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Middle School Mathematics Teachers' Perspective of Technology Integration: A Qualitative Case Study

Patricia Coleman
Walden University

Walden University

COLLEGE OF EDUCATION

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Patricia W. Coleman

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Dr. Jennifer Seymour, Committee Chairperson, Education Faculty
Dr. Charla Kelley, Committee Member, Education Faculty
Dr. Dan Cernusca, University Reviewer, Education Faculty

Chief Academic Officer

Eric Riedel, Ph.D.

Walden University
2015

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Doctoral Study Submitted in Partial Fulfillment

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Abstract

Many studies have documented that technology integration increases summative assessment scores, yet many teachers do not integrate technology in their teaching. The purpose of this qualitative study was to discover the extent to which middle school mathematics educators are or are not integrating technology in a school district where summative scores were below mathematics state benchmarks. Guided by instructional constructivism and the technology acceptance model, this case study examined how teachers perceived advantages and barriers to mathematics instruction that uses technology. Five of the nine mathematics teachers at the middle school volunteered to participate in a semi-structured interview and be observed in the classroom for evidence that they used the technology in the manner they described it during their interview. Data were coded and analyzed thematically. The findings revealed that although teachers perceived technology integration as viable to student academic success, they used the interactive whiteboards either as projectors or as marker boards instead of interacting with them through educationally meaningful tasks. Predominant technology integration barriers were limited resources and technological pedagogical knowledge. To address this deficit, a professional development project was created with the goal of increasing teachers' technology pedagogical integration strategies for the interactive whiteboards. Because technology is an essential part of 21st century education, positive social change can occur when teacher competence in technology integration increases, is applied in the classroom, and raises test scores. Additional positive social change can be realized as students build valuable skills that help them become positive active members of society.

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Dedication

This study is dedicated to my husband, Wayne, and my son, Darnell. You knew that I could accomplish this.

Acknowledgments

God said He would never leave me or forsake me—He never did. As well, there were many people instrumental in my success. To my dissertation committee, Dr. Jennifer Seymour, Dr. Charla Kelley, and Dr. Dan Cernusca, thanks for your guidance. Dr. Seymour, I was thrust upon you. Nevertheless, you welcomed me into the group. Dr. Cernusca, I could not have asked for a better URR. A special thanks to Dr. Zhu. When I was discouraged, you gave me words of encouragement.

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Section 1: The Problem

Introduction

Researchers have reported significant increases in students' academic outcomes when technology was effectively integrated into the curriculum. One such study, a meta-analysis, conducted by the International Society for Technology in Education (ISTE, 2008) concluded that technology integration had a positive effect on students' academic outcomes, especially in mathematics. According to the 2014-2015 School Accreditation Ratings, mathematic scores at the Title 1 School in the study continue to fall below state standards. The rigor of end-of-year mathematics assessments increased in the 2012-2013 school year. Students who did not pass assessments in the previous year found it increasingly difficult to pass new more rigorous tests (Richardson & Davis, 2012). Integrating technology into the curriculum, which is a mandate of the No Child Left Behind Act 2001 (NCLB), may be the resource teachers need to improve pedagogy and test scores. A major component of the NCLB act is the integration of technology into the curricula to close the achievement gap between high-performing and low-performing students (NCLB, 2001, Title II, Part D-Enhancing Education Through Technology).

Reports from the Department of Education School Accreditation Ratings, were reviewed beginning in the 2004 – 2005 school year. The school in the study has been unable to meet the NCLB directive of full accreditation in mathematics for more than 8 years. For 3 years, the school was considered a "priority" school, starting in 2010 and ending in 2013. At the end of the third year (2013), the school made progress and was removed from the priority school status list. The school remained as a "turnaround" school. According to Annual Measurable Objective (AMO), which replaced the Annual Yearly Progress (AYP), if a priority school's scores increased by 10% from one year to the next in a failing content area, the achievement status of that school would be updated from low-performing to proficient in that content area. Mathematics scores at the school remained below the standards set by the Department of Education, and they must be improved to meet these standards. Teachers at the school are required to use research based strategies to increase scores because proficient instruction is driven by data (Bambrick-Santoyo, 2010). Data revealed that technology integration is what will increase scores the most (Delen & Bulut, 2011).

Teachers must have technological pedagogical content and knowledge (TPACK) to effectively integrate technology into the curriculum to achieve ultimate success (Banister & Reinhart, 2011; Guerrero, 2010; Koehler, Mishra, Kereluik, Shin, & Graham, 2014). For example, Koehler et al. (2014) believed that to integrate technology in the classroom successfully, the teacher must be proficient in technology, must have a thorough knowledge of their subject matter, must understand how to engage the student in learning, and must incorporate all the components into the curricula. Some teachers stated that they would like to use technology in their classrooms but did not have the knowledge to effectively use the technology (Hagerman, Keller, & Spicer, 2013). Integrating technology into the classroom instruction requires that teachers must not only know the core content being taught, but also be pedagogically adept in technology and how to incorporate it into their content area.

Johnson and Kritsonis (2010) noted that according to the National Association of Educational Progress (NAEP, 2010), the achievement gap in mathematics is not closing. This gap is problematic because mathematics proficiency is a predictor of a country's economic wellness (Beaton, 1996). If students are not acquiring proficiency in mathematics before leaving high school, they will not be able to attain mathematics proficiency at the college level. Schornick (2010) and Stone, Alfeld, Pearson, Lewis, and Jensen (2008) concurred and added that students are not equipped with the mathematical skills necessary to compete in the 21st century workplace or college. Twenty-first century skills entail problem-solving and critical-thinking skills—skills that technology integration would develop (Izzo, Yurick, Nagaraja, & Novak, 2010; Pellegrino & Quellmalz, 2011).

Definition of the Problem

In a Title 1 middle school in the eastern region of the United States, students have been unable to meet federal accountability requirements in mathematics. The school comprises 408 sixth through eighth grade students (74% Black, 22% White, and 4% other), and 40 faculty members (Department of Education Fall Membership Report, 2013). The county has three elementary schools, one middle school, and one high school. Since the inception of the NCLB (2001) mandate, teachers have been required to integrate technology into their curricula to enhance student learning and to close the achievement gap, especially in mathematics and reading. More than a decade later, teachers have made minimal progress with curricular technology integration. Ertmer et al. (2009) reasoned that teachers are uncertain of how to use technology in their curricula.

Balfanz and Byrnes (2006) reported that mathematics courses in middle school are a critical juncture in a student's academic life. They go on to say that academic achievement gaps tend to widen if low achieving students do not get proper assistance in becoming proficient in mathematics during this time. Evident to what Balfanz and Byrnes stated the achievement gap is visible at the high school level in the county of the study. According to the 2013-2014 School Accreditation Ratings (Department of Education, 2012), the high school in the county of the study is accredited with warning in mathematics. Accredited with warning means that the students' summative assessment scores did not meet the mathematics accreditation benchmark, as set by the state mandates. Effective technology integration in this middle school may increase student mathematics scores (Brown, 2000; Davies, 2011; Harris, Stevens, & Higgins, 2011; Qing & Xin, 2010) and be the resource that teachers need to increase mathematics scores.

As stated in the school district's 2010-2015 Technology Plan (2009), some teachers are integrating technology into their curriculum, while others have expressed their discomfort about using it. School districts across the nation are facing dilemmas of limited educational technology integration into school curricula (Cakiroglu, Akkan, & Guven, 2012; Uslu & Bümen, 2012). Teachers who are not utilizing technology in their curricula are in need of professional development to decrease their anxiety by being acclimated in how to integrate technology effectively (Smolin & Lawless, 2011). At a time when schools are facing increasing accountability and accreditation demands, integrating technology into the curriculum should not be a concern, but rather a welcomed change. Low test scores and technology integration into the curricula are not problems that are limited to the school being studied, but, rather a national concern. The aforementioned researchers have shown that technology integration aids in student learning. Educators are unsure if integrating technology in mathematics classrooms in the middle school in the study would improve mathematics assessment scores.

The importance of technology integration cannot be understated in improving student success in mathematics. Once the teachers feel comfortable about the integration process and have mastered it, students' mathematics scores should improve, and the students themselves will be more proficient in a fundamental 21st century skill.

Rationale

Evidence of the Problem at the Local Level

Researchers of a plethora of studies conducted on technology integration by teachers reported that when technology was effectively integrated into a teacher's lesson, instruction goes from teacher-centered to student-centered learning (Brown, 2000; Hitchcock & Noonan, 2000; Qing & Xin, 2010; Thomas & Ye, 2013; Wolf et al., 2011; Yeşü, 2010). In student-centered learning students take ownership of what is learned and become more engaged and academically successful (Brown, 2000; Hitchcock & Noonan, 2000; Qing & Xin, 2010; Thomas & Ye, 2013; Wolf et al., 2011; Yeşü, 2010). At the middle school in the present study, some teachers may not be effectively using the many technology resources available to them. They are finding it increasingly difficult to teach students to attain proficient scores on summative assessments. According to a recent government report, *The Condition of Education 2013: Reading and Mathematics Score Trends*, mathematics scores reportedly are increasing nationally. However, according to data obtained from the Department of Education (DOE) School Report Card, students at the middle school in the study have not met mathematics testing proficiency status in more than 8 years on standards of learning (SOL) tests. The rationale for conducting this study is to explore whether teachers are effectively integrating technology into the curriculum. Technology integration could increase mathematics summative assessment scores and close the achievement gap.

Evidence of the Problem from the Professional Literature

Being mathematically proficient has become a topic of concern in many low-performing schools, especially for subgroups of students (i.e., minorities, English Language Learners, and students will disabilities). Historically, these subgroups of students perform below their peers academically (Kim & Chang, 2010). To eliminate this achievement gap, the NCLB act mandated that in 2014 every student would be proficient in mathematics and reading (Wei, 2012).

NCLB laws mandated that technology be integrated into the curriculum to, not only close the achievement gap for subgroups of students but to align the academic content with student academic outcomes (NCLB 2001, Title II, Part D-Enhancing Education Through Technology). Since the inception of the NCLB act, educational institutions have sought research based strategies to increase student academic outcomes and close student achievement gaps. One such strategy was the integration of technology into the curriculum as a supplement to traditional instruction. According to the district’s School Report Card (2013), White students consistently outperformed subgroups of students in content areas. Researchers have argued that technology has been effective in closing the achievement gap (Delen & Bulut, 2011; Kim & Chang, 2010).

Technology integration increased student academics (Mundy, Kupczynski, & Kee, 2012; Pamuk, Çakir, Ergun, Yilmaz, & Ayas, 2013), student engagement (An & Reigeluth, 2012), and was a resource that built student higher order thinking skills (Sheehan & Nillas, 2010). These skills are necessary to compete in a 21st century technologically global society. How teachers perceive the effectiveness of technology on student learning influences the extent to which technology will be integrated into the curriculum (Abbitt, 2011; Li & Ni, 2011; Palak & Walls, 2009). If teachers perceive technology as not aligning with their classroom curriculum, they will not use it. When technology aligns with teachers' curriculum, there were gains in students assessments (Cradler, McNabb, & Freeman, 2002; Ertmer & Ottenbreit-Leftwich, 2010).

Technology integration has been touted as a way to increase student summative assessment scores (Brown, 2000; Hadjerrouit, 2011; Kulik, 2003; Qing & Xin, 2010). Technology integration has long been a supplement to traditional instruction (Hitchcock & Noonan, 2000). Technology integration provided additional practice for underperforming students to gain proficiency in mathematics (Baya'a & Daher, 2013; Hitchcock & Noonan, 2000; Ross, Morrison, & Lowther, 2010; Yesilyurt, 2010) and is a pedagogical requirement to meet the demands of NCLB (NCLB, Title II, Part D-Enhancing Education through Technology).

NCLB, Title 1-Improving the Academic Achievement of the Disadvantaged requires schools to focus on increasing academics of every student. Additionally, NCLB act, Title II, Part D-Enhancing Education through Technology defines technology integrations as the use of technology to support student academic achievement (Sec. 2402. PURPOSES AND GOALS. (a) (1)) especially in, what is called “high-need areas” (Sec. 2403. DEFINITIONS. (3) (A)). Adhering to these mandates is imperative because student academic successes are central to the economic welfare of society. Johnson and Kritsonis (2010) noted that according to the National Association of Educational Progress (NAEP) data, the achievement gap in mathematics is not closing. This is problematic because mathematics proficiency reportedly is a predictor of a country’s monetary strength (Beaton, 1996).

Definitions

Annual Measurable Objective(s) (AMO): The minimum required percentages of students determined to be proficient in each content area (Hochbein, Mitchell, & Pollio, 2013).

Annual Yearly Progress (AYP): Represents the minimum level of improvement schools and school divisions are required to achieve under the federal NCLB Act prior to the issuance of Virginia’s flexibility waiver (Virginia Department of Education Accountability Terminology, 2012).

Computer assisted instruction (CAI): Refers to the use of computers and computer-related applications such as the Internet to support instruction and cognition (Chiappone, 2009).

Cut score: An operationalization of performance standards in which students are separated into groups according to their performance based on assessments or rating scales (Cravens et al., 2013).

Information Communication Technology (ICT): Refers to digital forms of communication (Hutchison & Reinking, 2011).

Professional Learning Environment (PLE): Any collection of resources and content that students have chosen to use in directing their own learning, at their own pace (Johnson, Adams, & Cummins, 2012).

Technology integration: A broad/interchangeable term and can be referred to by any of the following terms: CAI, computer assisted learning (CAL), information and communications technology (ICT; Hutchison & Reinking, 2011), and eLearning (Möller, Haas, & Vakilzadian, 2013), to name a few.

Significance

For teachers, engaging students in mathematical content is a challenge. Engaging students in mathematics may assist in increasing test scores that continue to not meet standards set by NCLB. Teachers at the school in the study are required to use research based strategies to increase student academic outcomes, and technology integration is one such strategy (NCLB, 2001, Title II, Part D-Enhancing Education Through Technology).

The school in the study is not meeting NCLB mathematics benchmarks. For 3 years, the school was considered a priority school, meaning it has failed to meet standards set by the state for passing summative assessments. In the third year, the school was removed from the priority school status. However, many students (35%) did not perform up to standard on the assessments (DOE Accreditation Rating, 2013). Although the school made progress, student scores were still below the cut score.

The school status is now in turnaround. A turnaround school is closely monitored by the Department of Education to ensure that academic progress continues to increase. If the decrease in mathematics scores persists, the school will be placed, once again, on the priority list. If the teachers perceive that technology integration will benefit the students and the teachers want more guidance on implementation strategies, then the findings of this study will be significant. Professional workshops could be developed to facilitate integrating technology at the classroom level to increase mathematics scores, which may allow the school to receive full accreditation.

Guiding/Research Questions

Students are not passing SOL mathematics assessments. Integrating technology into the curriculum may engage students to develop cognitive skills that may result in students acquiring the necessary skills to build mathematics knowledge. Though many researchers concurred that technology improved problem-solving and critical-thinking skills, teachers may not be using this resource fully. The research questions that will guide this qualitative study are:

1. How do teachers integrate technology into mathematics instruction?
2. How do teachers perceive technology integration as a resource for mathematics assessment?
3. What perceived barriers do teachers encounter in technology integration in mathematics instruction?

Review of the Literature

The many databases accessible from the Walden Library proved to be a phenomenal resource in conducting the literature review. They include EbscoHost, Education Research Complete, Education from Sage, Ed/ITLib Digital Library Proquest Central, and Science Direct was invaluable in conducting this study. Searching for articles for the literature review was an iterative process. I began by using a combination of terms like *technology integration* and *mathematics*. Though these terms returned many articles, I had to use more specific terms, like middle school and teachers' perspective, and teachers' perceptions to find articles that better pertained to my study. When using *teacher* as a search term, I would use a combination of spellings. I would use *teacher*, *teachers*, or *teachers'*. Each term would provide different articles. Other search terms using this strategy to review the literature included a combination of terms such as *technology, technology integration*, *educational and instructional technology integration, technology integration in public and secondary schools*, *computer assisted instruction*, *information and communication technology*, *research based instruction, traditional instruction*, *middle school*, *mathematics*, *teachers perceptions*, *teachers perspective*, *barriers teachers encounter, exemplary, NCLB, and TPCK*.

I reviewed the literature on the low mathematics test scores of a Title 1 school and whether teachers are effectively integrating technology into the mathematics curriculum as a resource to increase test scores. Many research studies have reported reasons why teachers may not be integrating technology into their curriculum. However, there remains a gap between what research based studies report and the teachers' technology integration practices. The topics of discussion will focus on the conceptual framework, on NCLB as it relates to technology integration and closing the achievement gap, on the reported benefits of technology integration as a resource to increase mathematics summative assessments, the teachers' perceptions of technology integration, teachers' perceived technology integration barriers, and what teachers say can be done to increase their use of technology integration.

Conceptual Framework

The conceptual frameworks employed in this study are instructional constructivism and the technology acceptance model. Suppes (1966) believed that technology would change pedagogy from behaviorism to constructivism and that educational technology was instrumental in differentiation of instruction. Educational technology software programs, such as SuccessMaker, give teachers a resource to aid low-performing students. SuccessMaker provides the student and teacher with a record of the students' mastered and unmastered skills. The teacher uses the data collected from the program to reteach unmastered skills. Students use the program to practice skills on their own and at their own pace. Students who do not need additional assistance do not have to practice skills in which they are already proficient (Tamim et al., 2011). Technology as a supplement to traditional instruction, allows students to interact with the subject matter, which is engaging for the student (Suppes, 1966). A more engaged student will inherently spend more time on academics, thereby increasing knowledge (Agustina & Tiara, 2013; Atweh & Goos, 2011). Other researchers have similar ideas about educational constructivism like Suppes and Null for example.

According to Anderson (as cited in Null, 2004) constructivism is "an interactive process during which teachers and learners worked together to create new ideas in their mutual attempt to connect previous understanding to new knowledge" (pp. 181-182). In conjunction to the ideas of Suppes (1966), Null stated that of the many different levels of constructivism most theorist define instructional constructivism as pedagogy in which student learning is interactive, relevant to their lives, and they construct their own knowledge. Instructional constructivism is student-centered. The learner is no longer a passive participant, but rather intrinsically involved in the learning process.

In alignment to constructivism, the National Council of Teachers of Mathematics (NCTM, 2014) asserted that mathematics epistemology should change to reflect 21st century pedagogy. This change should encompass the curriculum and the classroom and be constructivist in nature. NCTM reported that technology integration is a major factor in preparing all students to be proficient in mathematics. Twenty-first century learning is indicative of constructivism and provides student-centered learning relevant to the students' life. Seo and Bryant (2012) conducted a study using participants from Grades 2 and 3 to strengthen word problem solving skills using cognitive and metacognitive strategies. Students used either a technology program that was developed by the researchers, or paper and pencil to solve one step addition and subtraction word problems. Students using the technology program outperformed students who used the paper and pencil method. Technological programs contained what they called "virtual manipulatives" that may increase a student's attention span (Seo & Bryant, 2012, p. 218). Virtual manipulation gave the student opportunities to visualize and interact with the material. As well, interacting with the academic materials aids the student in critical-thinking and problem-solving abilities. In other words, virtual manipulatives make learning real for the student.

Researchers stated that though technology integration is an important component of student learning, how teachers perceive the usefulness of technology is equally important. To gauge teachers' perceptions and usefulness of technology integration into their daily curriculum, the technology acceptance model (TAM) can be beneficial (Davis, 1989; Esterhuizen, Ellis, & Els, 2012; Harris, Stevens, & Higgins, 2011). Holden and Rada (2011) reported that several factors contribute to a teacher's propensity to use technology. These factors include perceived usefulness (PU), perceived ease of use (PEU), and attitude toward usage (ATU).

If teachers believe that technology integration aligns with their curriculum and will positively affect the goal of student academic achievement, they are more likely to implement the technology. Teo (2012) conducted a study in which 157 preservice teachers from Singapore were surveyed and enrolled in a four-year educational program. Out of the six constructs, the participants were asked 17 questions. Of the six constructs, three entailed PU, PEU, and ATU. The results revealed that if teachers perceived technology as an effective resource to increase student knowledge, they would be more inclined to use technology.

Research Summary on Technology Integration

Technology integration has been mandated by NCLB to increase student academics in mathematics and reading as a resource that will close the achievement gap and increase student mathematical knowledge. Studies have been conducted to understand why some teachers use technology while other teachers did not. One study conducted by Kim, Kim, Lee, Spector, and DeMeester (2013) revealed that first and second order barriers may explain teachers use or lack of technology integration. First order barriers are indicative of limited access to computers and the Internet as well as teacher technology knowledge. Second order barriers are barriers inherent to technology integration and are "intrinsic factors that hinder technology integration" (p. 77). A teacher's beliefs or perceptions about the value of technology as a resource that will increase student academic achievement can be categorized as a second order barrier.

Tsai and Chai (2012) argued that third order barriers should be included in the list of barriers that further explained teachers' inclination to use or not use technology. When first and second order barriers are met (e.g., when teachers have access to computers, the Internet, and technology integration training) and minimal teacher technology integration persists, Tsai and Chai proposed that lack of "design thinking" (p. 1058) is the culprit. Design thinking removes all barriers and effective technology integration is attained. When design thinking is lacking, even though teachers have all the tools necessary to integrate technology into their curriculum, they do not have the needed creativity to for effectively implementation.

Scheer, Noweski, and Meinel (2012) defined design thinking as the constructivist method in which 21st century skills are pedagogically implemented. They explained that educators should prepare students with skills like critical-thinking and problem solving that encompass the global society of which students will be a part. Equipping students with design thinking skills requires the teacher to plan assignments that are real world based and relevant to the student.

Hammond et al. (2009) conducted a study of preservice teachers who effectively integrated technology into their instruction during their training and student teaching. The focus of the study was on preservice teachers who made “very good use of ICT” (p. 62), which was defined as those teachers who: (a) used technology themselves and used technology with their students for learning, and (b) used technology more than once per week in their lessons. First, they found that being a good user of technology entailed more than how often technology was used in instruction. Second, their findings suggested that for technology to be effectively used, certain factors were contributable to consistent use. Factors such as access to technology, school culture of technology use, and teachers who used technology in and outside of the classroom. The preservice teachers in the study believed that technology enhanced pedagogy.

Teachers provided with professional development on how to integrate technology effectively into their curricula gained technology integration knowledge. These teachers were more apt to use this resource as a student-centered tool (Wright & Wilson, 2011). Teacher-to-teacher collaboration was just as effective as being provided professional development (Li & Ni, 2010). Eristi, Kurt, and Dindar (2012) concurred with the aforementioned studies. They added that after professional development was completed, teachers needed technology scaffolding, if the expectation was for them to effectively use technology to increase student ability to pass mathematics assessments. Uslu and Bümen (2012) found in their study that after teachers were given professional development in technology integration, their use of technology in the classroom increased significantly. Most researchers have agreed that teachers' attitude about technology integration had a profound effect on whether the resource will or will not be used (Olusi, 2008; Uslu & Bümen, 2012). The problem of low test scores and the question of whether technology integration into the curriculum is being effectively used still exist.

Balfanz and Byrnes (2006) stated that middle school is a critical time in a student's life. They went on to say that academic achievement gaps tend to widen during middle school in mathematics if low achieving students do not get proper assistance in becoming proficient in mathematics. Students begin a decline in mathematic skills in the fourth grade; they are unable to meet the minimal set curricula standards (Balfanz & Byrnes, 2006). Knowing when students begin a decline in mathematics skills is important because processes can be put in place to eliminate the decline. Paine and Schleicher (2011) reported that according to the Program of International Student Assessment (PISA) the United States falls "below average" (p. 1) in mathematics in comparison to other countries. Purportedly, the education level of a country's population translates into "jobs and investment capital" (Paine & Schleicher, 2011, p. 2) for that country. In other words, the more educated its people mathematically, the more competitive and financially stable the country.

Technology integration creates a student-centered learning environment that facilitates student engagement in learning (Prensky, 2010). The teacher is no longer the only source of information; but now is a facilitator who assists the student in actively learning. Technology can create an academic environment that results in student collaboration. Using technology may inspire students to discuss areas of difficulty they may experience by sharing knowledge and bringing clarity to an otherwise ubiquitous situation (Demski, 2012). This may result in increased academic achievement. Johnson, Adams, and Cummins (2012) suggested that student collaborating and sharing is a trend toward professional learning environments (PLE). PLE is a technology-related resource that students use to take ownership of their own learning, in school and at home.

Students must possess 21^{st} century skills to compete in the global society. Rosenberg, Heimler, and Morote (2012) found that businesses indicated that college students are deficient in employability skills upon completion of college. Several skills students lack, they concluded, is the inability of college graduates to do “basic mathematical procedures” (p. 10). Students do not possess information technology skills, nor do they have “critical thinking skills” (p. 11). In a technology-rich society, critical-thinking, problem-solving, and mathematical skills are necessary. To satisfy the need for students to be mathematically and technologically skilled, technology integration into the curriculum is not optional. Ilgaz and Usluel (2011) suggested that educators should establish competencies for technology integration and that teachers should be trained in these competencies so that technology integration is used in the classroom. They further believed that developers of “undergraduate programs and in-service training” (p. 104) should be responsible for the establishment of the competencies and training for teachers.

Slavin, Lake, and Groff (2009) also reported the effectiveness of technology integration to increase student academics in mathematics. They concluded that remedial technology integration was effective not only for at-risk students, but for all students.

Numerous researchers credit technology as the conduit that will continuously increase mathematical achievement (Bottge, Grant, Stephens, & Rueda, 2010; Keengwe & Hussein, 2012; Tamim, Bernard, Borokhovski, Abrami, & Schmid, 2011). Though the achievement chasm is not closing, tenuously, technology integration is making a difference.

Not everyone agrees about the effectiveness of technology integration. Roschelle, Singleton, Sabelli, Pea, and Bransford (2008) stated that there is no concrete evidence that technology makes any difference in improving student scores in mathematics. Some researchers maintain that technology alone will neither engage nor enhance academic success. Spradlin and Ackerman (2010) conducted a study at a two-year college of students who were severely deficient in mathematics skills. The quasiexperimental study comprised four remedial mathematics classes. Two classes used the traditional instruction method while the other two classes used traditional instruction plus technology integration method. Findings suggested that the difference between the pre and posttest results were not significant. There was a significant difference between the scores of the female and male students; the female students consistently outperformed the male students.

Teachers' Perceptions of Technology Integration Barriers

The paradigm shift from teacher-centered instruction to student-centered instruction has forced teachers to rethink pedagogy. This shift has created a dialogue (i.e., traditional instruction vs. instructional technology integration) on integrating technology into their curriculum. Governmental mandates (i.e., NCLB) are specific in stating that technology integration be an integral part of daily instruction. Integrating technology into the curriculum has shown positive outcomes in student academic success. Though this may be accurate, the teacher is the decision-maker in whether to use technology as a resource or instructional tool in their classrooms (Sangra & Gonzalez-Sanmamed, 2011; Thomas & Ye, 2013). Hutchison and Reinking (2011) reported that teachers' perceptions and beliefs pertaining to technology integration are a major determinant of their propensity to use technology or not. These perceptions and beliefs correlate to Davis' (1989; 1993) technology acceptance model factors of perceived usefulness (PU) and perceived ease of use (PEU). The more teachers see the connection between technology and instruction, the more they will use the resource (Davis, 1989; Hutchison & Reinking, 2011).

Some teachers concur with the efficacious findings of the research studies, but reported that technology integration is sometimes challenging in its usage. For example, some teachers reported that in aligning technology integration with academic goals, there are time constraints in learning to use the technology, and there are difficulties resolving hardware and software issues (Anthony & Clark, 2011; Berrett, Murphy, & Sullivan, 2012). Teachers reported that school administrators are not fully supportive of technology implementation in the actual classroom. The administrators think that they give the teachers everything they need solely with professional development workshops; however, the administrators do not follow up with the day-to-day challenges in actually using the technology (e.g., lack of technology professionals when teachers have difficulty running the software or if the hardware breaks down). In other words, teachers are expected to begin technology implementation immediately with limited support, if any (Gorder, 2008; Meister, 2010).

To get the most out of professional development, leaders have to define and communicate their expectations clearly regarding use of technology, to give support, to monitor effectiveness and usefulness, and to provide educators with methods not only to use the resources but also to improve practice and student success (Killion, 2013). In other words, technology integration is cumbersome. When teachers know what is expected of them and feel supported in their efforts, the transition to technology integration will be met with less uncertainty and more acceptance.

Ertmer and Ottenbreit-Leftwich (2010) suggested that first there must be a paradigm shift in how technology is used in relation to student academic outcomes. They noted how other professions use resources analogous to their jobs. When a police officer stops a speeding vehicle, technology is used to research the drivers' history (e.g., "valid driver's license or outstanding tickets or warrants for his/her arrest" p. 255); mechanics use technology to repair vehicles. Doctors also use technology in their everyday patient diagnoses. These are simple expectations society holds for these professionals. The teacher should be expected to stay current and utilize resources that effectively educate every student. Though teachers concur with these ideas, they perceive insurmountable barriers that other professionals do not face. Mumtaz (2000) reported findings that reasoned that teacher integration barriers were,

- lack of teaching experience with ICT,
- lack of on-site support for teachers using technology,

- lack of help supervising children when using computers,
- lack of ICT specialist teachers to teach students computer skills,
- lack of computer availability,
- lack of time required to successfully integrate technology into the curriculum, and
- lack of financial support (p. 320)

Wright and Wilson (2011) reported similar barriers that hindered technology integration that included appropriate training, time constraints in learning to use technology, and technology support. They conducted a study of teachers who were enrolled in a social studies methods program course. This program motivated preservice teachers to integrate technology into their instruction when they became in-service teachers. The students in the program were required to write in a reflection journal during the methods class and in-service teaching. At the completion of the program, the teachers were followed until their fifth year as in-service teachers. If the teachers needed additional technology integration assistance at the completion of the methods class, they could contact the teachers from the program for assistance. Of the 21 teachers who were initially in the program only 10 (8 males and 2 females) participated in the study.

Teachers in Wright and Wilson's (2011) study were evaluated using Hooper and Rieber's five phases of technology integration: (a) familiarization (learning "how-tos..."), (b) utilization (trying technology, but not being attached to it), (c) integration (using regularly), (d) reorientation (complete acceptance and integral part of learning), and (e) evolution (evolving and adapting) (p. 48). Only one of the teachers reached the evolution phase, three reached the reorientation stage, and four reached the integration stage. Teachers who did not reach the integration stage reported that they could not overcome barriers such as “scheduling conflicts and lack of equipment” or “technology use was limited to pressures to meet the requirements for testing” (p. 57).

The teachers in this study reported that they were well equipped with skills required to use technology integration as a resource effectively (Wright & Wilson, 2011). Even though they believed that they had been prepared to integrate technology into their instruction, they were unable to cross the chasm of barriers they perceived that they faced. Chen (2008) and Moore-Hayes (2011) stated that a teacher’s belief and attitude toward technology integration was a major factor in using technology, which aligns with studies conducted using the TAM model’s factors of PEU and PU (Adiguzel, Capraro, & Willson, 2011). Wright and Wilson’s (2011) study suggested that more important than beliefs and attitudes is the fact that technology integration is a difficult process.

Implications

Technology integration reportedly is a viable resource to assist students in becoming proficient in mathematics. Many studies have been conducted that reported barriers teachers face with implementing educational technology. One barrier is how to integrate technology into the curricula. Kopcha (2012) reported that when teachers received professional development via a mentor, the teachers were more inclined to use technology integration as opposed to those who did not receive mentoring.

Researchers report the benefits of technology integration and the barriers teachers report that inhibit their use, little is being done to correct this problem. Lowther et al. (2008) stated that to ensure that professional development was provided to the teachers, funds were made available at the state level. They specifically stated that “the federal government addressed these issues by enacting the Enhancing Teaching Through Technology (ETTT) initiative as Title-II-D of the No Child Left Behind (NCLB) Act of 2001” (p. 198). As well, studies conducted using TAM to ascertain what influences a teacher to use technology have shown that the usefulness and ease of use of the technology greatly influences whether a teacher will use this resource as a tool in classroom instruction. The study might point to deeper issues than have been reported. This study may provide additional reasons teachers do not use technology and, if necessary, provide the specific professional development training teachers perceive that they need.

Summary

The NCLB act requires teachers to educate every student to pass state mandated summative assessments. Teachers are being held accountable if students do not pass these tests. NCLB requires teachers to use research based strategies as a resource to increase student academic outcomes. Integrating technology into the curricula is an invaluable strategy. Though many researchers believe that technology integration is the research based strategy that may achieve this goal, some teachers are not using this resource (Eristi, Kurt, & Dindar, 2012; Ertmer, 2005; Ertmer et al., 2009; Uslu, & Bümen, 2012; Wright & Wilson, 2011).

Much research has been conducted on reasons teachers give for not using technology in their curricula. Some teacher perceived barriers are inadequate technology support and time limitations (Berrett et al., 2012); administrative support and insufficient professional development (Meister, 2010); and the teachers' perceptions and beliefs of technology (Hutchison & Reinking, 2011). To understand why teachers at the school in the study do not use technology may have a profound effect on increasing their technology use and increasing student test scores. Section 2 of the study will discuss the research design, the participants in the study, the data collection and data analysis procedures.

Section 2: The Methodology

Introduction

In this study, I employed a qualitative research design to better understand mathematics teachers' perceptions of technology integration as a resource to increase student summative assessments scores. Deciding on a type of research design (quantitative or qualitative) depended on the research problem and the research questions to be answered. I chose the qualitative design because it is inductive and allows a researcher to understand a perspective from the individual or group that is living the experience. Participants were asked open-ended questions to get their specific views (Creswell, 2012; Yin, 2014). I did not lead or guide the participants into answering questions in any way (Lodico, Spaulding, & Voegtle, 2010).

Creswell (2009) defined a qualitative study as an inductive study that delved into some phenomenon from the perspective of an individual or group. Creswell differentiated between the two research designs by stating that (a) in a qualitative study the literature review is not as important as in a quantitative review, (b) data collection and analyses differ, and (c) reported research findings differ. A quantitative design would not provide a detailed description of what teachers perceived as how or why technology integration would or would not benefit student academic successes. Numeric data could only track how often technology was used in instruction or track summative scores from technology use. A qualitative study would give reasons teachers did or did not use technology. The research design for this study was a qualitative case study.

Yin (2014) defined case study as one in which some phenomenon that is occurring in the present is studied in depth. When selecting a methodology Yin proposed that the researcher should decide (a) the type of research question posed, (b) the extent of control he or she has over actual behavioral events, and (c) the degree of focus on contemporary as opposed to historical events (p. 9). The study questions asked how teachers perceived technology integration, how they integrated technology into the curriculum, and what the perceived barriers were to such integration. The study questions aligned with the qualitative case study design.

Participants

The study was conducted in a rural area with a predominately low socioeconomic population. The school comprises approximately 400 students and 40 faculty members. Lodico et al. (2010) stated that purposeful sampling "is the most often used in qualitative research" (p. 140). All participants were mathematics teachers who have knowledge of technology integration and were teachers employed at the study site. Lodico defined this purposeful type of sample as homogenous. Five mathematics teachers who worked at the school were purposively selected to participate in the study. These teachers were selected because they could provide the most in-depth information to best understand the phenomenon being studied, and that they work at the study site.

The perspective participants were invited to take part in the study via a face-to-face one-on-one conversation. It was made clear that participation was voluntary and that no repercussions in any way would ensue if their decision was to not participate. Participants gave immediate responses either accepting the participation invitation or declining it. All mathematics teachers at the research site were invited to participate in the study. Of the eight teachers (five regular education and three special education teachers) only five of them were willing to take part in the research. The school employs two regular education teachers per grade level (sixth through eighth). At the time the interviews began, the school employed a substitute teacher for one grade because of the school's inability to locate a certified mathematics teacher. The new teacher was eventually hired but not invited to participate because she was new to teaching in the part of the country in which the study took place. She could not provide sufficient information to contribute to the study. Participants were informed of their rights as study participants and given consent forms to sign acknowledging their understanding, expectations, and consent. They were also told of documents that I required them to provide (e.g., lesson plans, minutes from team meetings). At that time, arrangements were made in reference to when and where interviews would take place.

The research site employs six core mathematics teachers and three special education teachers. Lodico et al. (2010) called this a "bounded system" (p. 277) because of the small number of people that could be interviewed. Conducting interviews involved many hours of transcribing notes and developing themes, which are time-consuming. Due to time constraints, the participant count was acceptable (Lodico et al., 2010).

Ethical Protection of Participants

Both Walden University's Institutional Review Board (IRB) and the school of the study required written permission to conduct a study. Previous approval (Letter of Cooperation from a Research Partner in Appendix E) had been obtained from the superintendent of schools to conduct the study at the research site. The superintendent did not require IRB approval before agreeing to the study. Included in the correspondence was a request for permission to conduct the study, time needed to conduct interviews/observations, and information on how data would be used. I provided details of how the proposed study would benefit the study site and how I would assure participant confidentiality.

Once both Walden's IRB (Approval # 10-02-14-0197927) and the school district provided consent to conduct the study, the selected teachers were invited to participate in the study. Then they were given a written consent form (Appendix B). According to this informed consent template provided by Walden University, the decision to participate is voluntary and no repercussions would occur if the mathematics teachers decided not to participate in the study. If they made a decision to withdraw before or during the study, they would be well within their right to do so. I guaranteed the participants that when they decided to take part in the study; no harm would come to them. Any information they provided would be kept strictly confidential and maintained in part through pseudonyms. Data collected are to be kept locked up for a period of 5 years and deleted at the end of that time. I have worked in the study site for several years; I have a preestablished relationship with the participants.

Data Collection and Instruments

Lodico et al. (2010) suggested that when selecting a data collection method, the researcher should consider what method would best address the phenomenon being studied. In qualitative research, data collection methods normally may consist of interviewing and observing participants as well as analyzing documents.

Participants were asked a series of open-ended questions and allowed to respond unhindered. In addition to the interviews, observations were conducted at the classroom level. Teachers teaching similar subjects are required to meet regularly as a team and plan lessons together. Notes from these meetings are to be retained by the team and a copy submitted to administration. These team lesson plans and minutes from team meetings were also collected. I designed all the data collection instruments used in this study (e.g., interview questions and observation "look fors") which I describe below in more detail in the following three subsections.

Interviews

Upon receiving Walden's IRB approval to conduct research, the principal of the school was notified of the plan to conduct interviews and observations and gave approval to begin. The principal was told that the study was projected to last four weeks and not interrupt day-to-day instruction/activities. The study lasted from October 6, 2014 through November 5, 2014.

To answer the question of how teachers perceived technology integration as a viable resource to increase student summative assessment scores, I conducted one-on-one audio-recorded interviews and two classroom observations for each participant. Gaining access to participants was not a concern because I have worked at the research site for seven years and the participants were colleagues. It was only necessary to state my position, as not that of an educator, but as that of a researcher. My role was only to understand how participants perceived and integrated technology into their curriculum. Once the agreed-upon interviewing times were confirmed, I began the interviews. Three interviews were conducted after school in my computer lab for convenience and privacy, and two were conducted during planning periods, one in the participant's classroom and one in the computer lab. I recorded the interviews using an audio recorder.

The interview protocol (see Appendix C) provided consistency for each interview. The first three interview questions were related to the actual pedagogy in the classroom and connected to the first research question on technology integration. The last two interview questions were relevant to the last two research questions on general beliefs about technology and student achievement in mathematics as well as success on standardized tests. All participants were interviewed once at the beginning of the study and observed twice afterward.

There are advantages and disadvantages to conducting an interview. One advantage is that interviewees may feel that the interview is their opportunity to be heard, to give their perspective of the issue. A disadvantage is if the interviewee answers questions too succinctly to provide rich data. Another disadvantage could be an equipment malfunction where data that are thought to be collected are not present. To address this potential disadvantage, I used an audio recording device only (e.g., tape recorder) and also took written notes. To ensure that participants felt uninhibited while being interviewed, meticulous care was given to explain confidentiality protocols. The participants understood that taking part in the study was voluntary, every part of the interview and observations were kept confidential, and confidentiality would be provided by not including any identifying names or materials on interview or observation notes. In my field notes, I created code names for participant, and then placed these notes in a locked box. Finally, participants were required to sign consent forms agreeing to participation, which detailed their rights in the study.

To accommodate all of the teachers, interviews were conducted over a four-week period either in their own classrooms or the computer lab at 30-50-minute durations before the two observations. Of the five interviews, one took 30 minutes, another 40 minutes, and two lasted 50 minutes. Interviews were scheduled at the middle school as follows: before school the educators who arrive early in the morning, and after school for those who do most of their work in the afternoon.

Observations

Creswell (2012) stated that there are several skills inherent in the observation method to maximize results. When conducting observations, a researcher must be adept at listening, observing, and analyzing. The researcher should decide in advance on his or her role, what is to be observed, and how to keep a record of the observations. My role was that of an observer. Observations included discerning how the lesson progressed in conjunction with the interviews in which teachers stated how technology was being used in the classroom, how lesson plans aligned with technology use, and how teachers encouraged students to use technology.

Though observations can be an effective resource for obtaining triangulation in data collection, Lodico et al. (2010) indicated that the process must be systematic to avoid bias. To maintain the most unbiased position possible, during the observation, I took notes in a double entry notebook with the headings *observations* and *thoughts reflecting the observations*. Particular care was taken to record in the observation section only what was observed. At the completion of the observation, I reflected and noted my thoughts about what I had seen and heard.

There are advantages as well as disadvantages to using observations. One advantage of conducting an observation is that it gives the researcher an opportunity to observe and study participants in their natural work environment. Kothari (2004) stated that a disadvantage is how the participant may react to being observed and thus not act in a routine manner. It is important for the observer to discern what behaviors appear to be normal and what behaviors may be staged. I felt confident that staging was not an issue in this study, for I have already had numerous opportunities to observe participants in their natural classrooms over the years in a school-related peer protocol. For the past 5 years, administrators have encouraged teachers to observe colleagues and discuss teaching strategies. The goal of the study was to present findings that were concise and accurate and would lead to a project that should increase teacher technology integration use and increase mathematics scores.

Documents

Lastly, document analysis was used as a data collection instruments (Creswell, 2012). Documents taken from the regularly scheduled team meetings included lesson plans, minutes from team meetings, and any records of technology integration professional development for mathematics teachers. The school keeps all meeting minutes as well as records of professional development workshops. My viewing these documents did not present a conflict of interest because when mathematics department meetings are held after school (once per month), I have been assigned to meet with the team.

Lesson Plans

Even though one participant did not provide a lesson plan to me, objectives written by this teacher on the board during the observation of that class aligned with the content being taught. Grade level teachers are required to plan lessons together. This strategy contributes to teacher cohesion and collaboration. Participants 1 and 2 did provide shared lesson plans because they are on the same grade level. During observations of these two teachers, I found their instruction to be similar.

Data Analysis

Creswell's (2012) six steps for data analysis were used to analyze collected data, using thematic analysis, as suggested by Glesne (2011). Questions from the interview protocol (see Appendix C) were guided by the research questions approved by IRB. After each interview notes were transcribed and provided to the participants to ensure that the transcriptions reflected what had been recorded, only one participant returned the transcribed notes with a minor correction. Other participants stated that the transcriptions were acceptable and did not require corrections. Meticulous care was given to avoid researcher biases by reflecting on my thoughts and keeping them separate from the transcriptions. After the interviews were transcribed, I reflected on what I thought the interviewee had reported. After the classroom observations, I again reflected on what I perceived had transpired. My reflections were cross-referenced with what was stated in the interviews and what was observed in the classroom. Then I noted the similarities or differences to the literature research findings.

The data collected via interviews were transcribed after each session and coded to develop themes. I reviewed my field notes for the observations and any notes taken during the interviews for content. With the literature review in mind, I analyzed the difference(s) or similarities in what the literature review stated and what the interviewees believed. Although Creswell (2012) indicated that the literature review in a qualitative study does not contribute substantively to research questions, it yielded some important data to compare what was specified about the research problem to what was presently being stated and done. Once the interviews were conducted, the data were transcribed and organized to be analyzed.

Data analysis included several steps as suggested by Yin (2014) and Creswell (2012). First, I reflectively read and reread the transcriptions one at a time noting repetitious words and phrases. Next, these data were grouped into meaningful phrases and terms and coded into the categories. Because these procedures were iterative, I continued the coding until categories could be developed into themes. Concurrently, I used a color-coded matrix to categorize and record each step on an Excel spreadsheet. Spreadsheet headings were used to organize literature review findings, participant beliefs, participant beliefs unrelated to literature review findings, and themes. Included in the matrix were headings reflecting teacher practices as discerned during observations that did or did not align with the literature review and other documents.

Ensuring Credibility of Research Findings

Several data collection methods were necessary for validating the study, which Lodico et al. (2010) referred to as “triangulation” (p. 267). One such method, the interview, was conducted at the middle school before the school day began where I am employed, for those educators who arrive to school early and after school for those teachers who have other obligations early in the day. The credibility of any study is important. Lodico et al. suggested that credibility reflects the accuracy with which a researcher describes the perceptions of the participants. From the existing methods to ensure that the study was accurate and credible, I used triangulation and member checking. Participants were given transcribed notes and asked to review them for accuracy.

To triangulate the findings, I conducted interviews, observations to corroborate what the interviewees reported, member checking, and document review (e.g., lesson plans and notes from team meetings).If an interviewee stated that technology integration (student computer use, interactive whiteboards, student clickers, etc.) was a viable resource for instruction, the expectation was to see that technology integrated in the classroom. Observations were conducted to compare what the interviewee stated and their actual practices (e.g., what types of technology was used, how that technology was used, etc.). Lesson plans and team meeting notes, which are given to school administrators, were further compared against interviews and observations. Administrators did agree to allow me access to these documents for the purpose of this study.

Member checking was also useful in ensuring accuracy of the findings and curtailing researcher biases. I provided each participant with a copy of the transcribed interview notes to ensure I accurately captured what the interviewee stated (see Appendix D for a sample transcript). Based on the received feedback, corrections were made as needed.

Identifying discrepant cases was important. During the data analysis process, any data that differed from the research findings and from participants were included in the findings. The focus of the study was to understand the perspectives of every participant. Ensuring that the views of each participant, no matter how unaligned they were, were given credence. Such an approach was valuable in my understanding the problem of technology integration.

Findings from the Data Analysis

Technology integration as a resource to increase student summative assessment scores is an efficacious means of educating students in mathematics. The school in the study is not utilizing technology effectively. Of the nine teachers at the study site, five agreed to participate in the research. Participants were asked questions pertaining to their definition of technology integration along with their perceptions, use, and beliefs regarding technology integration.

When asked how teachers integrated technology into mathematics instruction, the findings revealed that teachers were unsure of how to use technology effectively. Technology integration was limited to using Promethean boards as projectors and calculators for solving problems. Participants were asked to give their perceptions of technology as a resource for mathematics in which they affirmed the use of technology as viable in driving instruction and engaging students to enhance instruction and increase academic assessment scores. A major barrier that participants encountered was their inability to effectively use the technology that the school had for curriculum integration.

Analysis of the data revealed many recurring words and phrases. All participants spoke of using computers, calculators, and the Promethean boards in one aspect or the other. All participants used the words *visual*, *paper and pencil*, *interactive*, *engage*, enhance, *supplement*, *lab use*, *professional development*, *limited resources*, and *other counties*. These words were used to form themes that included *technology and technology integration, technology integration barriers, limited professional development, limited access to technology and computer labs, time constraints, and technology use in neighboring counties*. These themes correlated to related research studies. What follows is a description of the words that developed into themes. Table 1 depicts the themes, the research questions, and the interview questions related to the themes and if observations were used in supporting those themes.

Technology and Technology Integration

Participants were first asked to define technology and technology integration, which they described electronics, headphone equipment, computers, Promethean boards, clickers, calculators, and anything that excluded paper, pencil, textbooks, or programs that were supplements to the textbook. The participants defined technology integration as using technology "to supplement instruction," "to drive instruction," and as "visuals for the students." Next, participants were asked to give examples of technology that they used in their classrooms. Examples of technology that participants would use in their classrooms included algebra tiles, overhead projectors, media carts, Promethean boards, clickers/ responders, calculators, and manipulatives (e.g., base ten blocks, fraction parts, and Lincoln cubes). Participant 5 responded, "the TI-Nspire calculator and that's it. If I had a smart board I would use one. But, I don't have one. There was a point in my career that I was at a school that had one. I enjoyed it."

Another example provided by Participant 3 stated:

> I don't have access to a Promethean board, but I know some teachers find that very helpful as well. I haven't had a chance to experience the Promethean board per se. But, like I say, I have been observing a few teachers and I have seen it's pretty useful. But, like I say, I don't have access to it in my classroom.

When the teachers were asked how often these types of technology tools were used in classroom instruction, two participants responded *daily* while others responded *once* or *twice per week*. When asked if they believed that technology was a viable resource in increasing student mathematics achievement only one participant said *no*. Most teachers expressed a preference for technology integration for increasing student mathematics comprehension. One teacher claimed that paper and pencil would provide the best comprehension results and another teacher who also preferred paper and pencil believed that technology could be used as a supplement. Technology was believed to be a viable resource.

Table 1

Research Questions, Themes, and If Interview Questions, Meetings, and Observations Were Used in Supporting that Theme

Research Questions	Data Themes	Interviews	Meetings	Observations
1. How do teachers integrate technology into mathematics instruction?	Technology and Technology Integration	Yes	No	Yes
2. How do teachers perceive technology integration as a resource for mathematics assessment?	Supplement to instruction	No	No	Yes
3. What perceived barriers do teachers encounter in technology integration in mathematics instruction?	Technology barriers	Yes	Yes	Yes
	Limited Professional Development	Yes	No	Yes
	Limited access to technology and computer labs	Yes	No	No
	Needed professional development on technology integration strategies	Yes	No	Yes
	Time constraints	Yes	No	No
Emergent Theme	Technology in Wealthier Counties	Yes	No	No

Technology as an instructional resource was evident to most participants, but not all. Words and phrases used were paper and pencil, drives instruction, engages, connects, and visual. Participants 1, 3, and 5 were the most verbal on technology integration. In particular, Participant 1 articulated skepticism about technology, expressing that technology did not contribute to mathematics knowledge. The assertion was that students needed to learn mathematics using paper and pencil because that is how “we are teaching them in class because we can’t be in a computer lab all day long.” Participant 3 agreed that technology may “hinder instruction” and students should gain basic knowledge to gain mathematics proficiency. Students must “understand the concept on how you arrive to your answer.”

Participant 5 proffered that times are changing and educators must keep up. Using antiquated pedagogy or methodology does not engage or encourage students to want to learn. Participant 3 understood that students have access to and use technology outside of the school environment. The caveat is that technology should not be used to the point that it will “weaken the student because all they’re familiar with is, ‘okay, what do I need to type in to get the answer instead of how to arrive to the answer.’” There is a distinct difference between comprehending the process and arriving at an answer. Though this may be true, technology is an evolving part of society. An example of the prevalence of technology and why the archaic idea of technology’s detriment to cognition is misplaced prompted Participant 5 to use this analogy:

> I will give the example; I had a parent argue with me saying that we needed to, to not let kids use the calculator. And that they were too overly dependent, which

> ultimately I don't think I got her attention until I said, "Do you want us to do carpet bombing?" So that's when she finally said "Okay." And I use that analogy in a sense of "yes, I hope the kids can multiply, subtract, and divide, but at the same time no one is going out and walking to Walmart because their car might break down." So why would we do some of the old things when we have the technology that makes it faster and more accurate?

All teachers reported using technology either daily or at least two to three times per week, even the teacher who did not agree that technology would increase mathematics knowledge. Participants 2, 3, 4, and to some degree Participant 5 proposed that technology does drive instruction and engages students to learn.

Technology Integration Barriers

Participants were asked if they experienced any barriers to integrating technology into their curriculum. Responses revealed three primary barriers: (a) limited professional development, (b) limited access to technology and computer labs that also was the most pervasive reason for not utilizing technology, and (c) time constraints. The limited amount of technology caused Participant 4 to be apprehensive during instruction when students interacted with the Promethean board.

> Barriers. Not having enough. Like sometimes you are afraid. I do allow the students to come up and work out problems on the board, but I get so scared because a kid will drop the pen and I'm like, "Oh my goodness, I'm never gonna get another pen." So you want them to be involved and come up and actually use what we do have... But, also we really don't have enough.

With the many requirements for preparing students to become proficient in mastering SOL skills, another barrier was finding time to plan to use technology in instruction. Participant 2 stated that, “sometimes if we don’t have the time. Sometimes it can be time consuming. That comes with planning effectively. If I plan, I find it comes easier than just integrating it at the spur of the moment.

Limited Professional Development is provided to teachers to learn only the “basics” about the technology that is available. Participants 3 and 5 indicated limited professional development as a barrier to technology integration. Having to learn on your own how to go beyond basic manipulation of technology was the sentiment of these two participants. In response to technology training, Participant 5 stated: “I had two days, and during the summer. And then it was ‘you’re on your own.’ The two days didn’t do much good. They did what you can do easily on your own. They didn’t get into the difficult stuff.”

Participants argued that professional development technology integration strategies were necessary to “drive instruction for the students.” Technology was perceived as not a device to have for the sake of having, but a resource that would increase academic productivity. For example, Participant 3 stated: “I wish I could utilize technology a little bit better. I wish I could get more professional development and build my skill level up so that I can present it to the students.”

When asked what technology they would get for their classrooms, all participants’ answers were similar: Promethean boards/smart boards, IPads, or computers for the classroom. Participants specifically stated that if they could not get Promethean boards, IPads, or computers for their classrooms that they should be assigned to a computer lab at least once or twice per week to acclimate students to end-of-year assessments. Participant 3 stated that though teachers are scheduled to use the computer labs once or twice per week it does not always happen that way. Indicating this point by stating, "but sometimes schedules change; we are on a different schedule every two weeks or every three weeks. Or we may not be able to get in there that week." Participant 2 had a similar perspective: "if we are not able to get into the lab about once a week, I don't think that is really sufficient to helping the student to get accustomed to using the computer and answering those technology enhanced items."

Limited access to technology and computer labs, as previously stated, is problematic. The participants in the study reportedly want to use technology but do not have adequate access to computers/computer labs. Participants 3 and 5 stated that they would use the Promethean board, but do not have access. They do the best that they can with what they have. For example, participants that have a Promethean board in their classrooms, use it to do what they know how to do. Participants who only have the TI-Nspire calculators also use them as best they can.

A reoccurring theme found throughout all of the data sources (i.e., interviews and classroom observations), was that teachers who had Promethean boards used them. The participants who had a Promethean board in their classroom used them in a teacher-centered manner, but they did use them. For example, during my observation of Participant 1, instruction involved problem solving, mathematical communication, mathematical reasoning, connections, and representations of integers. During this observation, instruction was limited to using the Promethean board to draw models manually representing number lines. The Promethean board was being utilized as a resource to explain and discuss integers; the teacher drew a number line and identified points on that number line to be ordered and compared. Mathematical symbols (<, >, =) were used to explain ordering integers further after which instruction involved determining absolute values of integers. Points were placed on the number line to reflect the fractional part of a number. Students were instructed to make a connection with the points on the line by thinking of the points in terms of money in cents. The number to be plotted was .75 and was to be visualized as 75¢.

After plotting several numbers on the number line, students were instructed to order and compare the plotted integers. The method of teaching that day aligned with the participants' perception of instruction (e.g., students learn better by using paper and pencil). Instruction followed procedures that paralleled teacher-centered instruction as opposed to student-centered instruction, which was the method of instruction for all other participants who had a Promethean board in their classrooms during my observation of their classroom. It was clear that in-depth professional development is necessary to assist teachers in developing strategies that will result in student-centered learning.

Three teachers who had Promethean boards did not mention using the calculator during the interviews. During the observations, all students did have calculators on their desks. During my classroom observations, the other two teachers (Participants 3 and 5) used calculators only because they did not have access to Promethean boards. For example, at the time of the classroom observation, Participant 5 used calculators for instruction because that was the only source of technology available to that individual. During instruction, students were engaged in learning even if instruction was teacher-centered. They were attentive to the instructor. The teacher was in front of the class using the whiteboard to explain the homework that students had been required to complete. Students asked questions for clarity as needed but did not go to the board to participate actively and take ownership of their learning by demonstrating their knowledge of the concepts being taught. Instead, the instructor controlled learning. What is notable about this observation is that much research reported that students learn best with technology. However, while this participant uses only calculators for instruction each day, disaggregated state assessment scores reveal that the students in this participant's classes consistently met state benchmarks. After the observation, I attempted to rationalize and reflect on what the participant was doing to affect this degree of success. Due to multiple factors influencing the instructional processes that were not the focus of this study, I concluded that this could be a question that would require further research.

Time Constraints. This was not an issue for everyone, it was a concern for Participants 3 and 2, "Dealing with a pacing guide" that must be adhered to get academic material covered "before this date because the test is then." Finding time to plan how to integrate technology into instruction was problematic. If instruction is to progress smoothly, there must be a well thought out plan. Participant 2 reported, "If I plan, I find it comes easier than just integrating it at the spur of the moment." Planning comes with the ability to utilize technology effectively. If participants do not have the necessary skills to implement technology integration, planning will continue to be cumbersome.

Technology in Wealthier Counties

Four of the five participants made references to how technology was being used in other counties. For example, Participant 5 mentioned how students in another county "have a laptop assigned to them the whole year." Participant 4 mentioned how a neighboring county required teachers to use computer labs and had personnel stationed in the labs to assist as needed. Participant 3 spoke of the "larger more affluent city schools" having the financing to acquire resources. It was interesting that the four participants compared their resources to other counties. It was clear that they were having collaborative discourse with neighboring counties to increase their pedagogic knowledge. In other words, the participants in this study were talking with teachers in other counties on what technologies they have and how these technology tools were being used.

Summary of Findings

Other research findings indicated that integrating technology into the mathematics classroom may increase student mathematics scores (Brown, 2000; Qing & Xin, 2010). This study explored whether teachers at the local school are integrating technology in their classrooms, which could increase mathematics summative assessment scores and close the achievement gap if the technology was used effectively. This section of the study presented the rationale for conducting a qualitative case study, a description of the setting and participants, and the procedure in carrying out interviews and observations as well as the analysis of the data for emerging themes. Section 3 will describe the actual study.

Participants' perceptions of technology integration aligned with many of the findings from the literature review studies. To determine whether all participants had similar definitions of technology and technology integration, they were first asked to define these terms.

The belief that technology integration was an effective resource reverberated throughout the interviews and observations as teachers were using their classroom resources often (e.g., Promethean boards and calculators). What participants stated during the interviews and what I found during the classroom observations validated this belief. Technology tools accessible to the classroom were being utilized. Promethean boards and calculators were fundamental resources during instruction. Technological resources were being used to the extent of teacher knowledge, even if at a lower level compared to their potential. For example, the Promethean board served as a projector for class discussion, a teacher-centered activity and not for the student to interact with the lesson, as a student-centered activity. For example, Promethean Planet has a plethora of resources that allows the student to interact with instruction, discussion boards help to collaborate and share ideas but they were not used during my classroom observations for this study.

One teacher rationalized that limited technology resources resulted in the need to be parsimonious when creating student-centered activities. Participants did report that lack of availability to technology (computers, computer lab time, and promethean board) was a barrier to technology integration. Other concerns involved lack of professional development for the Promethean board and calculators. All of the interviewed teachers did state that access to the Promethean boards would greatly influence pedagogy. Still, participants did not mention having access to an onsite technology facilitator. Such a person could answer questions and assist teachers with effective integration and could eliminate or reduce the professional development barrier. Participants did state that they lacked technology integration knowledge.

Addressing the needs of the teacher's professional development sessions would be beneficial. For example, for the Promethean board and the TI Nspire calculators, offsite training is available; two technologically savvy teachers can attend the training sessions and afterwards train other teachers. Section 3 provides further details for the proposed teacher professional development plan and its implementation strategies. The focus of the professional development workshop will be only on instruction on the use of the Promethean board.

Section 3: The Project

Introduction

The purpose of this study was to explore the perceptions of mathematics teachers pertaining to technology integration as a viable resource to increase student summative assessments. The teachers believed that effectively integrating technology into their curriculum would increase student academic abilities. Based on the study findings presented in Section 2, a professional development workshop is proposed and described in this section as a rational solution for closing the gap related to the lack of low technology integration. This intense workshop would last 4 days and will provide teachers with content specific instruction on using the Promethean board. The Promethean board is the predominant technology integration resource accessible to the participants. However, those who are currently using it are employing it for teacher-centered instruction as opposed to student-centered work. As a result, the students are not interacting with this technology.

To increase the effectiveness of its use, a professional development is the logical choice. Following the professional development workshop, teachers would continue to be provided with substantive assistance. The purpose of conducting such a workshop of this magnitude is beneficial because most teachers at the study site are not adept at technology integration techniques.

This section delineates the professional development sessions. A synopsis of the goals is followed by the rationale for the professional development workshop to be implemented. The review of the literature discusses how the project supports the findings from Section 2. Additionally, potential resources and barriers, implementation and timetables, project evaluation, and implications for social change are covered.

Description and Goals

A preponderance of evidence obtained from my research study revealed that barriers to technology integration included limited resources and lack of professional development on how to use the resources available to the teachers (e.g., Promethean board and TI-Nspire calculators). To understand teachers' perceptions of technology integration, one-on-one interviews were conducted. Observations were conducted to ascertain if what teachers stated during the interviews aligned with their classroom practices. It was found that teachers used the technology that they had; but, it was being used in a teacher-centered and not student-centered manner. The teachers reported that they would like to use technology more effectively; however, they were uncertain about how to do so. Conducting a professional development workshop would be the most efficacious way to address the problem.

To address the concern of limited resources, I am making two recommendations to administration. First, to address the concern of needed professional development, I am proposing a teacher professional development workshop, targeted for middle school mathematics teachers, on strategies describing how to use the Promethean board more effectively. This professional development workshop is the main focus of my project. A professional development of this magnitude is the best choice due to budgetary constraints. Using personnel already employed by the district will not create undue financial hardships. Participants will further have ongoing support because the workshop facilitator will be housed onsite. The findings from the study revealed that participants are dissatisfied with workshops that provide only basic instructions. This workshop will provide what the participants need—extended assistance when needed. Second, I am proposing (a) to apply for a STEM Academy Grant that would provide software to the school studied, and (b) to create a school-business partnership with a local business as a hardware resource.

The major goals of this project are to empower mathematics teachers to use the technology that the school has and to find resources that would assist them in effectively integrating technology into their daily lessons. Goals are not limited to how to complete these tasks but rather what resources to select based on the learning needs of the students. These goals should ultimately lead to student academic success.

Rationale

The findings from the study showed that teachers are in need of professional development. Technology is being underutilized. For example, the Promethean board is being used to illustrate lessons via Microsoft PowerPoint similar to using a projector. Another use for the Promethean board is comparable to a whiteboard. Teachers write on the whiteboard to illustrate concepts taught. Calculators are used to solve problems. Students miss the endless opportunities to interact with the device. The calculator capabilities allow every student to visualize and interact with mathematics. Using the TI-Nspire calculator gives students kinesthetic opportunities in which they can manipulate data thereby facilitating learning. Teachers are not fully cognizant of how to use the technology as a student-centered resource. Nor are they aware of where to find resources. A professional development workshop can address these issues.

There are many resources on the district website and on the Internet. Teachers, however, expressed that time constraints did not afford them the opportunity to search for the resources. A professional development workshop that, first, demonstrates how to use the hardware and, second, provides kinesthetic opportunities to practice using the hardware will be therefore beneficial. Next, to supplement the pedagogy further, part of a professional development session could focus on how to find and use technology resources. This workshop will therefore support the major goal of this project, that is, to increase the effective use of the Promethean board as a resource for classroom instruction.

Review of the Literature

Teachers at the study site are not proficient with classroom technology integration techniques. Though they are knowledgeable in their subject matter, they may be lacking technological knowledge in how to use technology as a resource to engage students. Findings from my study showed that teachers that participated in the study stated that they believed in technology as a resource for student academic achievement. However, their beliefs that technology can engage students to the point of them wanting to learn were not reflected in their observed practices. Belief must be transformed into practice. Twining, Raffaghelli, Albion, and Knezek (2013) stated that technology has become an essential resource to classroom instruction and that “TPD [teacher professional development] can be designed to support those changes” (p. 430). The caveat is that to integrate technology into classroom instruction efficaciously, teachers need professional development. Teachers that participated in this study reported the lack of such professional development as a barrier to effective technology integration in their classrooms.

These findings aligned with findings from literature that found that professional development needed to be content specific and more in-depth than simple basic instruction (e.g. Johnson, Adams, Estrada, & Freeman, 2014; Schrum & Levin, 2013). On the same line, Lai (2010) reported that “training is usually given by companies at the beginning stage” (p. 512) when technology is first installed in the school. Although this routine may be sufficient for veteran technology users, it is inadequate for teachers who are out of their comfort zone implementing technology integration strategies (Ajayi, 2010). The researchers went on to say that training should give participants the opportunities to learn to use the tools as a resource to conduct lessons that are engaging to the student. According to Campbell and Martin (2010), these skills take time to master. For this reason, professional development should not be short in duration but continuous (Spires, Wiebe, Young, Hollebrands, & Lee, 2012). The following subsections provide a synopsis of what researchers reported on the main components to be considered when planning effective professional development workshops.

Conducting the Literature Review Search

Conducting a literature review is an iterative process. Finding articles that pertained to my project proved to be straightforward. Many studies have been conducted on teacher professional development as a feasible method of providing needed guidance for enhancement of skill building. Several techniques were used in the search. First, I searched Walden Universities' many online library resources, which was most invaluable. The online databases included EbscoHost, EditLib, ERIC, Sage, and Taylor and Francis Online. Next, I used Google Scholar, which again, was instrumental in finding beneficial materials. Terms that yielded information included *technology integration, professional development, program implementation, scaffolding, training methods, teaching methods, learning modules, teacher collaboration, teacher education programs, interactive white boards, TAM, TPACK, educational technology, educational innovations, instructional delivery, ICT, and technology integration barriers*. As was expected, a variation of these terms was necessary to find a plethora of scholarly studies that fit my requirements.

Effective Professional Development

Effective professional development is the catalyst for a paradigm shift. Teachers are the ultimate decision makers when it comes to technology integration (Hutchinson & Reinking, 2011). They must lead the paradigm shift when it comes to forming a technological culture of change in the classroom. If they are unsure of how to integrate technology into their lesson effectively, apprehension will continue to result in low use. In other words, teachers must not only believe that technology integration will solve the problem of student academic success, but they must also model the use of technology in their day-to-day curriculum. For this integration to happen, sustained professional development is necessary.

Much research has been conducted on why technology integration remains an anomaly for educators. Based on the research discourse detailing barriers teachers faced with technology integration, findings consistently reported that a major barrier encompasses the user's belief system (Blocher, Armfield, Sujo-Montes, Tucker, & Willis, 2011; Niekerk &Blignaut, 2014). What teachers believe about the effectiveness of technology and how it aligns with their intended student academic outcomes is important. If teachers did not believe in technology, they would not use it (Davis, 1993). Davis believed that perceived ease of use (PEOU) and perceived usefulness (PU) were predominant factors of whether a teacher would use technology as an instructional delivery resource. As well, researchers have suggested that lack of availability of resources and time allocations for learning to use and implement the technology are hindrances to classroom technology integration (Anthony & Patravanich, 2014).

As reported by Archibald, Coggshall, Croft, and Goe (2011), if professional development is to meet the needs of teachers, it must be characterized by five components:

1. Aligned with school goals, state and district standards and assessments, and other professional learning activities including formative teacher evaluation
2. Focused on core content and modeling of teaching strategies for the content
3. Inclusion of opportunities for active learning of new teaching strategies
4. Provision of opportunities for collaboration among teachers

5. Inclusion of embedded follow-up and continuous feedback. (p. 3)

Often, the professional development that teachers are receiving does not support these characteristics (Shih-Hsiung, 2013; Shu Chein & Franklin, 2011). However, when teachers are provided with skills on how to integrate technology effectively into their day-to-day instructional practices, instruction is more infused with technology. Teachers are afforded opportunities to collaborate, share ideas, observe colleagues' instructional practices, and continue these practices long after the professional development has ended (Curwood, 2013). Periathiruvadi and Rinn (2013) added that the effectiveness of technology integration is contingent upon how well educators understand the concept of technology integration and how it should be implemented into the curriculum.

Technological Pedagogical and Content Knowledge

Several researchers suggested in addition to PEOU and PU, that teachers must have technological pedagogical and content technology (TPACK) to be proficient at technology integration (Doering, Koseoglu, Scharber, Henrickson, & Lanegran, 2014; Duran, Brunvand, Justin, & Sendag, 2011; Matherson, Wilson, & Wright, 2014; Shih-Hsiung, 2013; Shu Chein & Franklin, 2011). A TPACK amalgamation may ensure that educators have the necessary skills for such integration. Combining technological pedagogical and content knowledge via professional development sessions may help, according to Matherson et al. (2014). Raman and Mohamed (2013) concurred with this view and suggested that "teacher education and in-service professional development programs should provide learning opportunities for teachers to develop these areas" (p. 75). Levin and Wadmany (2008) added that intensive workshops would further assist teachers in developing compulsory skills that are both technological and pedagogical knowledge.

The TPACK theory aligns with what Tsai and Chai (2013) called design thinking. Design thinking removes all obstacles that teachers perceive as barriers to technology integration, as should TPACK. Yet, it is unclear if teachers will perceive TPACK as concomitant to design thinking. Teachers must accept/believe technology as useful (TAM, the technology acceptance model) before they undertake the concept of technology as a form of pedagogy. For this reason, a content specific in-depth professional development should suffice to provide teachers with cognitive insight to analyze and conceptualize the component parts of TPACK holistically.

The professional development that I am proposing will require participants to first obligate themselves to the requisite time to receive the necessary training. Time allocation include actual training time (4 days), time afterwards to reflect and review materials covered, and continuous updating of new skills.

Project Implementation

The Promethean board workshop will be a 4-day training. On Day 1, the instructor and participants will introduce themselves and the instructor will provide a synopsis of what is expected from the workshop. Participants will be required to have completed the prerequisite activity (i.e., to have downloaded the Promethean software from the Promethean website to acclimate themselves to the Promethean board). Participants will give their definition of what a Promethean board is and does. Next, the session will begin with reviewing the Inspire interface (e.g., ActivPen, Dashboard). In the afternoon, the Inspire tools will be covered (e.g., Main toolbox, Pen tool, and Text tool).

On Day 2, the workshop will begin with a summary of the previous day's lessons. During this time, participants will ask any questions in which are unclear. Then, participants will learn to create notes, create a Promethean account, and explore the Promethean website. In the afternoon session, participants will download flipcharts, and calibrate the board.

On Day 3, participants will begin with a summary of the previous day's lessons and ask any questions that remain unclear. Next, they will learn about Promethean board commonly used tools. Participants will also work on creating a lesson for presentations on Day 4.

On Day 4, participants will begin with a summary of the day's lessons and ask any questions that remain unclear. Next they will cover summative assessment test prep. In the afternoon, participants will present lessons created for presentations. At the completion of all presentations, participants will be given a wrap up/exit survey (see suggested questions at the end of Appendix A).

Potential Resources and Existing Supports

Potential resources for the effective implementation of the professional development are a classroom with a Promethean board, the Promethean Planet website and Promethean support, unrestricted internet access, YouTube, other resources that are available via the internet, and handouts with study materials. These resources are free and once participants are aware of their existence, they can be accessed at any time. For example, Promethean Planet provides training videos that introduce teachers to how to get started using the Promethean board, discussion blogs where teachers can discuss/share/find strategies on using the tool that have worked for other educators, and technical support if necessary. The Internet provides a variety of how-to videos that may supplement learning. Existing supports for using the Promethean board include the district's technical support team and the district website. The website has an instructional technology resource section that provides resources for Promethean board use, online resources and lessons, and interactive resources that the teachers may use with students.

Potential Barriers

Administrators at the local school recognize the importance of technology and are receptive to the idea of providing technology integration professional development support for teachers. Therefore, potential barriers to the effective professional development workshop are first the teachers' commitment to attending the sessions and next to continuing to develop learning after the workshop has ended. Abuhmaid (2011) contended that learning does not stop after the workshop but should continue with facilitator follow-up. Nonetheless, teacher's professional development success is contingent upon their obligations and determination to use the time that it may take to perfect technology integration skills.

An additional barrier may be teachers who are not skillful with technology may become frustrated or discouraged about their progress and discontinue training. For these participants, completion safeguards will be put in place (e.g., one-on-one instructional support before and/or after each session). The goals of the workshop are to create a professional development environment that guides teachers through effective use of technology integration in the mathematics curriculum and the adoption of a systemic culture of teacher collaboration. Therefore, if a colleague is deficient in these skills and needs additional support, other colleagues will be encouraged to adopt a professional learning community attitude and provide scaffolds to those participants who require supplementary assistance. In a professional learning environment, teachers learn together and should not feel inhibited concerning fear of making mistakes (Meiers & Buckley, 2009; Owens, 2015).

Proposal for Implementation and Timetable

Teachers are in need of technology integration strategies that will guide instruction and engage students for increased academic success. Once the principal gives permission for the professional development workshop to begin, teachers would be notified and dates set. Contingent upon administrative approval, scheduling the workshop would be during teacher staff development sessions. Teacher staff developments are scheduled for 3 days at the end of January and 1 day at the end of February. The professional development workshop would thus last approximately 4 days. Day 1 would begin with a question and answer session to get participants' expectations of the workshop. An introduction to the Promethean board will follow. Subsequent days would provide kinesthetic activities and instruction to perfect technology integration usage (see Appendix A for detailed scheduling).

Roles and Responsibilities

My role will be that of workshop instructor. I will conduct the workshop and assist teachers in developing technology integration skills. The research study involved understanding teachers' perceptions of technology integration. Teachers reported that effective technology integration would drive instruction and engage and increase student academic assessment scores. However, they were apprehensive about how to include technology into their instruction. They will be given instruction on how to use and find resources. The expectation is that participants will share their technology pedagogical knowledge at the end of the workshop by creating and implementing a technology integration lesson. Table 2 presents workshop roles and responsibilities.

Project Evaluation

The professional development workshop evaluation methodology will be determined by "the measurement of outcomes in comparison with goals" (Ham, 2010, p. 24). In other words, the goals of the workshop will be measured by the seamlessness of technology integration into classroom instruction (e.g., increased teacher efficacy in technology integration use during instruction). This evaluation measurement can provide validation that the workshop is meeting its intended goals/outcomes.

Table 2

Roles and Responsibilities of Participants

Instructor Responsibilities	Description of Instructor Responsibilities	Participants Responsibilities	Description of Participants Responsibilities
Be punctual	Punctuality lets participants know that instructor has a vested interest in their learning success	Be punctual	If students are not punctual they may miss valuable information
Have content knowledge	Important that participants know that instructor is knowledgeable about content	Bring all required materials to class/ Review materials outside of class	To get the most out of the instruction and be able to engage in instruction
Attentive to student body language/ Know your audience	Instructor needs to know if participants are learning the content and whether instruction should be altered for greater participant success	Ask questions/ Participate in class activities	For clarity, participants should ask questions and actively participant. They must be committed and highly motivated to learn
Know student expectations	Know what the students expect to glean from this workshop	Be courteous to others	Be respectful of participants' comments/ideas, do not be disrespectful (e.g., cell phones should be off so as not to be a disruption)

The workshop goal is to provide teachers with technology integration skills that will lead to student academic success on summative assessments. Outcome based evaluations aid in detecting the effectiveness of a program as well as what needs to be reinforced (Henry, Smith, Kershaw, & Zulli, 2013). Ultimately, student scores on end-of-year summative assessments would measure outcomes.

At the conclusion of the workshop, teacher evaluation will be based on the construction of an authentic planned lesson to be used in their classrooms. They will devise a lesson plan based on a strand of student academic deficiency. For example, if students are having difficulties with number and number sense, understanding the relationship among fractions, decimals, and percentages, the teacher can create a student-centered activity utilizing technology. This lesson will be presented to the participants of the workshop. At the conclusion of the presentation, teachers will do a critique of the lesson (see Appendix F). In addition, participants will complete a warp up/ exit survey on the effectiveness of the workshop (bottom of Appendix A).

At the conclusion of the project, I will follow up by observing teachers in their classrooms with the expectation of seeing technology integration as an integral addition to instruction. After each observation, scheduled at the teacher's convenience, a discussion will ensue reflecting on technological pedagogical instructional techniques used during the lesson. Participants will have the opportunity to discuss the effectiveness of using the Promethean board, or ask any questions that they may have. Because professional development is a continuous process, time can be scheduled for all participants to meet and continue the technology integration discourse. Grade level teachers will continue to collaborate on lesson planning as well.

Implications Including Social Change

Local Community

Technological investments in educating students are vast. Stakeholders hold school administrators accountable for not only educating students but also hold them accountable for how monies are being spent, especially due to budgetary restrictions. Stakeholders (e.g., district and school administrators, teachers, students, parents, community leaders and businesses) further hold school administrators responsible for educating citizens to grow the economy. Some researchers specifically stated that “much evidence suggests that many children who attend school may not learn enough to enable them to benefit from and contribute to their society’s future” (Pryor, Akyeampong, Westbrook, & Lussier, 2012, p. 409-410). An educated community equates to students not leaving the area upon graduation but staying to provide human capital. This educated human capital will result in economic growth for a declining local economy.

Far-reaching

In the larger context, the positive social change produced by this professional development workshop may change the way workshops are provided for teacher training to result in student academic mathematics mastery. The workshop would transcend standard workshops in that the workshop would deliver what the teachers reported that they needed as opposed to what administrators believed teachers needed. O’Connor (2012) claimed that teachers’ ability to effectively integrate technology into their curriculum would increase student academic assessments. As well, proficiency in technology integration creates a student-centered environment that engages students and results in increased learning (Minor, Losike-Sedimo, Reglin, & Royster, 2013). Districts that are finding it problematic to overcome student academic disparities efficaciously will find the change in how teacher professional development is administered encouraging.

Conclusion

Teachers are the predominant factor that influences how, when, and whether technology integration is included in classroom instruction. Much of the research on technology integration has reported that such integration is an integral part of students' academic success. Questions that directed this study focused on how teachers integrate technology into mathematics instruction, how they perceived technology integration as a resource of mathematics assessments, and how they addressed the barriers faced in technology integration. The findings confirmed what previous research studies have reported. For example, teachers used technology as they would an overhead projector—to display images on a screen as opposed to having students interact with the technology. Additionally, classrooms were equipped with one computer each; that computer was restricted mostly for teacher administrative duties (e.g., taking attendance, entering/reporting grades, etc.). This obsolete pedagogy does not invoke a desire to learn. Though technology was accepted as a useful tool and was used by most teachers every day, its proper use was not fully grasped by the participants. This may be the result of lack of technology integration knowledge due to lack of support in professional development training.

Although this lack of support may be accurate, my findings were that teachers do believe in the effectiveness of technology integration. Their concerns were getting sustainable professional development that scaffold finding resources and developing instructional strategies on how to implement instruction that would engage learners. Teachers do not want to use technology for the sake of just using it. They want to use it to educate their students.

Teachers who participated in my study have the content knowledge (CK) but not the technological pedagogical knowledge (TPK). Providing guidance in how to use the CK that they have and add how to find the resources they need would complete the TPACK theory. The TPACK theory aligns with design thinking. Design thinking removes all obstacles that teachers perceive as barriers to technology integration, as should TPACK. Yet, it is unclear if teachers will perceive TPACK as concomitant to design thinking. In other words, though research posits that TPACK and design thinking will provide teachers with skills to fully integrate technology into their curriculum, the teachers seem to see this instead as another cursory attempt at what other factions believe is necessary to equip teachers with what is needed. Additionally, teachers must accept/believe technology as useful (TAM, the technology acceptance model) before they undertake the concept of technology as a form of pedagogy. For this reason, a content specific in-depth professional development should suffice to provide teachers with cognitive insight to analyze and conceptualize the component parts of TPACK holistically.

The professional development that I am proposing would require participants to first obligate themselves to the requisite time to receive the necessary training. Time allocation includes actual training time (four days), time afterwards to reflect and review materials covered, and continuous updating of new skills.

Teachers, however, stated that they both lacked and needed professional development. For this reason, Section 3 discussed what the research posited on the effectiveness of providing professional development for the teachers. Also, this section included how the professional development workshop would be implemented. Section 4 includes the strengths and limitations of the study, recommendations for implementing professional development, and my reflections on the project.

Section 4: Reflections and Conclusions

Introduction

This section includes discourse of the strengths and limitations of the project. Reflections of scholarship, project development and evaluation of the professional development workshop, and leadership and change are also discussed. A contemplative analysis of self as practitioner and project developer is conducted. This section concludes with potential impact on social change, direction for future research, and a summary.

Project Strengths

The strengths of the professional development workshop project lie in the conception that the workshop supports what the participants reported were advantageous in helping them effectively integrating technology into their daily instruction. I used research based strategies found to be most effective in closing the gap between teacher technological knowledge and practice. The technological gap being filled through this workshop is training that meets the specific needs of the teachers. Teachers' reported needs were how to integrate technology into their curriculum, how to use the resources that they had to increase student knowledge, and how to provide ongoing technological assistance. The training and materials can be used in instruction immediately, which should result in positive student academic outcomes.

Recommendations for Remediation of Limitations

The project's limitations included teachers' time constraints and participants were restricted to mathematics teachers. Teachers feel overwhelmed in the many responsibilities in which they must address each day, before and after school. Time may not appear to be a constraint; however, it proved to be so in conducting this study. Data collection began in the first 4weeks of school, which is a tumultuous period. Participants were preparing students for assessments; therefore, interviews and observations had to be scheduled before participants started testing or after testing had been completed. Elimination of this problem would have been to conduct data collection in the weeks after teachers had completed testing and analyzed their data. Nevertheless, everything eventually came together.

Another limitation was sample size. Though sample size is not relevant in a qualitative study, it may have impacted this study in that different core area teachers may have been able to give different perspectives on technology integration issues. Teachers from schools with similar technology integration apprehensions could have further impacted the findings. However, findings from this study reflected teacher concerns reported by numerous other studies.

Lastly, researcher biases were a limitation. I believe that technology integration is an effective resource in educating students to increase critical thinking and problem solving. Still, I believe that being cognizant of my subjectivity aided in maintaining my objectivity. My position was that of researcher, to report the perceptions of the participants, thereby adding to research and instituting social change. This facet of social change means providing teachers with the resources they need to update pedagogy and increase student academic success.

Recommendations for Alternative Approaches

Acclimating teachers to updating their pedagogical skills can be conducted by providing onsite professional development workshops using technologically adept individuals, as I am proposing. However, an alternative method could be to have teachers attend professional development sessions offsite or via the Internet. Industries that provide software and hardware to academic institutions offer training support for their products through face-to-face instruction, webinars, and online training courses. Such training is sometimes free. Added benefits to attending this type of professional development may result in teachers earning continuing education units (CEUs) for recertification.

Scholarship

When I began my sojourn to complete this doctoral degree, my definition of scholarship was people who are knowledgeable and who are experts on many things. At this point in my academic life, the circumference of my definition of scholarship has changed. Scholarship refers to being knowledgeable in a particular area/discipline. It is not simply knowing how to accomplish a task because of being afforded the opportunity to have access to it. For example, Prensky (2010) reported that there is a difference in the efficiency in the acquisition of technology knowledge conducive to age, which is not exactly correct. People who have known no other way to function in life except with technology (Digital Natives, as coined by Prensky) are not more technological savvy than those who have had to grow into functioning with technology (Digital Immigrants, again, as coined by Prensky). Growing up with technology does not result in technological scholarship. Growing up with technology results in the affordance to have learned different aspects of technology; which is learning but is learning that somewhat differs from scholarship.

Scholarship is having the acumen to search for knowledge in an area or discipline where one may have an overwhelming desire to understand why or how. In the 21st century environment, scholarship is knowing how to research, analyze, and interpret various phenomena systematically. Systematic research begins with reading the peer-reviewed works of scholars who have spent numerous hours theorizing, testing, and collecting data, and retesting those data on some phenomenon: an iterative process. In undertaking this research process, I am preparing to conduct a similar study and am utilizing scholarly studies to guide my study. Scholarship is continuously adapting oneself to an ever-changing world by continuous learning and utilizing the preponderance of evidence/data in answering the question of why or how.

Leadership and Change

I have discovered that leadership can be germane to servitude, which means not focusing on self but on including others to complete an agreed upon goal. To be a leader encompasses meeting the needs of others/subordinates. Accomplishing this relies on knowing not only what is needed but also what leadership style is fit to acquire the desired results. If members of a team value involvement in decision-making, a participative style may work. Conversely, if members need rewards or sanctions for motivation, a transactional style may be more effective. Oftentimes, team members work best in a collaborative atmosphere. For this group of people, a transformational style may suffice. To effect the change necessary to implement my workshop, a transformational style may work best. Nonetheless, it may be necessary to glean aspects of all the different leadership styles to lead and change.

In preparation for creating the professional development workshop, it was not about what I wanted as an outcome, but rather, what the participants stated in the interviews that they wanted and needed. Participants needed to be instructed how to integrate technology into their curriculum. Step-by-step handouts could have been created and circulated among teachers, but that would not have met their needs. Such a protocol is what they have experienced in the past. Participants need someone to lead and guide them through the steps, someone who would give immediate feedback and with whom they could collaborate. Trust is important to obtaining change when leading. If participants do not trust that leadership's mission and goals are not aligning with theirs, change will not take place. Participants will resist both leadership and change.

Analysis of Self as Scholar

Analysis of self as scholar revealed that I have the acumen to be a scholar. I have always searched to understand why. Delving into the intricacies of ascertaining how and why things are the way that they are characterizes a scholar. Being a part of knowledge dissemination is my passion. To be labeled with the title of scholar provides me with the credentials to share learning.

Analysis of Self as Practitioner

The school where the study was conducted has been inundated with Department of Education (DOE) officials mandating how educators can be more effective. The strategies that are being provided are strategies that I have studied in this doctoral program. I feel confident that what DOE is doing, I could do as well. Additionally, in conducting interviews and observations, I discovered changes that may aid educators in attaining academic success for themselves and their students.

Analysis of Self as Project Developer

Through this doctoral program, my critical thinking and problem solving abilities have improved immeasurably. Upon considering the development of a project that would best meet the needs of teachers, students, and the school holistically, it was not difficult to decide on a genre for the project, though the idea of being the developer gave me moments of uncertainty. If the project was unsuccessful or not well received by participants, the outcome could be academic failure for the school. Immediately afterwards came the realization that failure could not be considered. I had done my work to understand the needs of the teachers from their perspectives; of that I was certain. Therefore, excitement replaced uncertainty. At the completion of developing my project it was shared with my strongest critic and well received. Self as a project developer—I look forward to take on any challenge.

The Project's Potential Impact on Social Change and Importance of Work

Educational institutions worldwide are finding it increasingly difficult to educate their students, which is problematic because much research has reported on the positive implications of technology integration in educational settings. As a result, business leaders are feeling the repercussions and report that jobs are available but viable human capital is not. President Obama is addressing this concern by proposing a program to get potential employees educated with needed skills. If my project is a success, it could change the concerns of limited technology integration practices in education. The impact on social change would be profound. Focused technology integration professional development would place teachers in their technological comfort zone and may result in more engaged and educated students.

Implications, Applications, and Directions for Future Research

The importance of the work that has been completed may change the way professional development workshops are orchestrated at the local level. When the needs of the end users are met, progress should be achieved. Academic institutions are required to do more with less due to budget constraints. For this reason, having an onsite technology facilitator, again, should give the teachers what they need to create a stronger learning environment. Tsai and Chai (2012) reported that if teachers were given all the necessary resources to engage and enhance student learning, student academic increase is an inherent outcome. They continued in stating that if teachers had all the tools for student-centered engaged instruction, and pedagogy did not change, it was the teachers' lack of innovation at fault. This doctoral program has led me to the discovery that there are numerous free training resources available, if individuals comprehend methods necessary to conduct a search. Partnering with stakeholders (e.g., parents, community, community leaders, and businesses) can prove to be an invaluable resource in developing collaborative partnerships for a system of educational change.

Future research should involve reporting on summative test scores after sustainable teacher professional developments have been conducted. After teachers have completed approximately 20 hours of ongoing professional development and feel comfortable about the training that they have received. They can elicit student input to discover the students' perceptions on whether instruction has changed from teacher-centered to student-centered learning and student perceptions of technology integration practices.

Conclusion

This section was an analysis of learning outcomes gained from this doctoral journey. Included in the discourse were sections on what was learned pertaining to scholarship, leadership and change, and self as a scholar and practitioner. I explained that becoming a scholar necessitated learning to contribute knowledge via research that would positively affect not only the immediate milieu but the world. Completing such a task can be accomplished through dedicating oneself to the betterment of some phenomenon; reviewing peer reviewed works of other scholars and learning what they have discovered; and analyzing, questioning, and reconstructing what has already been done as preparation for exploring new information.

Additional discussions were on self as a project developer and the impact of the project as a whole. Development of the project will give voice to the faction of the educational system—educators who do not perceive they are being considered when decisions are made about how they should become more efficient in technological pedagogy. Now that this project has been completed, "business as usual" is no longer the mantra but rather out with traditional pedagogy and in with technological pedagogy that will motivate students to be more engaged in education. It is time to transform the educational system to meet the needs of the most valuable assets—the students.

References

Abbitt, J. T. (2011). An investigation of the relationship between self-efficacy beliefs about technology integration and Technological Pedagogical Content Knowledge (TPACK) among preservice teachers. *Journal of Digital Learning in Teacher Education*, *27*(4), 134-143.

Abuhmaid, A. (2011). ICT training courses for teacher professional development in Jordan. *The Turkish Online Journal of Educational Technology*, *10*(4), 195-210. Retrieved from: http://www.tojet.net/articles/v10i4/10420,pdfAjayi, L, (2010). How asynchronous discussion boards mediate learning literacy methods courses to enrich alternative-licensed teachers' learning experiences. *Journal of Research on Technology in Education*, *43*(1), 1-28.

Adiguzel, T., Capraro, R. M., & Willson, V. L. (2011). An examination of teacher acceptance of handheld computers. *International Journal of Special Education*, *26*(3). doi:10.1.1.24.6074

An, Y., & Reigeluth, C. (2012). Creating technology-enhanced, learner-centered classrooms: K-12 teachers' beliefs, perceptions, barriers, and support needs. *Journal of Digital Learning in Teacher Education*, *28*(2), 54-62.

Anthony, A. B., & Clark, L. M. (2011). Examining dilemmas of practice associated with the integration of technology into mathematics classrooms serving urban students. *Urban Education, 46*(6), 1300-1331. doi:10.1177/0042085911416015

Anthony, A. B., & Patravanich, S. (2014). The technology principal: To be or not to be? *Journal of Cases in Educational Leadership*, *17*(2), 3-19. doi:10.117/1555458914528913

Archibald, S., Coggshall, J. G., Croft, A., Goe, L., & National Comprehensive Center for Teacher, Q. (2011). High-quality professional development for all teachers: Effectively allocating resources. Research & Policy Brief. *National Comprehensive Center for Teacher Quality*, 1-32.

Atweh, B., & Goos, M. (2011). The Australian mathematics curriculum: A move forward or back to the future? *Australian Journal of Education, 55*(3), 314-228. doi:10.1177/000494411105500304

Agustina, S., & Tiara, D. (2013). Web-based resources in EFL learning: An enhancement of students' digital literacy. *Advances in Language and Literacy Studies, 4*(2), 1-7. Doi:10.7575/aiac.alls.v.4n.2p.117

Balfanz, R., & Byrnes, V. (2006). Closing the mathematics achievement gap in high-poverty middle schools: Enablers and constraints. *Journal of Education for Students Placed at risk*, *11*(2), 143-159. doi:10.1207/s15327671espr1102_2

Bambrick-Santoyo, P. (2010). *Driven by data: A practical guide to improve instruction*. San Francisco, CA: Jossey-Bass.

Banister, S., & Reinhart, V. (2011). TPCK for impact: Social justice and narrow the digital divide in an urban middle school. *Computers in the Schools*, *28*(5), 5-6. doi:10.1080/07380569.2011.551086

Baya'a, N., & Daher, W. (2013). Mathematics teachers' readiness to integrate ICT in the classroom. *International Journal of Emerging Technologies in Learning*, *8*(1), 46-52. doi:10.3991/ijet.v8i1.2386

Beaton, A. E., Mullis, I. V. S., Martin, M. O., Gonzalez, E. J., Kelly, D. L., & Smith, T. A. (1996). *Mathematics achievement in the middle school years: IEA's Third International Mathematics and Science Study (TIMSS)*. Chestnut Hill, MA: TIMSS International Study Center, Boston College.

Berrett, B., Murphy, J., & Sullivan, J. (2012). Administrator insights and reflections: Technology integration in schools. *Qualitative Report*, *17*(1), 200-221.

Blocher, J. M., Armfield, S. W., Sujo-Montes, L., Tucker, G., & Willis, E. (2011). Contextually based professional development, computers in schools. *Interdisciplinary Journal of Practice, Theory, and Applied Research, 28*(2), 156-169. doi:10.1080/07380569.2011.577398

Bottge, B.A., Rueda, E., Grant, T. S., Stephens, A. C., & Rueda, E. (2010). Advancing the math skills of middle school students in technology education classrooms. *NASSP Bulletin, 94*, 417-437. doi:10.1177/0192636510379902

Brown, F. (2000). Computer assisted instruction in mathematics can improve students' test scores: A study. Retrieved from http://www.eric.ed.gov/contentdelivery/ servlet/ERICServlet?accon=ED443688

Cakiroglu, U., & Akkan, Y., & Guven, B. (2012). Analyzing the effect of web-based instruction applications to school culture within technology. *Educational Services: Theory and Practice*, *12*, 1043-1048.

Campbell, C., & Martin, D. (2010). Interactive whiteboards and the first year experience: Integrating IWBs into pre-service teacher education. Australian Journal of Teacher Education*, 35*(6). 68-75. http://dx.doi.org/10.14221/ajte

Chen, C. (2008). Why do teachers not practice what they believe regarding technology integration? *Journal of Educational Research*, *102*(1), 65-75.

Chiappone, L. (2009). Computer-assisted instruction. In E. Provenzo & A. Provenzo (Eds.), *Encyclopedia of the social and cultural foundations of education.* (pp. 171-174). Thousand Oaks, CA: SAGE Publications, Inc. doi:10.4135/9781412963992.n83

Cradler. J., McNabb, M., & Freeman, N. (2002). How does technology influence student learning? *Learn Lead Technology*, *29*(8), 46-49.

Cravens, X. C., Goldring, E. G., Porter, A. C., Polikoff, M. S., Murphy, A., & Elliot, S.N. (2013). *Educational Administration Quarterly, 49,* 124. doi:10.1177/0013161X12455330

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*. Los Angeles, CA: Sage.

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Upper Saddle River, NJ: Pearson Education.

Curwood, J. S. (2013). Applying the design framework to technology professional development. *Journal of Digital Learning in Teacher Education, 29*(3), 89-96. Doi:10.1080/21532974.2013.10784710

Davies, R. S. (2011). Understanding technology literacy: A framework for evaluating educational technology integration. *Techtrends: Linking Research and Practice to Improve Learning*, *55*(5), 45-52. doi:10.1007/s11528-011-0527-3

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*, 319-340.

Davis, F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies, 38*, 475-487. doi:10.1006/imms.1993.1022

Delen, E., & Bulut, O. (2011). The relationship between students' exposure to technology and their achievement in science and math. *Turkish Online Journal of Educational Technology - TOJET*, *10*, 311-317.

Demski, J. (2012). This time it's personal. *T.H.E. Journal*, *39*(1), 32-36.

Doering, A., Koseoglu, S., Scharber, C., Henrickson, J., & Lanegran, D. (2014). Technology integration in K-12 Geography education using TPACK as a conceptual model. *Journal of Geography, 113*(6), 223-237. doi:10.1080/00221341.2014.896393

Duran, M., Brunvand, S., Justin, E., & Sendag, S. (2011). Impact of research-based professional development. *Journal of Research on Technology Education, 44*(4), 313-334. doi:10.1080/15391523.2012.10782593

Eristi, S., Kurt, A., & Dindar, M. (2012). Teachers’ views about effective use of technology in classrooms. *Turkish Online Journal of Qualitative Inquiry, 3*(2), 30-41.

Ertmer, P. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration. *Educational Technology Research and Development, 53*(4), 25-39.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education*, *42*, 255-284.

Ertmer, P. A., Simons, K. D., Jones, D., Ottenbreit-Leftwich, A., Goktas, Y., Collins, K., & Kocaman, A. (2009). Facilitating technology-enhanced PBL in the K-12 classroom: An examination of how and why teachers adapt. International Journal of Learning Technology, *20*(1), 35-54. Retrieved from http://www.academia.edu/364194/Facilitating_Technology-Enhanced_Problem-based_Learning_PBL_in_the_Middle_School_Classroom_An_Examination_of_How_and_Why_Teachers_Adapt

Esterhuizen, H. D., Ellis, S. M., & Els, C. J. (2012). ODL Students' perceived computer literacy competencies, expectations of support intention to use and perseverance. *Turkish Online Journal of Distance Education*, *13*(4), 76-94.

Glesne, C. (2011). *Becoming qualitative researchers: An introduction* (4th ed.). New York. NY: Pearson.

Gorder, L. M. (2008). A study of teacher perceptions of instructional technology integration in the classroom. *Delta Pi Epsilon Journal*, *50*(2), 63-76.

Guerrero, S. (2010). Technological pedagogical content knowledge in the mathematics classroom. *Journal of Digital Learning in Teacher Education, 26*(4), 132-139.

Hadjerrouit, S. (2011). Using the interactive learning environment APlusix for teaching and learning school Algebra: A research experiment in a middle school. *The Turkish Online Journal of Educational Technology, 10*, 384-389.

Hagerman, M., Keller, A., & Spicer, J. L. (2013). The MSU educational technology certificate courses and their impact on teachers' growth as technology integrators. *Techtrends: Linking Research and Practice to Improve Learning*, *57*(3), 26-33. doi:10.1007/s11528-013-0659-8

Hammond, M., Crosson, S., Fragkouli, E., Ingram, J., Johnston-Wilder, P., Johnston-Wilder, S., Kingston, Y., Pope, M., & Wray, D. (2009). Why do some student teachers make very good use of ICT? An exploratory case study. *Technology, Pedagogy and Education*, *18*(1), 59-73.

Harris, G., Stevens, T., & Higgins, R. (2011). A professional development model for middle school teachers of mathematics. *International Journal of Mathematical Education in Science and Technology*, *42*, 951-961. doi:10.1080/0020739X.2011.611908

Henry, G.T., Smith, A. A., Kershaw, D. C., & Zulli, R. A. (2013). Formative evaluation: Estimating preliminary outcomes and testing rival explanations. *American Journal of Evaluation*, *34*, 465-485. doi:10.1077/1098214013502577

Hitchcock, C. H., & Noonan, M. J. (2000). Computer-assisted instruction of early academic skills. *Topics in Early Childhood Special Education, 20*(3), 145-158. doi:10.1177/027112140002000303

Hochbein, C., Mitchell, A. M., & Pollio, M. (2013). Gamed by the system: Adequate yearly progress as an indicator of persistently low-achieving school performance. *NASSP Bulletin, 97*(3), 272-289. doi:10.1177/0192636513479139

Holden, H., & Rada, R. (2011). Understanding the influence of perceived usability and technology self-efficacy on teachers' technology acceptance. *Journal of Research on Technology in Education, 43*, 343-367.

Hsu S. (2010). The relationship between teacher's technology integration ability and usage. *Journal of Educational Computing Research*, *43*, 309-325. doi:10.2190/EC.43.3.c

Hsu, H. Y., & Wang, S. K. (2010). Using gaming literacies to cultivate new literacies. *Simulation & Gaming, 41*, 400-417. doi:10.117/1046878109355361

Hutchison, A. & Reinking, D. (2011). Teachers' perceptions of integrating information and communication technologies into literacy instruction: A national survey in the United States. *Reading Research Quarterly*, *46*, 312-333. doi:10.1002/RRQ.002

Ilgaz, H., & Usluel, Y. (2011). ÖĞRETİM SÜRECİNE BİT ENTEGRASYONU AÇISINDAN ÖĞRETMEN YETERLİKLERİ VE MESLEKİ GELİŞİM. (Turkish). *Journal of Educational Sciences & Practices*, 87-106.

International Society for Technology in Education (2008). *Technology and Student Achievement—the Indelible Link*. Retrieved from http://www.bing.com/ search?q=ISTE_policy_brief_student_achivement-1&pc=conduit&ptag=AEA8A61FFA28F4F2791F&form=CONBDF&conlogo=CT3210127

Izzo, M. V., Yurick, A., Nagaraja, H. N., & Novak, J. A. (2010). Effects of a 21st-century curriculum on students' information technology and transition skills. *Career Development for Exceptional Individuals, 33*(2), 95-105. doi:10.1177/0885728810369348

Johnson, C., & Kritsonis, W. (2010). The achievement gap in mathematics: A significant problem for African American students. *Doctoral Forum*, *7*(1), 1-12.

Johnson, L., Adams, B. S,, Estrada, V., & Freeman, A. (2014). *NMC Horizon Report: 2014 K-12 Edition*. Austin, Texas, The New Media Consortium.

Johnson, L., Adams, S., & Cummins, M. (2012). *NMC Horizon Report: 2012 K-12 Edition*. Austin, Texas: The New Media Consortium.

Keengwe, J., Agamba, J. & Hussein, F. (2012). Technology and active learning in teaching and learning: A model. In P. Resta (Ed.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2012* (pp. 2879-2882). Chesapeake, VA: AACE. Retrieved from http://www.editlib.org/p/40026

Killion, J. (2013). Tapping technology's potential: Shrinking budgets, looming standards, and a dizzying array of innovations are changing the professional learning landscape. *Journal of Staff Development*, *34*(1), 10-12.

Kim, C., Kim, M. K., Lee, C., Spector, J. M., & DeMeester, K. (2013). Teacher beliefs and technology integration. *Teacher and Teacher Education*, 29, 76-85.

Kim, S., & Chang, M. (2010). Does computer use promote the mathematical proficiency of ELL students? *Journal of Educational Computing Research*, *42*, 285-305. doi:10.2190/EC.42.3.c

Koehle, M. J., Mishra, P., Kereluik, K., Shin, T. S., & Graham, C. R. (2014). The technological pedagogical content knowledge framework. In *Handbook of Research on Educational Communications and Technology* (pp. 101-111). Springer New York. doi:10.1007/978-1-4614-3185-5_9

Kopcha, T. J. (2012). Teachers' perceptions of the barriers to technology integration and practices with technology under situated professional development. *Computers & Education, 59*, 1109-1121. doi:10.1016/j.compedu.2012.05.014

Kothari, C. R. (2004). *Methodology methods and techniques*. Daryaganji, Delhi: New Age International.

Kulik, J. (2003). Effects of using instructional technology in elementary and secondary schools: What controlled evaluation studies say (SRI Project Number P10446.001). *SRI International*.

Lai, H. J. (2010). Secondary school teacher' perceptions of interactive whiteboard training workshops: A case study from Taiwan. *Australasian Journal of Educational Technology*, *26*, 511-522.

Levin, T., & Wadmany, R. (2008). Teachers' views on factors affecting effective integration of information technology in the classroom: Developmental scenery. *Journal of Technology and Teacher Education*, *16*, 233-263.

Lodico, M., Spaulding, D., & Voegtle, K. (2010). *Methods in educational research: From theory to practice*. (Laureate Education, Inc., custom ed.). San Francisco: John Wiley & Sons.

Lowther, D. L., Inan, F. A., Strahl, J. D., & Ross. S. M. (2008). Does technology integration “work” when key barriers are removed? *Educational Media International, 45*(3), 195-213. doi:10.1080/09523980802284317

Matherson, L. H., Wilson, E. K., & Wright, V. H. (2014). Need TPACK? Embrace sustained professional development. *Delta Kappa Gamma Bulletin*, *81*(1), 45-52.

Meiers, M., & Buckley, S. (2009). Successful professional learning [online]. *The Digest, NSWIT*. Retrieved from: http://research.acer.edu.au/digest/1

Meister, D. G. (2010). Experienced secondary teachers’ perceptions of engagement and effectiveness: A guide for professional development. *The Qualitative Report*, *15*, 880-898. Retrieved from http://www.nova.edu/ssss/QR/QR15-4/meister.pdf

Minor, M., Losike-Sedimo, N., Reglin, G., & Royster, O. (2013). Teacher technology integration professional development model (SMART BOARD), pre-algebra achievement, and Smart board proficiency scores. *Sage Open,* 1-10. doi:10.1177/2158244013486994

Möller, D. P. F., Haas, R., & Vakilzadian, H. (2013). Ubiquitous learning: Teaching modeling and simulation with technology. Paper presented at Proceedings of the 2013 Grand Challenges on Modeling and Simulation Conference, Vista, CA: Society for Modeling & Simulation International.

Moore-Hayes, C. (2011). Technology integration preparedness and its influence on teacher-efficacy. *Canadian Journal of Learning and Technology*, *37*(3), 1-15.

Mumtaz, S. (2000). Factors affecting teachers' use of information and communications technology: A review of the literature. *Journal of Information Technology for Teacher Education, 9*, 301-342. doi:10.1080/14759390000200096

Mundy, M. A., Kupczynski, L., & Kee, R. (2012). Teachers' perceptions of technology in the schools. *Sage Open*, 1-8. doi:10.1177/21582440813

Niekerk, M., & Blignaut, S. (2014). A framework for Information and Communication Technology integration in schools through teacher professional development. *African Education Review*, *11*(2), 236-253. doi:10.1080/18146627.2014.927159

No Child Left Behind (NCLB) Act of 2001, Pub. L. No. 107-110, § 115, Stat. 1425 (2002).

Null, J. W. (2004). Is constructivism traditional? Historical and practical perspectives on a popular advocacy. *The Educational Forum, 68*(2), 180-188.

Olusi, F. I. (2008). Using computers to solve mathematics by junior secondary school students in Edo State Nigeria. *College Student Journal*, *42*, 748-755.

Owens, S. M. (2015). Teacher professional learning communities in innovative contexts: 'ah hah moments', 'passion' an 'making a difference' for student learning. *Professional Development in Education*, *41*(1), 57-74. doi:10.1080/19415257.2013.869504

Paine, S. L., & Schleicher, A. (2011). *What the U.S. can learn from the world's most successful education reform efforts.* New York, NY: McGraw-Hill Research Foundation.

Palak, D., & Walls, R. T. (2009). Teachers' beliefs and technology practices: A mixed-methods approach. *Journal of Research on Technology in Education*, *14*, 417-441.

Pamuk, S., Çakir, R., Ergun, M., Yilmaz, H., & Ayas, C. (2013). The use of tablet pc and interactive board from the perspectives of teachers and students: Evaluation of the FATİH Project. *Educational Sciences: Theory & Practice*, *13*, 1815-1822. doi:10.12738/estp.2013.3.1734

Pellegrino, J. W., & Quellmalz, E. S. (2011). Perspectives on the integration of technology and assessment. *Journal of Research on Technology in Education*, *43*(2), 119-134.

Periathiruvadi, S., & Rinn, A. N. (2013). Technology in gifted education: A review of best practices and empirical research. *Journal of Research on Technology in Education*, *45*(2), 153-169.

Prensky, M. (2010). *Teaching digital natives: Partnering for real learning*. Thousand Oaks, CA: Corwin Press.

Pryor, J., Akyeampong, K., Westbrook, J., & Lussier, K. (2012). Rethinking teacher preparation and professional development in Africa: An analysis of the curriculum of teacher education in the teaching of early reading and mathematics. *The Curriculum Journal*, *23*, 409-502. doi:10.1080/09585126.2012.747725

Qing, L., & Xin, M. (2010). A meta-analysis of the effects of computer technology on school students' mathematics learning. *Educational Psychology Review, 22*(3), 215-243. doi:10.1007/s10648-010-9125-8

Raman, A., & Mohamed, A. (2013). Issues of ICT usage among Malaysian secondary school English teachers. *English Language Teaching*, *6*(9), 74-82. doi:10.5539//elt.v6n9p74

Richardson, A., & Davis, M. (2012). With new tests, math SOL scores expected to plummet. The Daily Progress. Retrieved from: http://www.dailyprogress.com

Roschelle, J., Singleton, C., Sabelli, N., Pea, R., & Bransford, J. D. (2008). Mathematics worth knowing, resources worth noting: A response to the National Advisory Panel Report. *Educational Researcher, 37*, 610-617. doi:10.3102/0013189X08329193

Rosenberg, S., Heimler, R., & Morote, E. S. (2012). Basic employability skills: A triangular design approach. *Education and Training, 54*(1), 7-20. doi:10.1108/00400911211198869

Ross, S. M., Morrison, G. R., & Lowther, D. L. (2010). Educational technology research past and present: Balancing rigor and relevance to impact school learning. *Contemporary Educational Technology, 1*(1), 17-35.

Sangra, A., & Gonzalez, S. M. (2011). The role of information and communication technologies in improving teaching and learning processes in primary or secondary schools. *Journal of Asynchronous Learning Networks, 15*(4), 47-59.

Scheer, A., Noweski, C., & Meinel, C. (2012). Transforming constructivist learning into action: Design thinking in education. *Design and Technology Education, 17*(3), 8-19.

Schornick, P. (2010). Looking at high school mathematics education from the inside out. *NASSP Bulletin, 94*(1), 17-39. doi:10.1177/0192636510375607

Schrum, L., & Levin, B. B. (2013). Lessons learned from exemplary schools. *Techtrends: Linking Research and Practice to Improve Learning*, *57*(1), 38-42.

Seo, Y. J., & Bryant, D. (2012). Multimedia CAI program for students with mathematics difficulties. *Remedial and Special Education, 33*(4), 217-225. doi:10.1177/0741932510383322

Sheehan, M., & Nillas, L. (2010). Technology integration in secondary mathematics classrooms: Effect on students' understanding. *Journal of Technology Integration in the Classroom*, *2*(3), 67-83.

Shih-Hsiung, L. (2013). Exploring thee instructional strategies of elementary school teachers when developing technological, pedagogical, and content knowledge via a collaborative professional development program. *International Education Studies*, *11*(6), 58-68. doi:10.5539/ies.v6n11p58

Shu Chien, P., & Franklin, T. (2011). In-service teachers' self-efficacy professional development, and Web 2.0 tools for integration. *New Horizons in Education*, *59*(3), 28-40.

Slavin, R. E., Lake, C., & Groff, C. (2009). Effective programs in middle and high school mathematics: A best-evidence synthesis. *Review of Educational Research*, *79*, 839-911. doi:10.3102/0034654308330968

Smolin, L., & Lawless, K. A. (2011). Evaluation across contexts: evaluating the impact of technology integration professional development partnerships. *Journal of Digital Learning in Teacher Education*, *27*(3), 92-98.

Spires, H. A., Wiebe, E., Young, C. A., Hollebrands, K., & Lee, J. K. (2012). Toward a new learning ecology: Professional development for teachers in 1:1 learning environments. *Contemporary Issues in Technology and Teacher Education*, *12*(2), 232-254.

Spradlin, K., & Ackerman, B. (2010). The effectiveness of computer-assisted instruction in developmental mathematics. *Journal of Developmental Education*, *34*(2), 12-14.

Stone, J. R. III, Alfred, C., Pearson, D., Lewis, M. V., & Jensen, S. (2008). Building academic skills in context: Testing the value of enhanced math learning in CTE (Final Study). St. Paul, MN: National Research Center for Career and Technical Education, University of Minnesota.

Suppes, P. (1966). The use of computers in education. Retrieved from http://*suppes--corpus.stanford.edu/article.html?id=67*

Tamim, R. M., Bernard, R. M., Borokhovski, E., Abrami, P. C., & Schmid, F. (2011). What forty years of research says about the impact of technology on learning: A second-order meta-analysis and validation study. *Review of Educational Research, 81*(4), 4-28. doi:10.3102/0034654310393361

Teo, T. (2012). Examining the intention to use technology among pre-service teachers: An integration of the technology acceptance model and theory of planned behavior. *Interactive Learning Environments, 20*(1), 3-18. doi:10.1080/10494821003714632

Thomas, M. J., & Ye, Y. H. (2013). Teacher integration of technology into mathematics learning. *International Journal for Technology in Mathematics Education, 20*(2), 69-84.

Tsai, C., & Chai, C. (2012). The "Third"-order barrier for technology-integration instruction: Implications for teacher education. *Australasian Journal of Educational Technology*, *28*, 1057-1060.

Twining, P., Raffaghelli, J., Albion, P. & Knezek, D. (2013). Moving education into the digital age: the contribution of teachers' professional development. *Journal of Computer Assisted Learning*, *29*, 426-437. doi:10.1111/jcal.12031

U.S. Department of Education, National Center for Education Statistics. (2010). *Teachers' Use of Educational Technology in U.S. Public Schools: 2009* (NCES 2010-040).

U.S. Department of Education. (2001). *Enhancing Education Through Technology Act of 2001.* (Section 2402). Retrieved from http://www2.ed.gov/policy/elsec/leg/esea02/pg34.html

Uslu, O., & Bümen, N. T. (2012). Effects of the professional development program on Turkish teachers: Technology integration along with attitude towards ICT in education. *Turkish Online Journal of Educational Technology*, *11*(3), 115-127.

Virginia Department of Education (2012). School Accreditation Ratings. Retrieved from http://www.doe.virginia.gov/statistics_reports/accreditation_federal_reports/accreditation/index.shtml

Virginia Department of Education (2014). School Accreditation Ratings. Retrieved from http://www.doe.virginia.gov/statistics_reports/accreditation_federal_reports/accreditation/index.shtml

Wei, X. (2012). Are more stringent NCLB state accountability systems associated with better student outcomes? An analysis of NAEP results across states. *Education Policy, 26*, 268-308. doi:10.1177/0895904810386588

Wolf, D., Lindeman, P., Wolf, T, & Dunnerstick, R. (2011). Integrate technology with student success. *National Council of Teachers of Mathematics, 16*, 556-560.

Wright, V. H., & Wilson, E. K. (2011). Teachers' use of technology: Lessons learned from the teacher education program to the classroom. *SRATE*, *20*(2), 48-60.

Yesilyurt, M. (2010). Meta-analysis of the computer assisted studies in Science and mathematics: A sample of Turkey. *Turkish Online Journal of Educational Technology - TOJET*, *9*(1), 123-131.

Yeşü, M. (2010). META analysis of the computer assisted studies in Science and mathematics: A sample of TURKEY. *Turkish Online Journal of Educational Technology, 9*(1), 123-131.

Yin, R. K. (2014). *Case study research: Design and methods* (5th ed.). Los Angeles, CA: Sage.

Appendix A: Project

Promethean Board Workshop

Inspire Me

Schedule – 2015

Day 1

9:00 AM	Participant Introduction
	Synopsis of Expectations
9:30 AM	Inspire Interface
10:15 AM	Morning Break
10:30 AM	Inspire Tools
NOON	LUNCH
1:30 PM	Hands-on activities
3:00 PM	ADJOURN

Day 2

9:00 AM	Discussion: Questions from previous day's activities
9:30 AM	Creating notes
10:15 AM	Morning Break
10:30 AM	Create Promethean account
	Calibrating the board
NOON	LUNCH
1:30 PM	Download flipcharts
3:00 PM	ADJOURN

Day 3

9:00 AM	Discussion: Questions from previous day's activities
9:30 AM	More tools (e.g., desktop tools, mathematics tools)
10:15 AM	Morning Break
10:30 AM	More tools continued
NOON	LUNCH
1:30 PM	Hands on activities
3:00 PM	ADJOURN

Day 4

9:00 AM	Discussion: Questions from previous day's activities
9:30 AM	How to create summative test prep
10:15 AM	Morning Break
10:30 AM	Creating games
NOON	LUNCH
1:30 PM	Participants will present/share lessons that they created with other participants
	WRAP UP
3:00 PM	ADJOURN

Note: Participants will have a working lunch break. This time will be used to collaborate with participants on activities (modeling a technology integration lesson) to be presented to peers.


Patricia Coleman
Promethean Board
Workshop
Inspire
Me

Inspire Me


"The most important thing we can do is inspire young minds and to advance the kind of science, math and technology education that will help youngsters take us to the next phase of space travel."
John Glenn

Project Objectives

- Create a professional development that guides teachers through effective use of technology integration into the mathematics curriculum
- Adopt a culture of teacher collaboration

Project Implementation

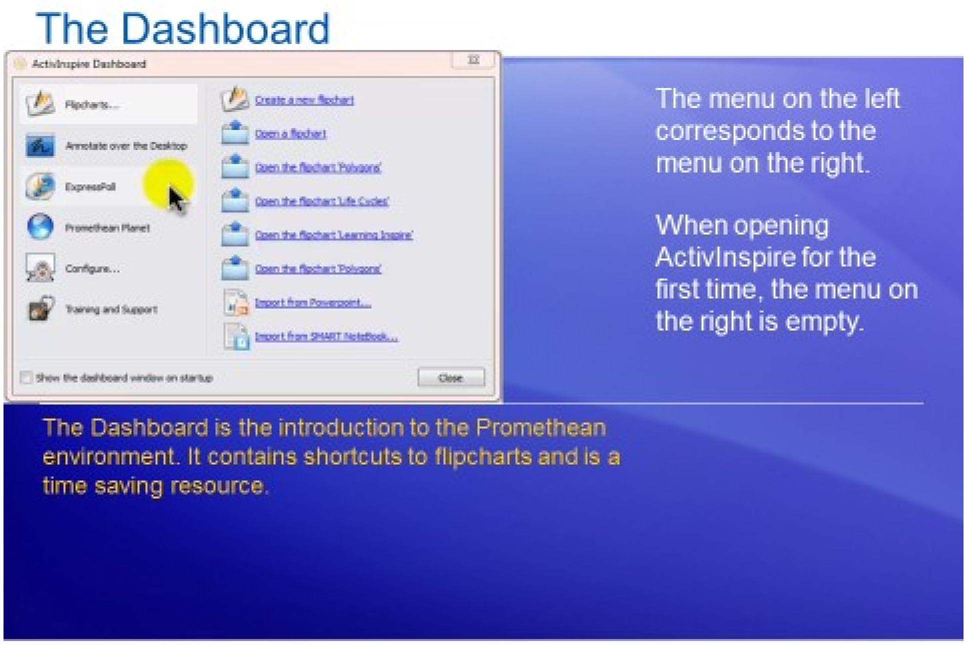
Teachers will participant in a 4 day intensive workshop

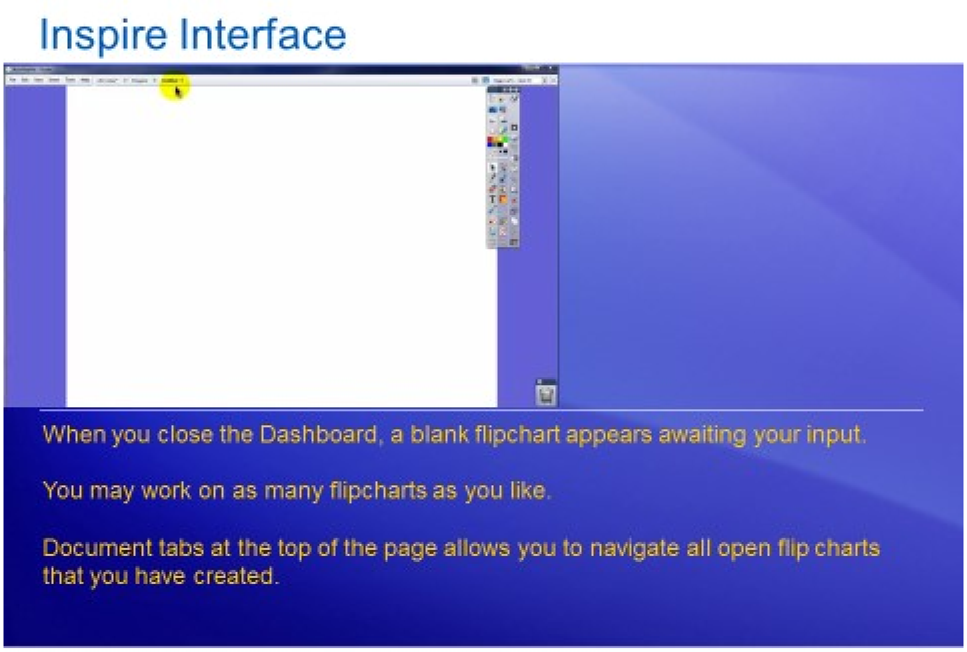
Day 1

- Participants will:
  - Introduce themselves
  - Give a synopsis of their expectations
  - Give a definition for Promethean board
- Facilitator will:
  - Give an overview of the workshop sessions

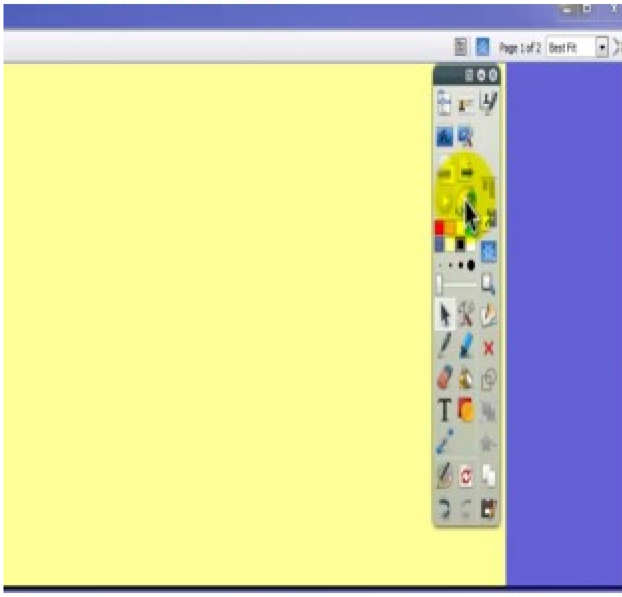
ActivPen

Explain the 2 different parts of the active pen and how they interact with the Active board


The Dashboard
ActivInspire Dashboard
Flipcharts...
Annotate over the Desktop
ExpressPoll
Promethean Planet
Configure...
Training and Support
Close
The menu on the left corresponds to the menu on the right.
When opening ActivInspire for the first time, the menu on the right is empty.
The Dashboard is the introduction to the Promethean environment. It contains shortcuts to flipcharts and is a time saving resource.

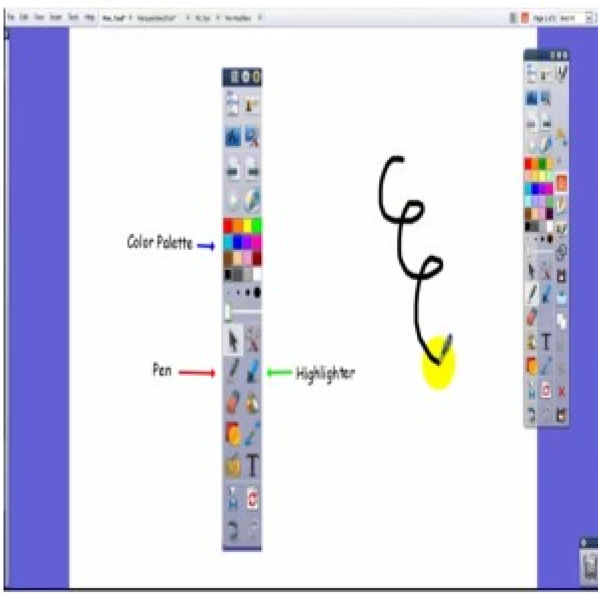

Inspire Interface
When you close the Dashboard, a blank flipchart appears awaiting your input.
You may work on as many flipcharts as you like.
Document tabs at the top of the page allows you to navigate all open flip charts that you have created.

Main Toolbox



The Main Toolbox includes tools for creating and presenting flipcharts.

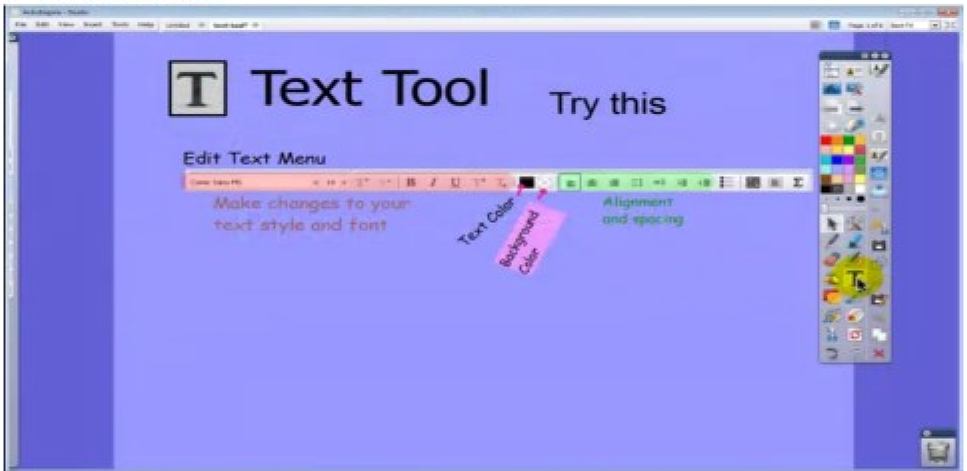
Pen Tool



The Pen Tool writes and draws on the flipchart.

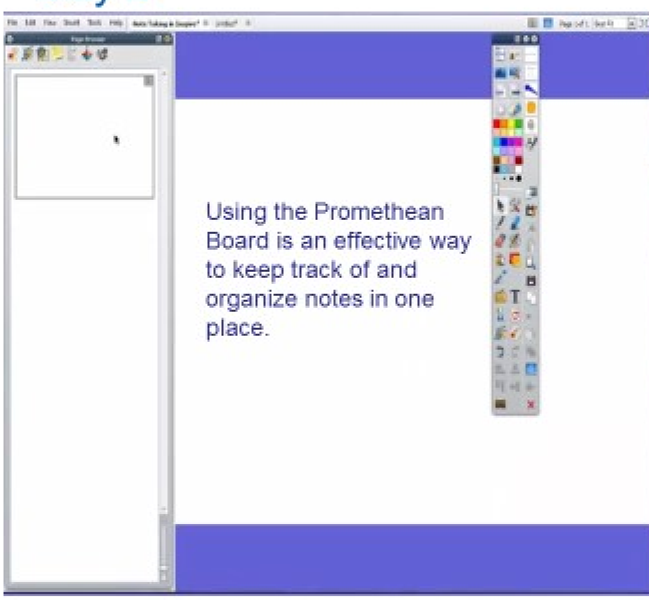
The highlighter pen highlights areas with translucent colors.

Text Tool



This tool allows you to type instead of write in your flipchart.

Day 2



Taking Notes

Promethean Board Website

Before you can download flipcharts from the Promethean website, you must create an account.

This is done by:

(1) Signing up for an account

(2) Logging in to your account

Now you can download flipcharts and access the main resources available on the website.

Downloading Flipcharts and Resources

- Hoover over "Resource" tab
- Select by:
  - Category
  - resource type
  - Age Grades
  - Subject Areas

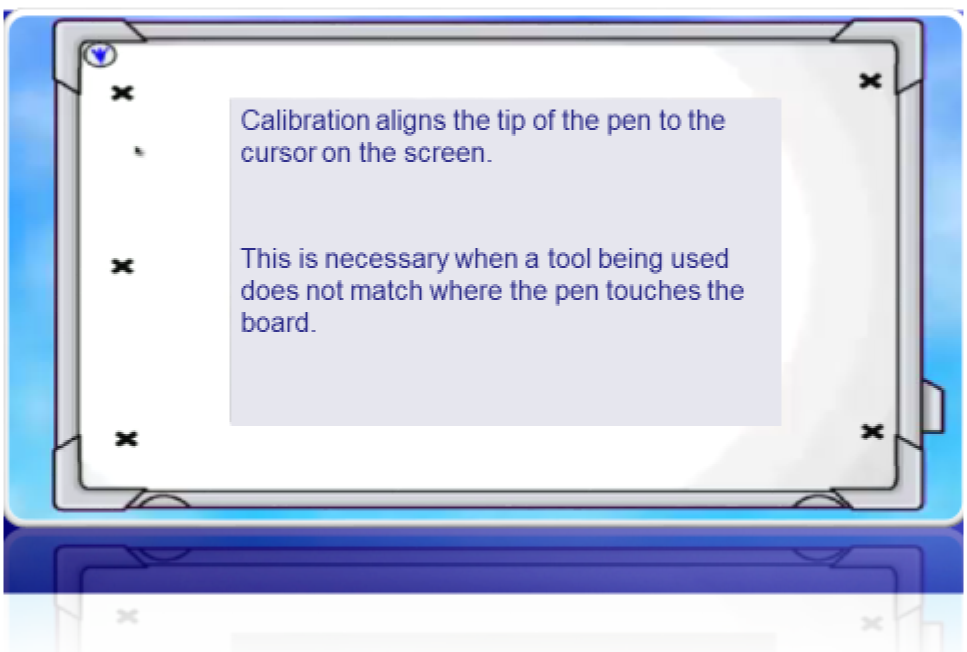
Downloading Flipcharts and Resources (Cont.)

- Downloading resources
  - school website resources
  - Internet Resources
- Professionally designed templates and activies

RESOURCRE BROWSER

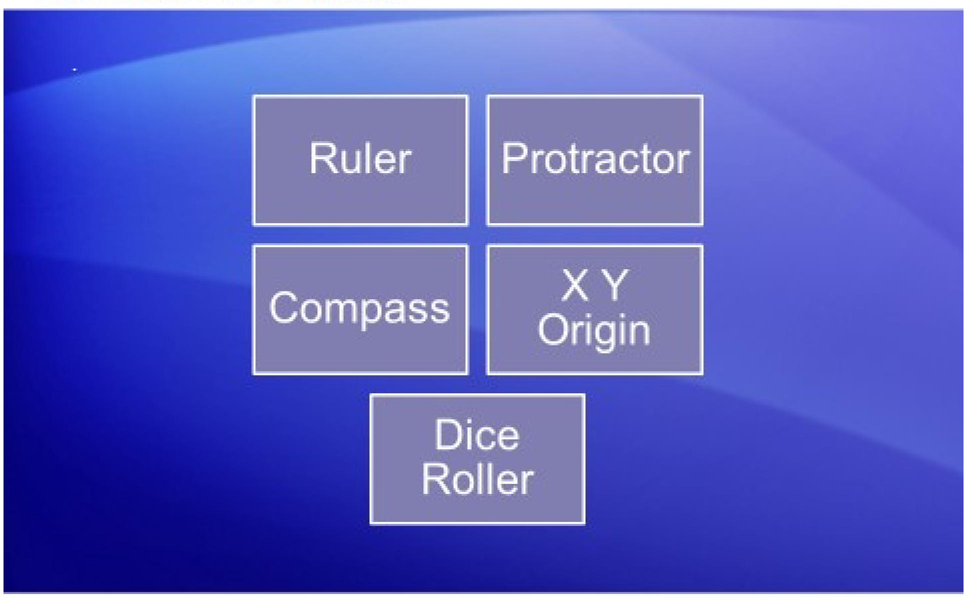
- Shared resources
- My resources

Board Calibration



Day 3

Mathematics Tools



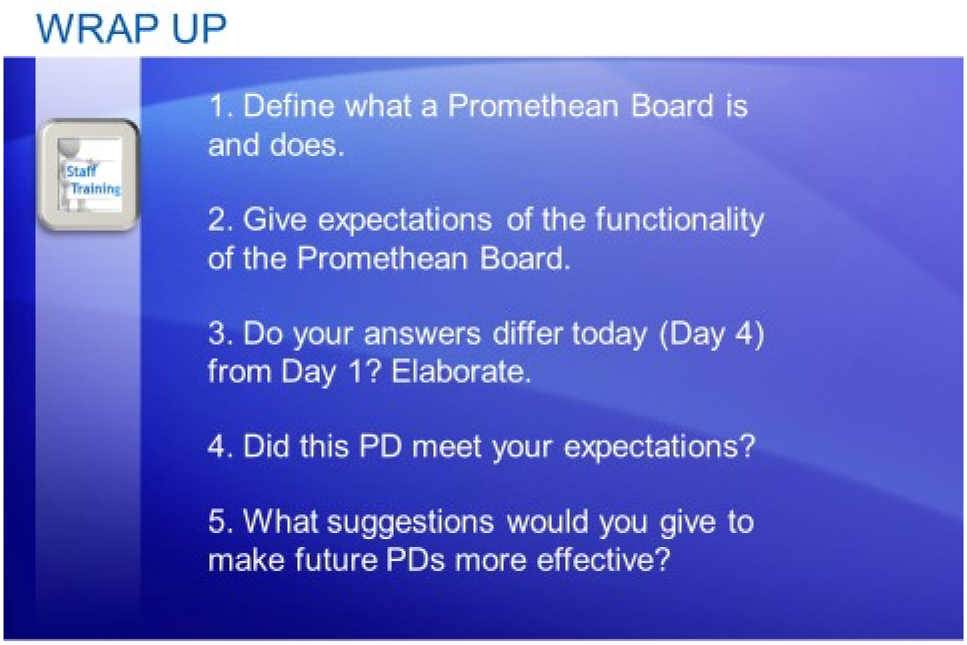
Hands-on activities—Review

- Create:
  - *How to* folder in My *Resources* folder
  - Enter a note reflecting instructions on *How to . . .*
- Demonstrate how to use the Dashboard
- Explain the Inspire Interface using tools that you found most useful
- Download and import a resource to be used in a lesson to be presented to participants
- Presentation should last a minimum of 10 minutes

Day 4

Creating Summative Assessment Test Prep

- Import PDF
- Lock background
- Use Spotlight tool to frame questions
- Using LRS
- Creating games


WRAP UP
Staff Training
1. Define what a Promethean Board is and does.
2. Give expectations of the functionality of the Promethean Board.
3. Do your answers differ today (Day 4) from Day 1? Elaborate.
4. Did this PD meet your expectations?
5. What suggestions would you give to make future PDs more effective?

Appendix B: Informed Consent

CONSENT FORM

You are invited to take part in a research study on how teachers perceive technology integration. The researcher is inviting middle school mathematics teachers involved in implementing technology in the classroom to be in the study. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part.

This study is being conducted by a researcher named Patricia Coleman, who is a doctoral student at Walden University. You may already know the researcher as a colleague, but she has a separate role in conducting the study.

Background Information
The purpose of this study is to explore how middle school mathematics teachers integrate technology into their curriculum.

Procedures
If you agree to be in this study, you will be asked to:

- Participate in one face-to-face interview of approximately 50 minutes.
- Allow the researcher to conduct two observations of classroom teaching and alignment of goals with practice.

Here are some sample questions:

1. How do you define technology integration?
2. What types of technology do you use in classroom instruction?
3. How often do you integrate technology in classroom instruction?

Voluntary Nature of the Study
This study is voluntary. Everyone will respect your decision of whether or not you choose to be in the study. Once you have made the decision to participate, you can still change your mind. You may stop at any time.

Risks and Benefits of Being in the Study
Being in this type of study involves limited risk of the minor discomforts that can be encountered in daily life, such as fatigue. Being in this study would not pose risk to your safety or wellbeing.

The benefit of this study is that if it is found that technology is not being fully implemented, then we can have workshops tailored to the needs of the teachers, thereby resulting in increased academic achievement for students and school accreditation.

Payment
There will be no payments or gifts provided to the participants.

Privacy
Any information you provide will be kept confidential. The researcher will not use your personal information for any purposes outside of this research project. Also, the researcher will not include your name or anything else that could identify you in the study reports. Data will be kept secure in a file cabinet with the combination for the lock known only by the researcher for 5 years, as required by the university, and destroyed at the end of this time period.

Contacts and Questions
You may ask any questions you have now. Or if you have questions later, you may contact the researcher via cellphone at 434-378-6710 or at pat_cole_09@yahoo.com. If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Walden University representative who can discuss this with you. Her phone number is 612-312-1210. Walden University's approval number for this study is **10-02—14-0197927** and it expires on **October 1, 2015.**

The researcher will give you a copy of this form to keep (for face-to-face research).

Statement of Consent:

I have read the above information and I feel I understand the study well enough to make a decision about my involvement. By signing below, I understand that I am agreeing to the terms described above.

Printed Name of Participant	______________________
Date of consent	______________________
Participant's Signature	______________________
Researcher's Signature	______________________

Appendix C: Interview Protocol

Study: Teachers' Perspective of Technology Integration

Time of Interview:

Date:

Method:

Interviewer:

Interviewee:

Script:

My name is Patricia Coleman and I am a doctoral student at Walden University in the Teacher Leadership program. You were previously given a copy of the consent form that you signed. Thank you again for agreeing to participate in my study. The purpose of this interview is to discover the extent to which mathematics educators use technology as a resource to increase summative assessment scores. In order to protect your identity, please refrain from using your name at any point in the interview. I will be recording this interview in order to obtain a permanent record. Is it okay with you if I begin recording now? (Record the meeting)

Questions:

1. How do you define technology integration? (Probe) So that I can better understand your definition, can you give some examples?
2. What types of technology do you use in classroom instruction? (Probe) Can you elaborate on how you use that technology?
3. How often do you integrate technology in classroom instruction? (Probe) Can you describe some activities that you used?
4. Do you believe that technology is a viable resource in increasing student mathematics achievement? (Probe) So that I may get a clear understanding, can you elaborate on your response?
5. Are there barriers to integrating technology into your curriculum? (Probe) Would you give some examples?
6. Is there anything you would like to add?

I appreciate your cooperation in taking part in this study. Again, is there anything you would like to add before the interview concludes? Thank you for taking the time to participate in my study. Your responses will remain confidential.

Appendix D: Interview Transcript

R: The first question is how do you define technology?

P3: Technology, let's see. A broad question. I guess, you know, utilizing the computer. Anything that's not utilizing paper, pencil or textbook. Or I'll say using the computer. Maybe using some devices to drive instruction or drive what you do in the classroom. You know, I am not a technology guy I am a math teacher and I do not utilize technology as much as I would like to use it. But that's how I would define technology.

R: Ok, so how would you define technology integration?

P: How would I define it?

R: Yes.

P: Ok. Technology integration is utilizing technology to drive, I guess what you plan on doing or what you want to get at or what you want to arrive to. So, for example, let's see how I can use that as an example. If I am using geometric figures or geometric shapes or geometric terms. If I am doing rotations or reflections, maybe get the kids to utilize technology to come up with various ways of symmetry to utilize the different reflections that symmetry or that rotation to visualize it per se. Because most of these kids, these students are visual learners. So sometimes just seeing it, seeing the different types of rotations on a computer whether it's a 180 degree rotation, maybe a 360 is a full turn or 270. So….

R: Ok. What types of technology do you use in instruction in classroom instruction?

P: The most or the simplest one I have of course is the graphing calculator. And what we do with the graphing calculator is sometimes, the kids they have to know how to graph equations and once they know how to graph it and set it up they can write an equation. It will visualize on their screen with coordinate plane and will show them the grid and it will show them the graph. And then from that graph they can dictate or picture where, if I want to go to two units to the left, two units to the right, what's my new graph going to look like. So, the basic one we use in the classroom would be our graphing calculator. Now, I also use the media cart, and we have what is called technology enhanced items. So we are working on items where you have to drag and drop, fill-in-the blank. Or maybe some questions may be more than one answer where you have to drag and drop those two solutions into a box. But the most basic one that we use of course is the graphing calculator. I don't have access to a Promethean board, but I know some teachers find that very helpful as well. I haven't had a chance to experience the Promethean board per se. But like I say, I have been observing a few teachers and I have seen it's pretty useful. But like I say, I don't have access to it in my classroom. So I utilize the media cart and the graphing calculators.

R: So the TI technology enhanced items how do you give students practice on that if you don't have the Promethean board or any other technology?

P: Now I start off with maybe paper and pencil first. They are so used to multiple choice test, just getting the answer and just figuring out what the answer is. I start out with paper and pencil and I give them like maybe drag and drop questions or fill in the blank questions and I just ask them what did the directions tell you to do. What do you need to do? Tell me because you can't give me the answer because you have to utilize technology. But what is this technology enhanced item asking you for. So, if it is a fill in the blank question, and they will have to tell me I have to fill in the blank. Some questions may ask you to plot certain points on a coordinate grid or coordinate plane. So, tell me exactly what the directions ask you to do. Then when we have access to the lab, because we are scheduled to go to the lab maybe once a week or twice on a scheduled date. Then when we go to the lab we do have access to that online so we go in the lab and utilize those technology enhanced items there. But I just try to ask them to visualize and tell me what do you see first, what are the directions asking you to do. And you tell me in your own words. And then when we get to the lab and you actually see it and you have to utilize the technology, should be a little bit easier for you to figure it out.

R: Ok, do you believe that technology is a viable resource in increasing mathematic achievement?

P: It depends. It depends. Now it can drive instruction. Sometimes it can also hinder instruction too. I'm just being honest. Like going back to the graphing calculator. I had a student today, we were doing solving equations-- we have a solver on the calculator. But they have to know exactly what to type in and how to type it in to get the answer. Instead of them understanding how to arrive at the answer because there are also some questions that will say what steps do you do first, what steps should you do second, what property was used they didn't necessarily say what the answer was. So, you know, I do believe technology can drive instruction, yes. And I have no problem with it but it can hinder it to. Sometime students will ask, "Can I just put this in my calculator? Can I just put in the solver and get the answer?" And I say yes but I don't teach the graphing calculator because it could be a question that will say what do you have to do first. Alright, but I think it's a great tool. And now technology is enhancing and increasing every day it seems like. And especially with the use of the cellphone and all of the applications out there that you can put on cellphones. I do think that it’s a good way to drive instruction but it shouldn’t be your total method of instruction.

R: Well how about the computer assisted instructional programs? Do you think that they are helpful?

P: Yes, depending on which ones you use and I do think they are helpful. And I have seen some of them and it’s hard for use to gauge that we did something paper and pencil. We will give a paper and pencil test and then we will have to come up with our own data and our own criteria and figure out how to reassess those students or reteach those students. But what I’m finding out is depending on what computer assisted instructional program it is that they will take and assessment if they miss a question it may take them back to an easier question or a prerequisite skill that they should’ve had before that question. And it helps them and assists them. Or they will finish a whole assessment and it automatically gathers all the data and it will say, “Ok, this student is at this grade level or on this subject. And this is where they need to be at or these are their deficits or deficiencies and this is what they need to improve on or build upon.” And it will be easier for us to go through and see it. I kinda like that because, like I say, if they miss an easy question it will give them another question on a prerequisite skill that they should have. And if a student gets it right, on the other hand, too, it will give them what I call a higher order thinking question. So it will say so well, “Ok, this student is pass grade level.” So we don’t have to spend that much time on a particular skill. I can teach them the critical thinking type question, the higher order thinking questions the rigor of the questions. Or, I do like most of them depending on what it is the computer assisted instruction programs.

R: Are there any barriers to integrating technology into your curriculum?

P: Like I said, I mean not just having access to a Promethean board you know in my class. That probably could help. Like I said trying to get better at utilizing technology a little bit more in my classroom. But sometimes, you know, I guess the barrier would be finding a place to put it at in my classroom. Not having access to be able to put it in the classroom. Sometimes space is a problem as well. That is the only barrier that I see.

R: So if there was one thing that you would want that would help you with technology integration or getting you to use it more what would that be?

P: Probably just professional development. You know and how could I use that for the core area that I am teaching. Because I can tell you about technology but how do I incorporate it into my classroom. How would I incorporate it into my classroom that would drive instruction for the students? That is my main thing. I want to use it so that I can get the best out of the students. You know I don't want to use it just to say that I'm using it. I want to know how can I use it that it will be beneficial to me and the students that will help drive instruction

R: is there anything that I have not covered about integrating instruction that you would like to add?

P: No, I think you have covered everything pretty well. But like I said it's just me getting more familiar with, with not just using technology but again how do I use technology to drive the core subject that I teach. Because again, I can tell you about technology, I can tell you what I do with technology but it's not in reference to the core subject that I teach which is math. And how can I use that to drive instruction. And it's like I said it's a whole lot out there for them and it's a lot out there that I don't know per se that if I had the skills and the knowledge then I can direct it to the students. And like I say even with the graphing calculators that's a type of technology. And if I had more professional development on that I mean the new, we have Nspire now, TI-Nspire. They can do everything for you. Everything. And it's a great tool. But again like I say I don't want it to weaken the student because all they're familiar with is "Ok, what do I need to type in to get the answer" instead of how to arrive to the answer. And I am also doing a class now. I am taking Abstract Algebra and they have all of these computer programs to help you drive instruction to help you get to your answer. And one software mathematical software that if you know what to put in it will give you your answer. But again, if you don't understand the basic terms on what to do like we were talking about Cyclic groups generators all that. But if you don't understand what a Cyclic group is or a generator is or a permeation you are not going to understand the concept on how you arrive to your answer. But that software did all the work for you and I mean it was great. But like I said how do you use it to drive your instruction where the kids will understand what to do. It's just put it in and arrive to an answer because it may not ask you for an answer all the time. You may have to critique something and tell somebody else how you got to this, or how you do this, or how you do that or just say ok put that in there.

R: So, historically our scores in math have been low. What do you attribute that to?

P: I think it's a combination of quite a few things. I think reading level. And you know I and the other math teachers we talk about it all the time and we always get together with the English teachers. If their reading level is low, if they can't comprehend what they're reading then they are going to struggle on questions. Because just a basic example. A question may say "what is the solution to this problem?" The solution is to get your answer, what's the final answer. It may be another question that says to evaluate. They may see the two terms as being different but actually they are the same. Evaluate and solve—come up to your answer. But some people, again, just the comprehension and the reading level. And that's what I have noticed. And like the technology enhanced questions, it may be a question that will say "choose all the correct answers, all the possible choices." They may just get the first answer they see and click it. But it's asking for all of them. So you have to read the entire set of directions to understand what the directions are saying. It may be a question, again, not even asking for an answer. And they just aren't reading the question thoroughly and all the way through. That's the main factor that I see and I think a little bit has to do with technology as well as all our SOLs are now on the computer. I think this is the third year for the technology enhanced items. It's still new to the students. But I don't see that as being a big problem because it seems like they use technology every day and most of them got cellphones. And they are on Facebook on their cellphones. They're on twitter on their cellphones. They got all these applications on their cellphones. When they go home they get on the Internet. So I think they are familiar with the technology. I just think it is a little bit maybe a combination of technology and the reading.

R: Ok so as you stated students use technology all the time and research states that integrating technology will increase student scores and when they get home they are always on the computer they collaborate. Do you think that technology, if we had more technology in the school that was accessible to you, that that would help the students more; they would collaborate more?

P: No question. No question. Because they would be using it every day all day and for those subjects not just when they go to a specific class. Or not when they assign a specific lab for that day or that period. But if they utilized it more and they had access to it every day every class it doesn't have to be you know for the whole class period. It could be ten or fifteen minutes at the beginning and it has to be something that is structured for that lesson. It's not just, ok you go and get on the computer and you find this or google that and research this. And that's what I think. I mean I know and I've heard some schools some students they have a laptop assigned to them the whole year. Some of them have it in their classroom in their particular classroom for a core subject not just a computer class. Not just a keyboarding class. But they have it for that core area class. And even with the typing now students have to be able to learn how to type. They have to do that.

So if they had that technology and that access in every class period when they want it not just I can go every Tuesday. Or I can only go every Thursday for this hour. You know I think would help. But sometimes schedules change, we are on a different schedule every two weeks or every three weeks or we may not be able to get in there that week. But I do think it would help the students. And like I say sometimes they are going on it when they go on it at home they are going on it for pleasure and not to build their skill level per se.

R: Okay, is there anything else you would like to add before we conclude?

P: Like I said I just feel like and I had this conversation with the principal and I said I feel like I could do a better job utilizing technology. But again there are some barriers and some factors such as time, time constraints. And then you are kinda always say dealing with a pacing guide. So you're locked in and you've gotta get these SOLs done before this date because the test is then. So time constraints are a big factor as well. But I say I wish I could utilize technology a little bit better. I wish I could get more professional development and build my skill level up so that I can present it to the students

Appendix E: Sample Letter of Cooperation from a Research Partner

Community Research Partner Name
Contact Information

Date

Dear Researcher Name,

Based on my review of your research proposal, I give permission for you to conduct the study entitled Insert Study Title within the Insert Name of Community Partner. As part of this study, I authorize you to Insert specific recruitment, data collection, member checking, and results dissemination activities. Individuals' participation will be voluntary and at their own discretion.

We understand that our organization's responsibilities include: Insert a description of all personnel, rooms, resources, and supervision that the partner will provide. We reserve the right to withdraw from the study at any time if our circumstances change.

Include the following statement only if the Partner Site has its own IRB or other ethics/research approval process: The student will be responsible for complying with our site's research policies and requirements, including Describe requirements.

I confirm that I am authorized to approve research in this setting and that this plan complies with the organization's policies.

I understand that the data collected will remain entirely confidential and may not be provided to anyone outside of the student's supervising faculty/staff without permission from the Walden University IRB.

Sincerely,
Authorization Official
Contact Information

Walden University policy on electronic signatures: An electronic signature is just as valid as a written signature as long as both parties have agreed to conduct the transaction electronically. Electronic signatures are regulated by the Uniform Electronic Transactions Act. Electronic signatures are only valid when the signer is either (a) the sender of the email, or (b) copied on the email containing the signed document. Legally an "electronic signature" can be the person's typed name, their email address, or any other identifying marker. Walden University staff verify any electronic signatures that do not originate from a password-protected source (i.e., an email address officially on file with Walden).

Appendix F: Lesson Critique

1. The objective of the lesson was made clear.

Agree	Somewhat Agree	Somewhat Disagree	Disagree
☐	☐	☐	☐

2. The information was presented in an organized manner.

Agree	Somewhat Agree	Somewhat Disagree	Disagree
☐	☐	☐	☐

3. The technology used aligned with the standard(s) being taught.

Agree	Somewhat Agree	Somewhat Disagree	Disagree
☐	☐	☐	☐

4. The lesson was student-centered.

Agree	Somewhat Agree	Somewhat Disagree	Disagree
☐	☐	☐	☐

5. The use of the Promethean board made this lesson engaging.

Agree	Somewhat Agree	Somewhat Disagree	Disagree
☐	☐	☐	☐

Comments and suggestions: