section, email a scanned copy to bgrahamec@olatheschools.com or send a hard copy to Bev Graham at the Education Center.

Institutional Review Board approval letter submitted.

22. Any other comments regarding your application?

You may view a working copy of the TIMQ at http://moodle.rustymeigs.com/timq3.php.

Here is the formal request letter recently sent out to other districts:

Dear District Leader,

As a doctoral student at Baker University, I am currently working on my Clinical Research Study concerning technology integration. After a decade of supporting teachers in their efforts to integrate technology within classroom settings, I continue to witness the need for implementation of best practices. Consequently, I am working with the Florida Center for Instructional Technology and the Florida Department of Education to conduct groundbreaking research on a survey instrument I created to measure integration based on their model: the Technology Integration Matrix or TIM. The Matrix is unique in that it measures levels of integration in different types of learning environments. While the model is currently being used to measure integrative practices of entire school buildings across the nation, my survey instrument, the Technology Integration Matrix Questionnaire (TIMQ), was designed to measure teaching practices individually.

I would like to invite teachers in your district to participate in the pilot of this survey instrument. As your district seeks to remain current regarding best practices in teaching with technology, please consider the benefit of having your teachers take part in this online pilot. Not only can they gain ideas for implementing integration activities into their own classrooms (based on real-world examples I developed for each question), they would be helping to refine

Done

Unified School District 233

November 19, 2009

Rusty Meigs
Senior Web Architect
Olathe School District
Education Center
14160 Black Bob Road
Olathe, KS 66063

The research project "Technology Integration Matrix Questionnaire Field Test " has been approved with the following criteria:

The project goals are aligned with the district and building school improvement goals.

Donna Roper , Library Media/Instr. Technology Coordinator, Instructional Resource Center and Special Services Office, 14090 Black Bob Road, Olathe, KS 66062, will serve as district contact for the project. Ms. Roper's email is droperirc@olatheschools.com and she be reached by phone at (913-780-8228).

A summary report should be submitted following the completion of your project. Please submit the report to me at email address bgrahamec@olatheschools.com.

Olathe staff members look forward to working with you throughout the project. If you should have any questions or require any assistance, please contact me at the Olathe District Education Center (913-780-7000).

Sincerely,

Beverly Graham, Ph.D., MPA
Program Analyst & Evaluator
Olathe District Schools

Appendix N: E-Mail Invitations and Reminder E-Mails to Pilot Participants

From: Rusty Meigs
To: Donna Roper
Date: 11/19/2009 2:01 PM
Subject: Technology Integration Research Invitation to Teachers

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Dear Teacher:

I would like to invite you to participate in the pilot of a questionnaire instrument on technology integration. The survey takes approximately 20-25 minutes and is anonymous in that you will not be asked to provide your name--only the school district with which you are affiliated. The instrument is located at http://timq.rustymeigs.com and the keycode to access it is **tech2009** . Your participation in this pilot by completing the questionnaire is not only appreciated, but will aid in the development of a unique tool designed to measure technology usage and integration in individual teachers' classrooms.

The instrument was created to measure levels of technology integration within various learning environments as outlined in a model known as the Technology Integration Matrix (TIM) created at the Florida Center for Instructional Technology (FCIT) out of the University of South Florida. The goal behind creating such an instrument, along with its subsequent field test, was to provide teachers with a tool to gauge their technology integration practices and offer insights for future improvements regarding these practices. Additionally, you will find the FCIT's Technology Integration Matrix a valuable resource for incorporating technology into classroom instruction. A link to FCIT's Matrix Web Site--which has many helpful videos demonstrating tech integration practices in classrooms--will be provided upon completion of the questionnaire. The instrument will be available until midnight on Monday, Dec. 14th, 2009. Pressing the **[Submit]** button after completing the questionnaire serves as your consent to participate in this study.

I thank you in advance for taking time out to test the quality of this instrument.

Sincerely, Rusty.

Rusty Meigs, M.Ed.
Senior Web Architect
Olathe District Schools

From: Rusty Meigs
To: Abbey Graham; Aimee James; Amy Bloodgood; Amy Wells; Brenda Smith; ...
Date: 12/1/2009 5:37 PM
Subject: Technology Integration Research Reminder
CC: Linda Armstrong

Dear Tomahawk Trailblazers,

First, I would like to thank those of you who completed my technology integration questionnaire. I truly appreciate you taking time out of your busy schedules.

Second, if you have not taken my questionnaire, this is a friendly reminder inviting you to participate in the pilot of this survey instrument on technology integration. I believe you will find this tool useful in the future as you incorporate technology into your teaching practices. As a doctoral student at Baker University, this field test marks the last phase of data collection for my clinical research study.

The survey takes approximately 20-25 minutes and is anonymous in that you will not be asked to provide your name or the school building in which you work. You are only asked to indicate whether or not you are affiliated with Olathe District Schools. The instrument is located at http://timq.rustymeigs.com and **tech2009** is the keycode for accessing it. Additionally, you will find the FCIT's (Florida Center for Instructional Technology) Integration Matrix a valuable resource for incorporating technology into classroom instruction. A link to FCIT's Matrix Web Site will be provided upon completion of the questionnaire. This site has many helpful videos demonstrating tech integration practices in classrooms.

Your participation in this pilot by completing the questionnaire is not only appreciated, but will aid in the development of this innovative tool designed to measure technology usage and integration in individual teachers' classrooms across the district. The instrument will be available until midnight on Monday, Dec. 14th, 2009. Pressing the **[Submit]** button after completing the questionnaire serves as your consent to participate in this study. I thank you in advance for taking time out to test the quality of this instrument.

Brief Description of the Purpose:
The instrument was created to measure levels of technology integration within various learning environments as outlined in a model known as the Technology Integration Matrix (TIM) created at the FCIT out of the University of South Florida. The goal behind creating such an instrument, along with its subsequent field test, was to provide teachers with a tool to gauge their technology integration practices and offer insights for future improvements regarding these practices.

Rusty Meigs
Senior Web Architect
Olathe District Schools
Education Center
14160 Black Bob Road
Olathe, KS 66063

From: Rusty Meigs
To: Abbey Graham; Abigail Kreutziger; Abigail Spencer; Adam Moos; Adrian...
Date: 12/14/2009 4:20 PM
Subject: Tech Research: Thank You & Deadline Extension
CC: Amy Hercules; Angela Thrasher; Barry Cook; Brenda Traughber; Brent Y...

Dear Olathe Elementary Teachers,

I cannot thank you all enough for completing my technology integration questionnaire! I absolutely received the best response from teachers in our district with nearly 200 reporting--approaching 20%. There is still time to take the survey instrument located at http://timq.rustymeigs.com (using the keycode of **tech2009** to access it) because I am extending the deadline--which was originally set for midnight today--into Winter Break to midnight on Tuesday, Dec. 22nd. It takes approximately 15-25 minutes to complete. Remember, a link to helpful videos demonstrating tech integration practices in classrooms at FCIT's Matrix Web Site will be provided upon completion of the questionnaire. Pressing the **[Submit]** button after completing the questionnaire serves as your consent to participate in this study. Thank you, once again!

Sincerely, Rusty.

Rusty Meigs
Senior Web Architect
Olathe District Schools
Education Center
14160 Black Bob Road
Olathe, KS 66063

From: Rusty Meigs Monday - January 4, 2010 12:23 PM
To: Aaron Hunter; Adam Kelly; Adam Kinzer; Adam Olerich; Aileen Kerling; Aimee Wallace; Al Carpenter; Alicia McElroy; Allan Carter; Amanda Bussone; Amanda Robertson; Amber Smith; Amy Brockway; Amy Hart; Amy Kroeker; Amy Wojahn; Andrea Paulakovich; Andrew Chapple; Andrew Fine; Angela Carlson; Angela Gill; Angie Lee; Anita Ross; Anne Burch; Anne Jones; Anne Kolarik; Anne LaMar; Anne Marie Case; Anthony Bozarth; Anthony Ruiz; Ashleigh Winkler; Ashley Azeltine; Ashley Olerich; Ashley Smith; Audra McClelland; BETH HARRISON; Barb Christensen; Barbara Bolte; Beth Carver-Swain; Beth Dean; Beth Hufnagel; Beth Noland; Betty McCollum; Bill Brooks; Bill Tomassi; Brad Yantis; Brandon Schwarz; Bree Beattie; Brian Pollack; Bridget Boggs; Brooke Briley; Bruce Snyder; Bryon Larson; Camille Dunlap; Candi Stewart; Carol Merrick; Carol Nycklemoe; Carol Toburen; Carol Wilson; Carole Hutcheson; Carrie Cronan; Cassie Wingert-Murray; Catherine Buchman; Catherine Phillips;
CC: Amy Jensen; Bill Weber; Carl Garrett; Elaine Carpenter; Elizabeth Holland; Jennifer Steele; Jennifer Stoskopf; Jim Brockway; Jim Foil; Julie Veatch; Karey Ficken; Kelly Ralston; Ken Taylor; Kerry Lane; Larry Katzif; Margo Twaddle; Michael Wolgast; Paige May; Rebecca Vrbas; Shane Kaberline; Stacey Yurkovich; Stephen Massey; Steve Skoczek; Tim Anderson
Subject: Tech Research: Thank You & Last Call

Dear Olathe Junior High Teachers,

Happy New Year! Once again, thank you so much for participating in my research study. 225 of you completed the TIM Questionnaire. This was fantastic! Because other area districts are taking time to participate in the next couple of weeks, I am keeping the questionnaire open until midnight on Monday, January 18th in case any of you would still like to take it. Please note that this is the last and final call. The survey instrument is located at http://timq.rustymeigs.com (use the keycode of **tech2009** or **tech2010** to access it) It takes approximately 15-25 minutes to complete. Remember, a link to helpful videos demonstrating tech integration practices in classrooms at FCIT's Matrix Web Site will be provided upon completion of the questionnaire. Pressing the **[Submit]** button after completing the questionnaire serves as your consent to participate in this study. Thank you!

Sincerely, Rusty.

Rusty Meigs
Senior Web Architect
Olathe District Schools
Education Center
14160 Black Bob Road
Olathe, KS 66063

From: Rusty Meigs Thursday - January 21, 2010 3:20 PM
To: Aaron Prater; Aaron Watkins; Abby Shopper; Amanda Doane; Amanda Faunce; Amy England; Amy Hastings; Amy Henry; Amy Johnston; Amy Osipik; Amy Razor; Andrea Cronin; Andrew Netterville; Andy Pollom; Angela Epps; Angela Verstraete; Ann Street; Anna Cardenas; Anna-Lynn Morris; Anne Otroszko; Annette Johnson; Annie Winkler; Barbara Nikoo-Manesh; Barbara Williams; Barbie Ginavan; Barbra Gonzales; Becky Metcalf; Beth Butler; Blake Revelle; Bonnie Paulsen; Bradley Hankins; Brandon Gillette; Brenda Larson; Brent Reynolds; Brigid Mayer; Britni Jarvis; Bruce Wellman; Bryan McCall; Caine Kreimendahl; Calin Kendall; Careth Palmer; Carla Steiner; Carmen Smull; Carol Ann Rau; Carol Buckland; Carolyn Goodrick; Carrie McIlwee; Cassidy Schneweis; Catherine M. Miller; Catherine Smith; Cathy Alcorn; Ceresa Schaffer; Chad Brown; Chad Coughlin; Charles Golladay; Chris Borchers; Chris Delay; Christeena Winter; Christine Hagemann; Christine Hanks; Christine Sales; Christy L
Subject: Thank you again!

Dear High School Teachers,

Once again, I truly wish to thank you for your response in completing my district-approved Technology Integration Matrix Questionnaire (TIMQ)! The number of teachers participating from our district reached **246**! If you are still interested in taking my questionnaire, I wanted to let you know will be open a few more days until shortly after midnight on Monday, January 25th. It is located at *http://timq.rustymeigs.com* . Use the keycode of **tech2009** or **tech2010** to access it. It takes approximately 15-25 minutes to complete. Not only do I believe you will find useful examples with unique ideas as you incorporate technology into your classrooms, a link to helpful videos at the Florida Center for Instructional Technology's (FCIT) Matrix Web Site demonstrating tech integration practices in classrooms will be provided upon completion of the questionnaire. Pressing the **[Submit]** button after completing the questionnaire serves as your consent to participate in this study.

Thank you and have a wonderful second semester!

Sincerely, Rusty.

Rusty Meigs, M.Ed.
Senior Web Architect
Olathe District Schools
Education Center
14160 Black Bob Road
Olathe, KS 66063

Appendix O: Computer Workstations/Internet Connectivity

Table O1

Connectivity as a Function of Number of Available Workstations (N = 498)

Workstation Quantity	Responses	Internet Connectivity Responses		
	N	Same Number	1 Less	2 Less
0	11	11	0	0
1	174	174	0	0
2	92	89	3	0
3	62	58	1	3
4	38	37	0	1
5	18	17	1	0
6	14	13	1	0
7	7	6	1	0
8	7	6	0	1
9	3	2	1	0
10	3	3	0	0
11	5	5	0	0
12	2	2	0	0
13	1	1	0	0
14	3	3	0	0
15	6	6	0	0
16	1	1	0	0
17	3	3	0	0
18	1	1	0	0
19	3	3	0	0

Note. The *Same Number* column refers to that part of the sample whose respondents indicated the quantity of computer workstations was equal to the number of these workstations connected to the Internet in their classroom. The *1 Less* column refers to the part of the sample where the number of workstations connected to the Internet is one less than the quantity of workstations in a respondent's classroom. The *2 Less* column refers to the part of the sample where the number of workstations connected to the Internet is two less than the quantity of workstations in a respondent's classroom.

Table O2

Connectivity as a Function of Number of Available Workstation Sets (N = 498)

	Computer Responses	Internet Connectivity Responses		
Workstation Sets	*N*	All Connected	Same Quantity	Different Quantity
20 – 24	20	9	11	0
25 – 29	15	2	13	0
30 and Over	9	4	5	0

Note. The *All Connected* column refers to the part of the sample where respondents indicated that all of their classroom workstations in the chosen set were connected to the Internet. The *Same Quantity* column refers to the part of the sample where respondents chose the same quantity set regarding Internet connectivity as the set representing the number of computer workstations in the classroom. This may or may not mean all of the computer workstations are connected to the Internet in these classrooms (e.g., a teacher might have 23 workstations in the classroom while only 21 are connected to the Internet). The *Different Quantity* column refers to the respondents who chose a different quantity set regarding Internet connectivity than the set referring to the number of workstations in their classrooms.

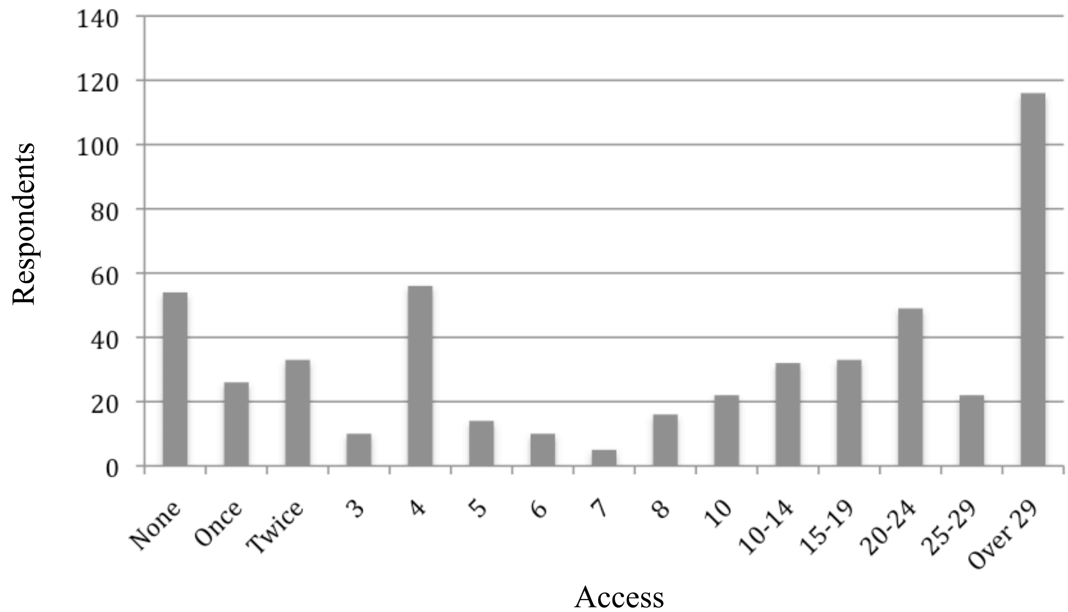


Figure O1. Respondents' monthly access to computer labs/mobile laptop labs.

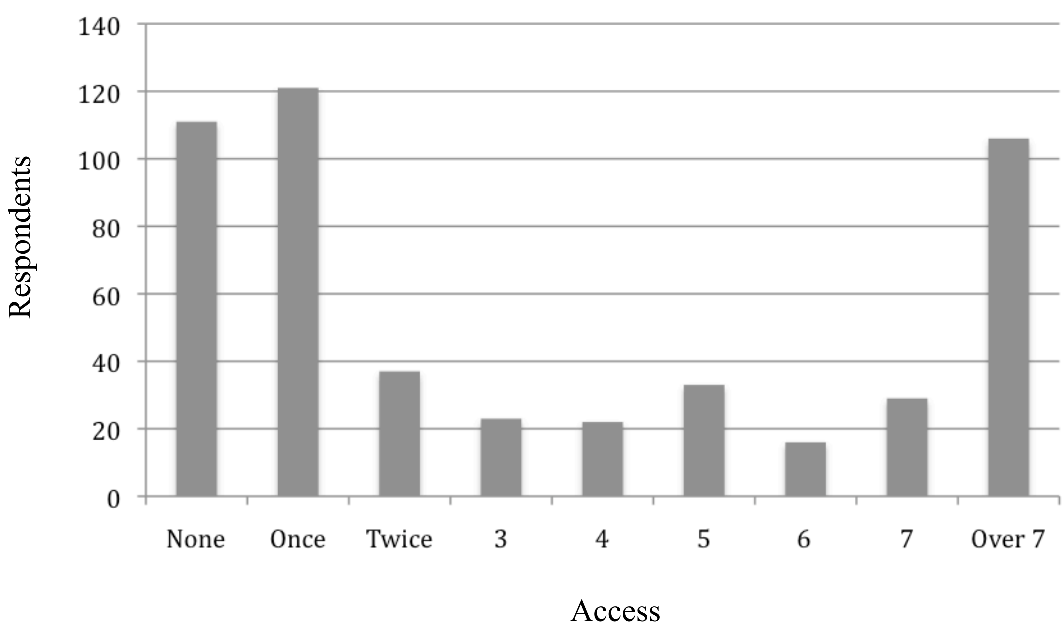


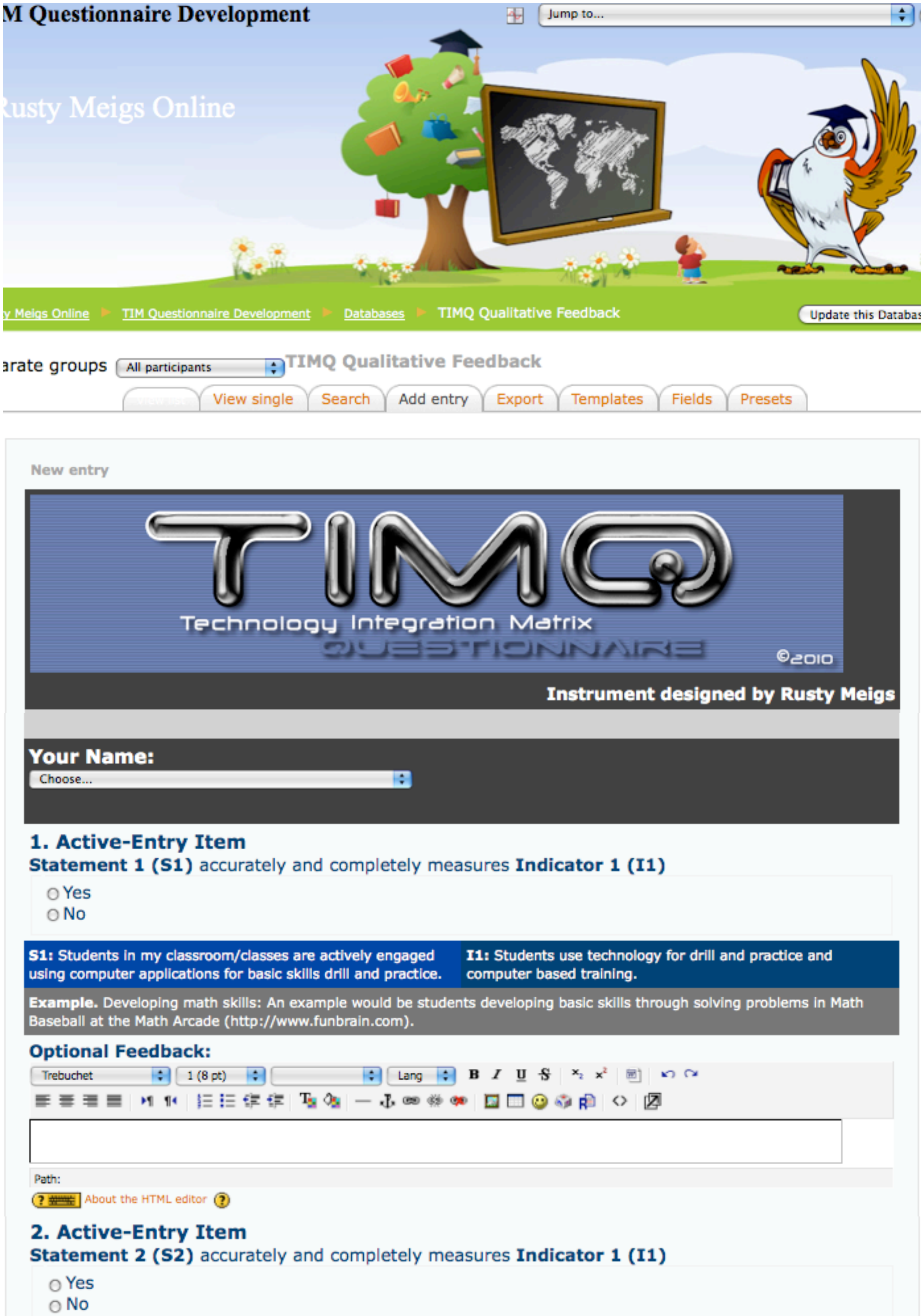
Figure O2. Respondents' daily access to computer labs/mobile laptop labs.

Table O3

Access to Instructional Technology (N = 498)

Technology	Classroom	Building/District
Airliner	213	262
Backpack	9	18
Clickers	190	394
Digital Camera	185	431
Document Camera	186	319
Handheld GPS	14	57
Interwrite Mobi	8	24
Interwrite Tablet	90	115
Mimio Tablet	10	41
LCD Projector	386	384
SMART Board	174	281
DVD/VCR	438	423
Web Cam	34	142
None	18	3

Appendix P: Moodle Database Activity for Final Content Validity Feedback


M Questionnaire Development
Jump to...
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Update this Databas
arate groups All participants
TIMQ Qualitative Feedback
View single Search Add entry Export Templates Fields Presets
New entry
TIMQ
Technology Integration Matrix
QUESTIONNAIRE
©2010
Instrument designed by Rusty Meigs
Your Name:
Choose...
1. Active-Entry Item
Statement 1 (S1) accurately and completely measures Indicator 1 (I1)
Yes
No
S1: Students in my classroom/classes are actively engaged using computer applications for basic skills drill and practice.
I1: Students use technology for drill and practice and computer based training.
Example. Developing math skills: An example would be students developing basic skills through solving problems in Math Baseball at the Math Arcade (http://www.funbrain.com).
Optional Feedback:
Trebuchet
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Path:
About the HTML editor
2. Active-Entry Item
Statement 2 (S2) accurately and completely measures Indicator 1 (I1)
Yes
No

S2: Students in my classroom/classes are actively engaged using computer-based tutorials to learn basic skills.	**I1:** Students use technology for drill and practice and computer based training.

Example. Completing a tutorial: An example would be a student completing an online lesson at America's Past Internet Tutorial (http://tutorial.teachtcl.com) over the U.S. Bill of Rights.

Optional Feedback:

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3. Active-Adoption Item

Statement 3 (S3) accurately and completely measures **Indicator 2 (I2)**

- Yes
- No

S3: Students in my classroom/classes are actively engaged using productivity tools like word processors to create reports.	**I2:** Students begin to utilize technology tools to create products, for example using a word processor to create a report.

Example. Writing a report: An example of this would be a student using a word processor to write a narrative about key battles of the Civil War.

Optional Feedback:

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4. Active-Adoption Item

Statement 4 (S4) accurately and completely measures **Indicator 2 (I1)**

- Yes
- No

S4: Students in my classroom/classes are actively engaged using online productivity tools like Citation Machine or conversion charts to complete projects.	**I2:** Students begin to utilize technology tools to create products, for example using a word processor to create a report.

Example. Citing Sources: An example would be a student using the Citation Machine allows to give credit to sources in MLA by typing pertinent information into an electronic template (http://citationmachine.net).

Optional Feedback:

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5. Active-Adaptation Item

Statement 5 (S5) accurately and completely measures **Indicator 3 (I3)**

- Yes
- No

S5: Students in my classroom/classes are actively engaged in selecting technology tools to complete specific tasks.	**I3:** Students have opportunities to select and modify technology tools to accomplish specific purposes, for example using colored cells on a spreadsheet to plan a garden.

Example. Using a spreadsheet: An example of this would be a student choosing the automated attributes of Excel to create an interactive crossword puzzle.

Optional Feedback:

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6. Active-Adaptation Item

Statement 6 (S6) accurately and completely measures **Indicator 3 (I3)**

- Yes
- No

S6: Students in my classroom/classes are actively engaged in adapting technology tools to complete specific tasks.	**I3:** Students have opportunities to select and modify technology tools to accomplish specific purposes, for example using colored cells on a spreadsheet to plan a garden.

Example. Adapting a drawing program: An example would be a student using a vector program like Adobe Illustrator to map out and depict geometric shapes and angles visually.

Optional Feedback:

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7. Active-Infusion Item

Statement 7 (S7) accurately and completely measures **Indicator 4 (I4)**

- Yes
- No

S7: Students from my classroom/classes are actively engaged using technology software and hardware tools throughout the school day.	**I4:** Throughout the school day, students are empowered to select appropriate technology tools and actively apply them to the tasks at hand.

Example. Creating a broadcast: An example of this would be students using multiple computer applications and hardware in a thematic unit to produce a video. Students may use scanners, image editing software, audio clips, and video programs to complete a project.

Optional Feedback:

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8. Active-Infusion Item

Statement 8 (S8) accurately and completely measures **Indicator 4 (I4)**

- Yes
- No

S8: Students in my classroom/classes are actively engaged using online technology tools throughout the school day.	**I4:** Throughout the school day, students are empowered to select appropriate technology tools and actively apply them to the tasks at hand.

Example. Producing a magazine: An example of this would be students utilizing multiple online resources throughout the day to research on the Internet, e-mail experts in the field, and write articles in GoogleDocs.

Optional Feedback:

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9. Active-Transformation Item

Statement 9 (S9) accurately and completely measures **Indicator 5 (I5)**

- Yes
- No

S9: Students in my classroom/classes are actively engaged in an ongoing manner using computer applications to learn beyond the confines of the school day.	**I5:** Given ongoing access to online resources, students actively select and pursue topics beyond the limitations of even the best school library.

Example. Keeping a financial ledger: An example of this would be students using spreadsheets to learn about personal finance and sharing about related experiences using spreadsheets outside the classroom.

Optional Feedback:

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10. Active-Transformation Item

Statement 10 (S10) accurately and completely measures **Indicator 5 (I5)**

- Yes
- No

S10: Students in my classroom/classes are actively engaged in an ongoing manner using online technology tools to learn beyond the confines of the school day.	**I5:** Given ongoing access to online resources, students actively select and pursue topics beyond the limitations of even the best school library.

Example. Mapping phases of the moon: An example of this would be students connecting classroom experiences regarding the phases of the moon with online tools outside the school day like the calculator at the Sky & Telescope Web site in addition to using direct observation (http://www.skyandtelescope.com/observing/objects/javascript/Moon_Phase_Calc.html).

Optional Feedback:

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11. Collaborative-Entry Item

Statement 11 (S11) accurately and completely measures **Indicator 6 (I6)**

- Yes
- No

S11: Students in my classroom/classes work alone using Internet tools for comprehension.	**I6:** Students primarily work alone when using technology.

Example. Develop map-reading skills: At the Sheppard Software site students can learn to identify countries by clicking and dragging each while an audio file pronounces the name (http://sheppardsoftware.com).

Optional Feedback:

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12. Collaborative-Entry Item

Statement 12 (S12) accurately and completely measures **Indicator 6 (I6)**

- ○ Yes
- ○ No

S12: Students in my classroom/classes work individually using software applications to make meaning of their world.	**I6:** Students primarily work alone when using technology.

Example. Discovering plant cells: An example of this would be students indvidually following each slide of a PowerPoint covering the basic building blocks of plant life.

Optional Feedback:

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13. Collaborative-Adoption Item

Statement 13 (S13) accurately and completely measures **Indicator 7 (I7)**

- ○ Yes
- ○ No

S13: Students in my classroom/classes use communication tools like E-Mail to collaborate with others on assignments.	**I7:** Students have opportunities to utilize collaborative tools, such as email, in conventional ways.

Example. Understanding diverse cultures: An example of this would be a group of students--each student with particular tasks--communicating via e-mail like gaggle.net to compile a presentation on the different cultures around the world.

Optional Feedback:

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14. Collaborative-Adoption Item

Statement 14 (S14) accurately and completely measures **Indicator 7 (I7)**

- ○ Yes
- ○ No

S14: Students in my classroom/classes collaborate using digital tools to share documents and information with others on assignments.	**I7:** Students have opportunities to utilize collaborative tools, such as email, in conventional ways.

Example. Sharing resources about dinosaurs: An example of this would be students using network or file-sharing capabilities to learn about different types of dinosaurs in a cooperative or jigsaw type structure.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

15. Collaborative-Adaptation Item

Statement 15 (S15) accurately and completely measures **Indicator 8 (I8)**

- ○ Yes
- ○ No

S15: Students in my classroom/classes choose tools like chatting, blogs, or discussion forums to collaborate with others on assignments.	**I8:** Students have opportunities to select and modify technology tools to facilitate collaborative work.

Example. Identifying character roles in a story: An example of this would be students in an online classroom choosing to blog, instant message, or post threads to a discussion forum reversing the roles of the protagonist, antagonist, and other characters in a story and then defending their reasons for doing so.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

16. Collaborative-Adaptation Item

Statement 16 (S16) accurately and completely measures **Indicator 8 (I8)**

- Yes
- No

S16: Students in my classroom/classes configure or adapt technology tools in order to collaborate with others on assignments.	**I8:** Students have opportunities to select and modify technology tools to facilitate collaborative work.

Example. Creating a guide: An example of this would be students setting up a collectively managed Web site at a location like PB Works (http://pbworks.com) and then collaboratively creating pages explaining the steps in the Scientific Method.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

17. Collaborative-Infusion Item

Statement 17 (S17) accurately and completely measures **Indicator 9 (I9)**

- Yes
- No

S17: Students from my classroom/classes use technology tools to collaborate across disciplines.	**I9:** Throughout the day and across subject areas, students utilize technology tools to facilitate collaborative learning.

Example. Researching energy: An example would be students researching alternative sources of fuel for a science class, but collaborating in an online environment with the automotive instructor and/or students.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

18. Collaborative-Infusion Item

Statement 18 (S18) accurately and completely measures **Indicator 9 (I9)**

- Yes
- No

S18: Students from my classroom/classes use technology tools to collaborate throughout the school day.	**I9:** Throughout the day and across subject areas, students utilize technology tools to facilitate collaborative learning.

Example. Describing electrical circuits: An example would be a group of students meeting in an online classroom environment during seminar, enrichment, study hall, or other free periods to develop a set of parallel and series circuit problems for physics classmates to troubleshoot and discuss.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

19. Collaborative-Transformation Item

Statement 19 (S19) accurately and completely measures **Indicator 10 (I10)**

- Yes
- No

S19: Students in my classroom/classes use communication tools like iChat, Skype, or instant messaging to collaborate with others within and beyond the confines of the school day.	**I10:** Technology enables students to collaborate with peers and experts irrespective of time zone or physical distances.

Example. Promoting alternative energies: An example would be students collaborating via Skype (http://skype.com), a video conferencing tool, to come up with ideas for alternative sources of fuel.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

20. Collaborative-Transformation Item

Statement 20 (S20) accurately and completely measures **Indicator 10 (I10)**

- Yes
- No

S20: Students in my classroom/classes use technology tools to post content online to collaborate with others within and beyond the confines of the school day.	**I10:** Technology enables students to collaborate with peers and experts irrespective of time zone or physical distances.

Example. Sharing cultures: An example would be students in New York sharing cultures with students in New Delhi via a blog (http://wordpress.org).

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

21. Constructive-Entry Item

Statement 21 (S21) accurately and completely measures **Indicator 11 (I11)**

- Yes
- No

S21: Students in my classroom/classes experience technology through the teacher using presentation tools like PowerPoints, informative Web sites, Airliners, or SMART Board technologies.	**I11:** Technology is used to deliver information to students.

Example. Diagramming sentences: An example would be students learning how sentences go together from a teacher modeling the concept on the screen using an Airliner or other SMART presention technology tool.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

22. Constructive-Entry Item

Statement 22 (S22) accurately and completely measures **Indicator 11 (I11)**

- Yes
- No

S22: Students in my classroom/classes experience technology through traditional instructional technologies like overhead projectors, white boards, audio players, or VHS/DVD players.	**I11:** Technology is used to deliver information to students.

Example. Watching a video about sea life: An example would be students viewing a DVD to discover how anemones live and many times protect other sea creatures.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

23. Constructive-Adoption Item

Statement 23 (S23) accurately and completely measures **Indicator 12 (I12)**

- Yes
- No

S23: Students in my classroom/classes use technology tools to construct graphic organizers to illustrate concepts.	**I12:** Students begin to utilize constructive tools such as graphic organizers to build upon prior knowledge and construct meaning.

Example. Illustrating cause and effect: An example would be students arranging types of pollution along with the negative effects of each using a graphic organizing tool like Kidspiration, Inspiration, or CMap.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

24. Constructive-Adoption Item

Statement 24 (S24) accurately and completely measures **Indicator 12 (I12)**

- Yes
- No

S24: Students in my classroom/classes use technology tools to construct meaning based upon prior knowledge.	**I12:** Students begin to utilize constructive tools such as graphic organizers to build upon prior knowledge and construct meaning.

Example. Identifying marketing strategies: An example would be students recording prior knowledge about advertising strategies companies use to sell products in an online forum. This would be followed by each student applying five strategies found in the forum to sell their own unique inventions.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

25. Constructive-Adaptation Item

Statement 25 (S25) accurately and completely measures **Indicator 13 (I13)**

- Yes
- No

S25: Students in my classroom/classes construct meaning by selecting and adapting technology tools to gather information.	**I13:** Students have opportunities to select and modify technology tools to assist them in the construction of understanding.

Example. Analyzing the Titanic disaster: An example would be students using the Internet-based resources found in a WebQuest about the Titanic to construct a model demonstrating the greatest cause for the large loss of life.

Optional Feedback:

Trebuchet 1 (8 pt) Lang

Path:

About the HTML editor

26. Constructive-Adaptation Item

Statement 26 (S26) accurately and completely measures **Indicator 13 (I13)**

- Yes
- No

S26: Students in my classroom/classes use inquiry-based technology tools to construct meaning.	**I13:** Students have opportunities to select and modify technology tools to assist them in the construction of understanding.

Example. Constructing models: An example would be students using a 3D modeling/animation program to construct replicas of aircraft and then testing these models by varying physical factors such as wind speed or weather.

Optional Feedback:

Trebuchet 1 (8 pt) Lang

Path:

About the HTML editor

27. Constructive-Infusion Item

Statement 27 (S27) accurately and completely measures **Indicator 14 (I14)**

- Yes
- No

S27: Students from my classroom/classes use technology tools to construct meaning across several disciplines.	**I14:** Students utilize technology to make connections and construct understanding across disciplines and throughout the day.

Example. Building a house: An example would be students designing a house for a shop class using a CAD program while also using a spreadsheet--as learned in a computer applications course--to calculate the costs of materials and supplies.

Optional Feedback:

Trebuchet 1 (8 pt) Lang

Path:

About the HTML editor

28. Constructive-Infusion Item

Statement 28 (S28) accurately and completely measures **Indicator 14 (I14)**

- Yes
- No

S28: Students from my classroom/classes use technology tools to make associations with other subject areas throughout the school day.	**I14:** Students utilize technology to make connections and construct understanding across disciplines and throughout the day.

Example. Creating a timeline: An example would be students using a mapping tool like Inspiration to create a timeline regarding the advent of the locomotive its impact on Westward Expansion. This could be tied to science lesson where students study how steam is used to power engines and then they create an interactive game to illustrate the process using a freeware software tool like Game Maker (http://www.yoyogames.com).

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

29. Constructive-Transformation Item

Statement 29 (S29) accurately and completely measures **Indicator 15 (I15)**

- ○ Yes
- ○ No

S29: Students in my classroom/classes use technology tools to construct meaning through the creation of products like media, Podcasts, or electronic publications.	**I15:** Students use technology to construct, share, and publish knowledge to a worldwide audience.

Example. Creating a PSA: An example would be students constructing a public service announcement (PSA) about bullying in GarageBand and publishing it to iTunes U (http://education.apple.com/itunesu).

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

30. Constructive-Transformation Item

Statement 30 (S30) accurately and completely measures **Indicator 15 (I15)**

- ○ Yes
- ○ No

S30: Students in my classroom/classes use technology tools to construct media content for sharing with an extended or global audience via the Internet.	**I15:** Students use technology to construct, share, and publish knowledge to a worldwide audience.

Example. Constructing a virtual tour: An example would be students designing a Web site with pages and short descriptions for each planet in the solar system. Students could create an illustration of the system in a drawing program and then construct an image map for visitors to easily click on the planet about which they wish to read.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

31. Authentic-Entry Item

Statement 31 (S31) accurately and completely measures **Indicator 16 (I16)**

- ○ Yes
- ○ No

S31: Students in my classroom/classes use technology tools to solve basic problems, which require only specific routines, steps, or memorization.	**I16:** Students use technology to complete assigned activities that are generally unrelated to real-world problems.

Example. Evaluating expressions: An example would be students using the Order of Operations to solve problems through online games like the ones at the Math Playground site (http://www.mathplayground.com)

Optional Feedback:

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About the HTML editor

32. Authentic-Entry Item

Statement 32 (S32) accurately and completely measures **Indicator 16 (I16)**

- Yes
- No

S32: Students in my classroom/classes use technology tools to solve problems generally unrelated to real-word situations.

I16: Students use technology to complete assigned activities that are generally unrelated to real-world problems.

Example. Pronouncing Spanish words: An example would be students using electronic flash cards online to learn the basic pronunciation of Spanish words at a site like Online Spanish Help (http://www.onlinespanishhelp.com) as opposed to a real-word situation like ordering from a menu written in Spanish.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

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About the HTML editor

33. Authentic-Adoption Item

Statement 33 (S33) accurately and completely measures **Indicator 17 (I17)**

- Yes
- No

S33: Students in my classroom/classes use software applications to solve content-specific problems given real-world parallels.

I17: Students have opportunities to apply technology tools to some content-specific activities that are based on real-world problems.

Example. Monitoring weather patterns: An example would be students using a Davis WiFi Weather Station (http://www.ambientweather.com) to monitor weather patterns like the sudden drop in temperature with a cold front.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

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About the HTML editor

34. Authentic-Adoption Item

Statement 34 (S34) accurately and completely measures **Indicator 17 (I17)**

- Yes
- No

S34: Students in my classroom/classes use online tools to apply solutions to authentic, real-world problems.

I17: Students have opportunities to apply technology tools to some content-specific activities that are based on real-world problems.

Example. Tracking hurricanes: An example would be students plotting the paths of hurricanes with information from the Hurricane Strike! Web Site (http://deved.meted.ucar.edu/hurrican/strike) applying latitude and longitude. This may be accomplished at a SMART Board using mobile Airliner writing pads.

Optional Feedback:

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Path:

About the HTML editor

35. Authentic-Adaptation Item

Statement 35 (S35) accurately and completely measures **Indicator 18 (I18)**

- Yes
- No

S35: Students in my classroom/classes locate technology tools to solve real-world problems in a variety of ways.	**I18:** Students have opportunities to select and modify technology tools to solve problems based on real-world issues.

Example. Protecting wildlife: An example would be students selecting video podcast media to create a vodcast educating others about the endangered Burrowing Owl and providing guidelines for protecting it.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

Path:

About the HTML editor

36. Authentic-Adaptation Item

Statement 36 (S36) accurately and completely measures **Indicator 18 (I18)**

- Yes
- No

S36: Students in my classroom/classes adapt various technology tools to solve problems based on real-world scenarios.	**I18:** Students have opportunities to select and modify technology tools to solve problems based on real-world issues.

Example. Designing rain gardens: An example would be students using a computer drawing program or 3D modeling program to design a rain garden to capture runoff water from parking lots, roofs, and walkway which can often result in erosion, pollution, or flooding.

Optional Feedback:

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About the HTML editor

37. Authentic-Infusion Item

Statement 37 (S37) accurately and completely measures **Indicator 19 (I19)**

- Yes
- No

S37: Students from my classroom/classes select appropriate technology tools from several disciplines to solve real-world problems.	**I19:** Students select appropriate technology tools to complete authentic tasks across disciplines.

Example. Colonizing the moon: An example would be students playing differing roles in cooperative groups to create a plan for colonizing the moon. One student may act as the scientist and research NASA's Web site to figure out how life could be sustained. Another student may use a spreadsheet to tabulate the costs of financing the project, etc.

Optional Feedback:

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About the HTML editor

38. Authentic-Infusion Item

Statement 38 (S38) accurately and completely measures **Indicator 19 (I19)**

- Yes
- No

S38: Students from my classroom/classes conduct research using appropriate technology and apply solutions to problems based on real-world situations.	**I19:** Students select appropriate technology tools to complete authentic tasks across disciplines.

Example. Preventing crocodile attacks: An example would be students using online tools and resources like United Streaming (http://streaming.discoveryeducation.com) to research crocodiles and their migration patterns. Students could create solutions for humans avoiding crocodile attacks by observing migration patterns on Web sites that display satellite data.

Optional Feedback:

Path:

About the HTML editor

39. Authentic-Transformation Item

Statement 39 (S39) accurately and completely measures **Indicator 20 (I20)**

- Yes
- No

S39: Students in my classroom/classes use technology tools to participate in authentic, problem-solving projects outside of school.	**I20:** By means of technology tools, students participate in outside-of-school projects and problem-solving activities that have meaning for the students and the community.

Example. Ending genocide: An example would be students researching the holocaust through language arts and social studies lessons to determine the reasons behind such a tragic time period. Then, students could investigate current cases of genocide like Darfur or Rwanda via the Web. Students could e-mail public leaders to promote an end to such violence.

Optional Feedback:

Path:

About the HTML editor

40. Authentic-Transformation Item

Statement 40 (S40) accurately and completely measures **Indicator 20 (I20)**

- Yes
- No

S40: Students in my classroom/classes use technology tools to solve real-world problems beyond the confines of the classroom that have meaning for the students or the community.	**I20:** By means of technology tools, students participate in outside-of-school projects and problem-solving activities that have meaning for the students and the community.

Example. Creating a brochure: An example would be students researching the characteristics of tornados at the Weather Channel site (http://www.weather.com) and using the Interactive Twister (an online simulator at http://whyfiles.org/013tornado/3.html) to predict the path of tornados as well as determine the amount of destruction caused by different sizes on the Fujita scale. The students would then come up with various solutions for keeping people protected during a storm to publish in an electronic brochure.

Optional Feedback:

Path:

About the HTML editor

41. Goal Directed-Entry Item

Statement 41 (S41) accurately and completely measures **Indicator 21 (I21)**

- Yes
- No

S41: Students in my classroom/classes receive automated feedback when using technology tools for drill and practice.	**I21:** Students receive directions, guidance, and feedback from technology, rather than using technology tools to set goals, plan activities, monitor progress, or self-evaluate.

Example. Applying laws of motion: An example would be in an electronic game where students choose angles based on wind speeds in order to launch projectiles toward an opponent's base like in Order Up (http://www.iknowthat.com). Students immediately are provided with visual feedback in terms of how close they were to the target.

Optional Feedback:

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About the HTML editor

42. Goal Directed-Entry Item

Statement 42 (S42) accurately and completely measures **Indicator 21 (I21)**

- Yes
- No

S42: Students in my classroom/classes receive differentiated feedback from computer-based training tools.	**I21:** Students receive directions, guidance, and feedback from technology, rather than using technology tools to set goals, plan activities, monitor progress, or self-evaluate.

Example. Receiving feedback about typing: An example would be students using a Web site that diagnoses typing skills and gives differentiated feedback based on speed, number of errors, etc. (http://www.typingweb.com).

Optional Feedback:

Trebuchet 1 (8 pt) Lang

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About the HTML editor

43. Goal Directed-Adoption Item

Statement 43 (S43) accurately and completely measures **Indicator 22 (I22)**

- Yes
- No

S43: Students in my classroom/classes use technology tools to create and plan educational goals.	**I22:** From time to time, students have the opportunity to use technology to either plan, monitor, or evaluate an activity.

Example. Managing a schedule: An example would be a student using a digital calendar to plan stages of work on a science project and record the task completed.

Optional Feedback:

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About the HTML editor

44. Goal Directed-Adoption Item

Statement 44 (S44) accurately and completely measures **Indicator 22 (I22)**

○ Yes
○ No

S44: Students in my classroom/classes use technology tools to monitor and evaluate their activities.	**I22:** From time to time, students have the opportunity to use technology to either plan, monitor, or evaluate an activity.

Example. Learning vocabulary: An example would be students keeping a daily journal in an online learning management system reflecting on vocabulary words, their meaning, and example sentences where the words are used.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

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About the HTML editor

45. Goal Directed-Adaptation Item

Statement 45 (S45) accurately and completely measures **Indicator 23 (I23)**

○ Yes
○ No

S45: Students in my classroom/classes choose certain technology tools to assist with goal directed activities.	**I19:** Students have opportunities to select and modify the use of technology tools to facilitate goal-setting, planning, monitoring, and evaluating specific activities.

Example. Monitoring plant growth: An example would be a student creating a table in Google Docs (http://docs.google.com) to monitor plant growth, watering, amount of sunlight, and temperature from day to day.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

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About the HTML editor

46. Goal Directed-Adaptation Item

Statement 46 (S46) accurately and completely measures **Indicator 23 (I23)**

○ Yes
○ No

S46: Students in my classroom/classes modify technology tools to meet specific requirements of goal directed activities.	**I23:** Students have opportunities to select and modify the use of technology tools to facilitate goal-setting, planning, monitoring, and evaluating specific activities.

Example. Organizing research: An example would be a student setting up multiple tables in a database to organize sources in order to perform queries for quick retrieval while writing a paper on healthcare.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

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About the HTML editor

47. Goal Directed-Infusion Item

Statement 47 (S47) accurately and completely measures **Indicator 24 (I24)**

○ Yes
○ No

S47: Students from my classroom/classes use appropriate software tools to manage goal directed activities throughout the school day.	**I24:** Students use technology tools to set goals, plan activities, monitor progress, and evaluate results throughout the curriculum.

Example. Maintaining a calendar: An example would be students managing their daily agendas by using GroupWise calendars to track important assignments, deadlines, and dates for school activities.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

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About the HTML editor

48. Goal Directed-Infusion Item

Statement 48 (S48) accurately and completely measures **Indicator 24 (I24)**

- ○ Yes
- ○ No

S48: Students from my classroom/classes use technology tools to manage goal directed activities across disciplines.	**I24:** Students use technology tools to set goals, plan activities, monitor progress, and evaluate results throughout the curriculum.

Example. Compiling a portfolio: An example would be students submitting and organizing their work for various classes in an online portfolio like Mahara (http://mahara.org)--even cataloging work over multiple years of school.

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

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About the HTML editor

49. Goal Directed-Transformation Item

Statement 49 (S49) accurately and completely measures **Indicator 25 (I25)**

- ○ Yes
- ○ No

S49: Students in my classroom/classes use technology tools like WIKIs, blogs, or forums to obtain feedback from multiple sources beyond the confines of the school day.	**I25:** Students engage in ongoing metacognative activities at a level that would be unattainable without the support of technology tools.

Example. Utilizing a learning management system: An example would be students maintaining personal calendars, monitoring grades, evaluating progress, and responding to feedback from teachers for all their classes using a learning management system (LMS) like Moodle (http://moodle.org).

Optional Feedback:

Trebuchet | 1 (8 pt) | Lang

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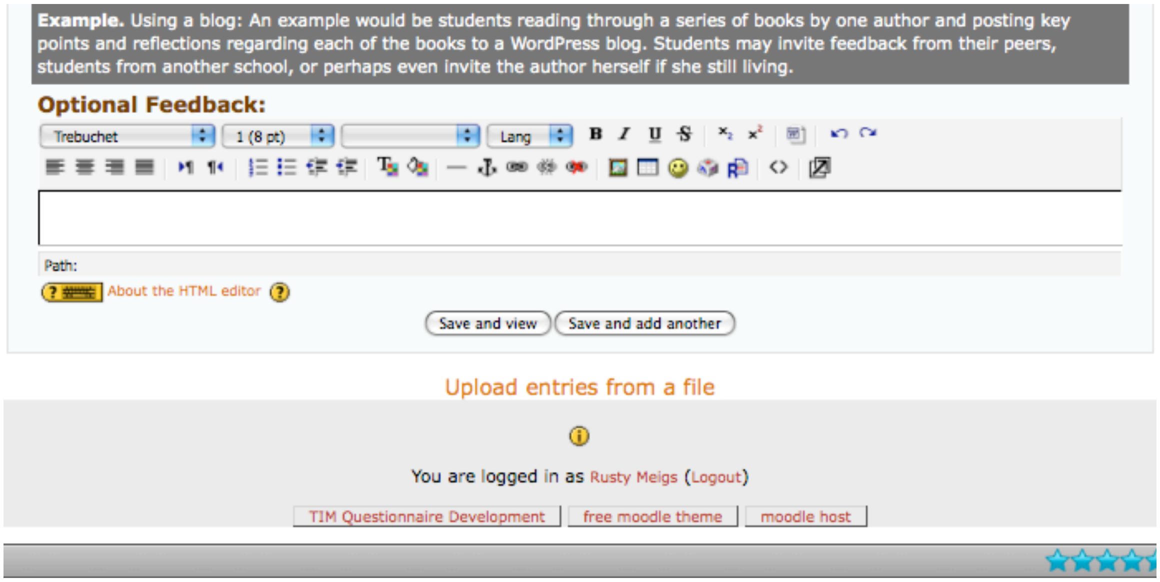
About the HTML editor

50. Goal Directed-Transformation Item

Statement 50 (S50) accurately and completely measures **Indicator 25 (I25)**

- ○ Yes
- ○ No

S50: Students in my classroom/classes use technology tools to receive ongoing feedback for goals within and outside the contexts of the school day.	**I25:** Students engage in ongoing metacognative activities at a level that would be unattainable without the support of technology tools.


Example. Using a blog: An example would be students reading through a series of books by one author and posting key points and reflections regarding each of the books to a WordPress blog. Students may invite feedback from their peers, students from another school, or perhaps even invite the author herself if she still living.
Optional Feedback:
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Appendix Q: Inter-Item Correlation Matrices

Table Q1

Inter-Item Correlation Matrix for the Entry Integration Level (N = 498)

Items	Q1	Q2	Q11	Q12	Q21	Q22	Q31	Q32	Q41	Q42
Q1	1.000	.494	.370	.258	.265	.211	.447	.329	.524	.473
Q2	.494	1.000	.441	.397	.192	.163	.407	.406	.427	.492
Q11	.370	.441	1.000	.582	.260	.152	.461	.524	.356	.400
Q12	.258	.397	.582	1.000	.209	.059	.467	.493	.345	.369
Q21	.265	.192	.260	.209	1.000	.200	.224	.215	.262	.233
Q22	.211	.163	.152	.059	.200	1.000	.115	.111	.145	.139
Q31	.447	.407	.461	.467	.224	.115	1.000	.490	.380	.358
Q32	.329	.406	.524	.493	.215	.111	.490	1.000	.297	.401
Q41	.524	.427	.356	.345	.262	.145	.380	.297	1.000	.553
Q42	.473	.492	.400	.369	.233	.139	.358	.401	.553	1.000

Table Q2

Inter-Item Correlation Matrix for the Adoption Integration Level (N = 498)

Items	Q3	Q4	Q13	Q14	Q23	Q24	Q33	Q34	Q43	Q44
Q3	1.000	.509	.422	.465	.460	.391	.483	.506	.477	.396
Q4	.509	1.000	.406	.442	.454	.376	.431	.423	.418	.380
Q13	.422	.406	1.000	.551	.361	.425	.398	.431	.483	.386
Q14	.465	.442	.551	1.000	.498	.526	.570	.524	.558	.527
Q23	.460	.454	.361	.498	1.000	.488	.513	.451	.471	.471
Q24	.391	.376	.425	.526	.488	1.000	.616	.604	.519	.530
Q33	.483	.431	.398	.570	.513	.616	1.000	.666	.549	.515
Q34	.506	.423	.431	.524	.451	.604	.666	1.000	.531	.508
Q43	.477	.418	.483	.558	.471	.519	.549	.531	1.000	.578
Q44	.396	.380	.386	.527	.471	.530	.515	.508	.578	1.000

Table Q3

Inter-Item Correlation Matrix for the Adaptation Integration Level (N = 498)

Items	Q5	Q6	Q15	Q16	Q25	Q26	Q35	Q36	Q45	Q46
Q5	1.000	.648	.391	.625	.628	.608	.619	.630	.589	.668
Q6	.648	1.000	.409	.568	.568	.602	.581	.681	.583	.571
Q15	.391	.409	1.000	.582	.475	.423	.388	.462	.368	.465
Q16	.625	.568	.582	1.000	.629	.612	.588	.639	.582	.687
Q25	.628	.568	.475	.629	1.000	.593	.604	.647	.584	.630
Q26	.608	.602	.423	.612	.593	1.000	.623	.686	.596	.597
Q35	.619	.581	.388	.588	.604	.623	1.000	.686	.616	.575
Q36	.630	.681	.462	.639	.647	.686	.686	1.000	.621	.627
Q45	.589	.583	.368	.582	.584	.596	.616	.621	1.000	.556
Q46	.668	.571	.465	.687	.630	.597	.575	.627	.556	1.000

Table Q4

Inter-Item Correlation Matrix for the Infusion Integration Level (N = 498)

Items	Q7	Q8	Q17	Q18	Q27	Q28	Q37	Q38	Q47	Q48
Q7	1.000	.578	.450	.490	.513	.491	.482	.543	.527	.479
Q8	.578	1.000	.554	.596	.594	.584	.603	.555	.553	.551
Q17	.450	.554	1.000	.602	.584	.567	.580	.559	.516	.576
Q18	.490	.596	.602	1.000	.591	.563	.617	.557	.588	.584
Q27	.513	.594	.584	.591	1.000	.618	.637	.607	.546	.602
Q28	.491	.584	.567	.563	.618	1.000	.595	.558	.495	.623
Q37	.482	.603	.580	.617	.637	.595	1.000	.663	.532	.603
Q38	.543	.555	.559	.557	.607	.558	.663	1.000	.516	.571
Q47	.527	.553	.516	.588	.546	.495	.532	.516	1.000	.592
Q48	.479	.551	.576	.584	.602	.623	.603	.571	.592	1.000

Table Q5

Inter-Item Correlation Matrix for the Transformation Integration Level (N = 498)

Items	Q9	Q10	Q19	Q20	Q29	Q30	Q39	Q40	Q49	Q50
Q9	1.000	.667	.485	.505	.502	.494	.626	.575	.461	.517
Q10	.667	1.000	.447	.514	.494	.500	.609	.509	.446	.526
Q19	.485	.447	1.000	.521	.378	.405	.472	.319	.564	.471
Q20	.505	.514	.521	1.000	.529	.548	.555	.450	.628	.590
Q29	.502	.494	.378	.529	1.000	.638	.517	.528	.472	.460
Q30	.494	.500	.405	.548	.638	1.000	.538	.525	.459	.488
Q39	.626	.609	.472	.555	.517	.538	1.000	.664	.485	.592
Q40	.575	.509	.319	.450	.528	.525	.664	1.000	.378	.482
Q49	.461	.446	.564	.628	.472	.459	.485	.378	1.000	.515
Q50	.517	.526	.471	.590	.460	.488	.592	.482	.515	1.000

Table Q6

Inter-Item Correlation Matrix for the Active Constructivist Characteristic (N = 498)

Items	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q1	1.000	.494	.195	.158	.244	.204	.317	.357	.261	.191
Q2	.494	1.000	.255	.243	.376	.360	.362	.416	.283	.275
Q3	.195	.255	1.000	.509	.553	.428	.401	.490	.481	.438
Q4	.158	.243	.509	1.000	.480	.384	.346	.421	.464	.414
Q5	.244	.376	.553	.480	1.000	.648	.617	.610	.564	.569
Q6	.204	.360	.428	.384	.648	1.000	.542	.548	.573	.545
Q7	.317	.362	.401	.346	.617	.542	1.000	.578	.568	.512
Q8	.357	.416	.490	.421	.610	.548	.578	1.000	.563	.584
Q9	.261	.283	.481	.464	.564	.573	.568	.563	1.000	.667
Q10	.191	.275	.438	.414	.569	.545	.512	.584	.667	1.000

Table Q7

Inter-Item Correlation Matrix for the Collaborative Constructivist Characteristic (N = 498)

Items	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q11	1.000	.582	.374	.480	.373	.538	.511	.468	.295	.383
Q12	.582	1.000	.432	.549	.376	.577	.554	.502	.337	.439
Q13	.374	.432	1.000	.551	.602	.557	.446	.532	.525	.547
Q14	.480	.549	.551	1.000	.537	.665	.584	.635	.415	.595
Q15	.373	.376	.602	.537	1.000	.582	.449	.539	.627	.701
Q16	.538	.577	.557	.665	.582	1.000	.609	.698	.450	.634
Q17	.511	.554	.446	.584	.449	.609	1.000	.602	.341	.460
Q18	.468	.502	.532	.635	.539	.698	.602	1.000	.464	.579
Q19	.295	.337	.525	.415	.627	.450	.341	.464	1.000	.521
Q20	.383	.439	.547	.595	.701	.634	.460	.579	.521	1.000

Table Q8

Inter-Item Correlation Matrix for the Constructive Constructivist Characteristic (N = 498)

Items	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
Q21	1.000	.582	.374	.480	.373	.538	.511	.468	.295	.383
Q22	.582	1.000	.432	.549	.376	.577	.554	.502	.337	.439
Q23	.374	.432	1.000	.551	.602	.557	.446	.532	.525	.547
Q24	.480	.549	.551	1.000	.537	.665	.584	.635	.415	.595
Q25	.373	.376	.602	.537	1.000	.582	.449	.539	.627	.701
Q26	.538	.577	.557	.665	.582	1.000	.609	.698	.450	.634
Q27	.511	.554	.446	.584	.449	.609	1.000	.602	.341	.460
Q28	.468	.502	.532	.635	.539	.698	.602	1.000	.464	.579
Q29	.295	.337	.525	.415	.627	.450	.341	.464	1.000	.521
Q30	.383	.439	.547	.595	.701	.634	.460	.579	.521	1.000

Table Q9

Inter-Item Correlation Matrix for the Authentic Constructivist Characteristic (N = 498)

Items	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
Q31	1.000	.490	.411	.403	.420	.459	.456	.367	.387	.401
Q32	.490	1.000	.482	.501	.491	.522	.488	.477	.497	.499
Q33	.411	.482	1.000	.666	.640	.694	.670	.622	.605	.613
Q34	.403	.501	.666	1.000	.674	.691	.640	.654	.650	.594
Q35	.420	.491	.640	.674	1.000	.686	.647	.686	.643	.581
Q36	.459	.522	.694	.691	.686	1.000	.716	.654	.681	.667
Q37	.456	.488	.670	.640	.647	.716	1.000	.663	.662	.613
Q38	.367	.477	.622	.654	.686	.654	.663	1.000	.647	.607
Q39	.387	.497	.605	.650	.643	.681	.662	.647	1.000	.664
Q40	.401	.499	.613	.594	.581	.667	.613	.607	.664	1.000

Table Q10

Inter-Item Correlation Matrix for the Goal Directed Constructivist Characteristic (N = 498)

Items	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50
Q41	1.000	.553	.231	.408	.300	.234	.258	.288	.158	.286
Q42	.553	1.000	.311	.439	.307	.307	.368	.368	.261	.331
Q43	.231	.311	1.000	.578	.580	.599	.627	.594	.430	.509
Q44	.408	.439	.578	1.000	.524	.519	.507	.495	.363	.445
Q45	.300	.307	.580	.524	1.000	.556	.587	.581	.400	.465
Q46	.234	.307	.599	.519	.556	1.000	.523	.659	.436	.506
Q47	.258	.368	.627	.507	.587	.523	1.000	.592	.426	.527
Q48	.288	.368	.594	.495	.581	.659	.592	1.000	.401	.467
Q49	.158	.261	.430	.363	.400	.436	.426	.401	1.000	.515
Q50	.286	.331	.509	.445	.465	.506	.527	.467	.515	1.000

Appendix R: Parallel Forms Reliability

Table R1

Parallel Forms Reliability Tests, A1 – B1 through A3 – B3 (N = 498)

Indicator	A1	B1	A2	B2	A3	B3
I1	Q1	Q2	Q1	Q2	Q2	Q1
I2	Q3	Q4	Q3	Q4	Q3	Q4
I3	Q5	Q6	Q6	Q5	Q6	Q5
I4	Q7	Q8	Q8	Q7	Q8	Q7
I5	Q9	Q10	Q10	Q9	Q9	Q10
I6	Q11	Q12	Q12	Q11	Q11	Q12
I7	Q13	Q14	Q14	Q13	Q14	Q13
I8	Q15	Q16	Q16	Q15	Q15	Q16
I9	Q17	Q18	Q18	Q17	Q18	Q17
I10	Q19	Q20	Q19	Q20	Q19	Q20
I11	Q21	Q22	Q22	Q21	Q21	Q22
I12	Q23	Q24	Q24	Q23	Q24	Q23
I13	Q25	Q26	Q25	Q26	Q26	Q25
I14	Q27	Q28	Q27	Q28	Q27	Q28
I15	Q29	Q30	Q29	Q30	Q30	Q29
I16	Q31	Q32	Q31	Q32	Q32	Q31
I17	Q33	Q34	Q33	Q34	Q34	Q33
I18	Q35	Q36	Q36	Q35	Q36	Q35
I19	Q37	Q38	Q37	Q38	Q37	Q38
I20	Q39	Q40	Q40	Q39	Q40	Q39
I21	Q41	Q42	Q41	Q42	Q41	Q42
I22	Q43	Q44	Q43	Q44	Q44	Q43
I23	Q45	Q46	Q46	Q45	Q45	Q46
I24	Q47	Q48	Q47	Q48	Q48	Q47
I25	Q49	Q50	Q50	Q49	Q49	Q50

Table R2

Parallel Forms Reliability Tests, A4 – B4 through A6 – B6 (N = 498)

Indicator	A4	B4	A5	B5	A6	B6
I1	Q2	Q1	Q2	Q1	Q1	Q2
I2	Q3	Q4	Q3	Q4	Q4	Q3
I3	Q5	Q6	Q6	Q5	Q6	Q5
I4	Q7	Q8	Q7	Q8	Q7	Q8
I5	Q9	Q10	Q10	Q9	Q10	Q9
I6	Q11	Q12	Q11	Q12	Q11	Q12
I7	Q13	Q14	Q13	Q14	Q13	Q14
I8	Q16	Q15	Q15	Q16	Q16	Q15
I9	Q17	Q18	Q18	Q17	Q18	Q17
I10	Q20	Q19	Q19	Q20	Q19	Q20
I11	Q21	Q22	Q22	Q21	Q21	Q22
I12	Q23	Q24	Q24	Q23	Q23	Q24
I13	Q25	Q26	Q26	Q25	Q26	Q25
I14	Q28	Q27	Q28	Q27	Q28	Q27
I15	Q29	Q30	Q29	Q30	Q30	Q29
I16	Q32	Q31	Q31	Q32	Q31	Q32
I17	Q33	Q34	Q33	Q34	Q33	Q34
I18	Q36	Q35	Q35	Q36	Q36	Q35
I19	Q38	Q37	Q37	Q38	Q37	Q38
I20	Q40	Q39	Q40	Q39	Q40	Q39
I21	Q41	Q42	Q41	Q42	Q42	Q41
I22	Q43	Q44	Q43	Q44	Q44	Q43
I23	Q45	Q46	Q46	Q45	Q45	Q46
I24	Q47	Q48	Q47	Q48	Q48	Q47
I25	Q49	Q50	Q49	Q50	Q49	Q50