Teacher attitudes and beliefs about successfully integrating technology in their classroom during a 1:1 technology initiative and the factors that lead to adaptations in their instructional practices and possible influence on standardized test achievement

by

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ABSTRACT

The purpose of this study is to measure factors that may lead to adaptations by teachers in their instructional practices as they relate to technology integration in a 1:1 laptop environment in a Western Pennsylvania school district. Much has been done around the concept of technology integration in schools and the impact or lack of impact on student achievement. Most of the literature on technology use in schools centers around availability and access to technology in the classroom setting. This study looks at the actual integration of technology through instructional delivery in the classroom. Teacher perceptions with regard to their own instructional practices were gathered using the Technological Pedagogical Content Knowledge (TPACK) Framework and measured next to classroom observational practices as gathered by building administrators throughout the school year. If teacher perceptions using TPACK correlate with instructional technology delivery as measured by classroom observation using SAMR and the Charlotte Danielson Framework, then districts may be able to ensure their investment in technology by focusing on factors that increase likelihood of actual use in the classroom. Participants in this study reported above average comfort with regard to technology as related to technology knowledge and technology pedagogy knowledge which may be attributed to the time and investment in teaching staff by the district through ongoing professional development activities. In addition, teachers were observed implementing technology in their classrooms, in some cases at a higher level of implementation on the SAMR scale, as observed through walkthrough observations. Finally, the district in this study saw tremendous gains by first time test takers on state the mandated standardized

test since the inception of the 1:1 initiative which might be attributed to the above mentioned professional development activities focused on technology, technology content creation, and instructional technology delivery.

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Chapter 1

INTRODUCTION

School districts are continually looking for ways to improve student achievement and test scores. In recent years, technology has become a popular tool that some believe will further engage students in learning, and, therefore, increase student achievement. Touted as a magical and revolutionary way to experience education, mobile technology has become an investment for teachers and students in classrooms all around the country. Netbooks, iPads, cell phones, iPods, and e-readers are becoming attractive options for educational use as they offer a more flexible approach to instruction and instructional delivery enhancing teaching and learning more than the traditional approaches to teaching and learning, prior to this most recent digital revolution. The prevalence of technology, as a tool for instructional delivery, should cause a pedagogical shift in the way teachers deliver instruction to transform education, and the look and feel of the 21st century classroom. Even with the abundance of technology that is available to educators, today, many fail to use technology as a tool to enhance teaching and learning. While studies have been conducted to identify barriers to technology integration in the classroom, the literature on 1:1 mobile technologies is fairly new, as is the technology and its use in the educational arena. As districts make huge financial commitments to 1:1 technology, it is imperative that they understand the factors that are necessary for the successful integration of mobile technology into the classroom.

This study looked at teacher attitudes and beliefs about successfully integrating technology in their classroom during a 1:1 technology initiative at the secondary level,

and the factors that lead to adaptations in their instructional practices. The study was a mixed methods design. Selective response surveys were used to measure knowledge, skills, and teacher perspectives toward technology integration in their classrooms. The information gathered satisfied the quantitative portion of the study design. A slightly modified Technological Pedagogical Content Knowledge ([TPACK], Shulman, 1986) inventory was administered to educators at the end of the 2015/2016 school year, as part of the school district's ongoing evaluation of the effectiveness of the technology integration initiatives in this school district. This measure of knowledge and skills may be an indicator of teacher attitudes and beliefs about the impact or value of technology. Observational evidence was gathered as additional quantitative evidence for the purpose of observing technology utilization. The observational evidence was gathered during formal walkthrough observations throughout the 2015/2016 school year, using the Danielson's Framework for Teaching rubric. Trained administrators gathered additional observational evidence as part of annual walk throughs, and as a part of this process, scored the observed activities on the
Substitution Augmentation Modification Redefinition Model (SAMR) protocol
(Puentedura, 2009).

For the purposes of this investigation, the three pieces of data discussed above were analyzed to understand the association between level of technology integration, teacher effectiveness, and teacher technology integration efficacy. Descriptive statistics will be reported and included gender, experience, content area, and building level taught and were analyzed via SPSS software to understand the association between the three measures. Frequency tables and graphs will also be used to present the results.

Purpose of the Study

This research explored factors that influence teacher attitudes and beliefs about successful mobile technology integration in their classroom during a 1:1 technology initiative. The teachers' responses were analyzed with their technology integration scores, and their classroom observation results, in an effort to understand if an association between these three measures existed. As such, the current investigation used multiple measures to address the following research questions:

1. What are educators' reported efficacy, knowledge, and perspectives about technology integration, as measured by the TPACK?
2. What is the association between the teachers' responses, as indicated on the TPACK, and their SAMR score?
3. What is the association between the teachers' responses, as indicated in the TPACK, and their classroom observation measures on the Danielson domains?
4. Is there an association across the Danielson domains, the SAMR model, and the factors measured by the TPACK?
5. Is there an association between TPACK, SAMR, and/or Danielson Domain 3 and student achievement as measured by teachers' Keystone proficiency averages?

Significance of the Study

As districts commit millions of dollars toward technology and technology integration, it is critical that the implementation plans address the necessary factors to ensure their success. This study identified teacher perceptions about factors that influence the implementation of technology in their classroom as a teaching tool. The study identified teacher perceptions regarding various variables including skill level, professional development, principal leadership, availability of resources, technology support, impact on student learning, curriculum, assessment, time, accountability, and outside influences. The study should help schools determine whether they possess the capacity to address and overcome barriers to technology integration as a teaching and learning tool, prior to investing significant amounts of money in mobile learning devices for staff and students. The results may help districts in their planning and implementation for technology integration in the classroom to be successfully implemented to transform teaching and learning in the 21st century. The results of this investigation can also inform the school district as to the strengths and weaknesses of the technology integration initiatives, and inform where more professional development is needed. All teachers received ongoing technology training (two hours per month) to the present date. Technology training is provided by in-house teacher-leaders, who have dedicated time in their schedule to plan for and provide professional development.

Limitations and Delimitations

The researcher is superintendent of schools in the district being studied. There is the possibility that the relationship of the researcher with the school and the subjects participating in the study could be influenced by that relationship. Data collection is being performed by the trained building administrators and through self-reporting. All responses will be evaluated for reliability and validity using Cronbach's α and through close examination of the data.

Definition of Terms

1:1 – The term one-to-one is applied to programs that provide all students in a school, district, or state with their own laptop, netbook, tablet computer, or other mobile computing device. One-to-one refers to one computer for every student (edglossary.org).

21st Century Skills – The term, 21st-century skills, is generally used to refer to certain "core competencies such as collaboration, digital literacy, critical thinking, and problem-solving that advocates believe schools need to teach to help students" thrive in today's world (Rich, 2010, p. 32).

iPad – "The iPad is a tablet computer developed by Apple. It is smaller than a typical laptop, but significantly larger than the average smartphone. The iPad does not include a keyboard or a trackpad, but instead, has a touchscreen interface, which is used to control the device" (Techterms.com 2011, p. 1).

Mobile Device – "A mobile device is a handheld tablet or other device that is made for portability, and is therefore both compact and lightweight. New data storage, processing, and display technologies have allowed these small devices to do nearly anything that had previously been traditionally done with larger personal computers. Mobile devices are also known as handheld computers" (Techopedia 2017, p. 1).

SAMR Model – The Substitution Augmentation Modification Redefinition Model offers a method of understanding how computer technology might impact teaching and learning (Technology is Learning, n.d.).

Technology Integration– Technology integration is using computers effectively and efficiently in the general content areas to allow students to learn how to apply computer skills in a meaningful way (Dockstader, 1999, p. 73). Based on investments by districts in technology it is expected that technology integration is a developer of 21st century skills.

TPACK – Technological Pedagogical Content Knowledge (TPACK) is a framework that identifies the knowledge needed for effective technology integration (The TPACK Framework, (n.d.).

Chapter 2

LITERATURE REVIEW

History of Technology Use in Schools

Technology in schools, in its earliest form, came through the availability of electronic media as a resource in the classroom. Televisions and movie projectors were some of the first, modern technology tools to reach the classroom to support education. In the mid-1970s, the invention of the personal computer allowed for a new technology to work its way into schools.

> The advent of the TV in the late 1930s and its adoption by the public in the 1940s generated predictions of how important TV would be to education in the future. The 1970s saw the introduction of the microcomputer. Shortly after, with the genius of Bill Gates, Steve Wozniak, and Steve Jobs, personal computing became available to the masses, including schools. While it took nearly another 10 years to see microcomputing begin to become a reality in schools, the predictions were in. This machine — the personal computer — would radically change the way we teach and learn. (Bigenho, 2015, p. 20)

Over time, how computers have been used and accessed in the education arena has changed with the technology and its evolution. "Questions about technology integration persist, even after more than half a century of research documenting the use of technologies such as television and the benefits of using computers for learning" (Boss, 2011).

Due to availability, cost, and size, early computers were barely accessible to the general population and/or educators. The invention of the personal computer led to the implementation of computer labs in schools. The use of computer labs in education evolved from a single computer to a single classroom, from single classrooms to classroom clusters, and from classroom clusters to individual student access.

> While many educational technology issues continue to be debated, the presence of technology in schools continually expands. This expansion will continue, whether one believes that computers should be an integral part of education for pedagogical reasons, or that their use is justified simply because of the technical requirements of the world in which today's students will work. (Coley, Cradler, & Engel, 1997, p. 11)

As access and availability of technology have evolved, so has the hardware. Desktop computers were replaced by laptop computers, which are currently being replaced by handheld devices. Laptop computers and handheld devices allow for easy mobility from classroom to classroom. “The prevalence of mobile, handheld devices has exploded in the past five years with the invention of touch screens and decreasing prices” (Williams, 2014, p. 2). According to Williams (2014), a growing number of schools have embraced BYOD, or bring your own device, as a way to ensure individual access to technology. Handheld devices, such as cell phones and tablets, provide the same level of technology as desktop and laptop computers. The use of laptops and handheld devices has made technology accessible inside or outside of the school setting. Mobility is also possible due to the evolution of network accessibility. This evolution has led to a myriad of educational uses for technology and the challenge of determining where to invest time, energy, and money.

> Add to this cacophony the latest trends making educational news and you have myriad options to consider. The short list looks something like this: 1:1 laptop schools, BYOD programs, all students coding, massive open online courses (MOOCs), garnification, e-portfolios, flipped classrooms, 3-D printing, computer science as a new core literacy, blended learning, online classes, and, most interesting in my mind, the maker movement. The challenge before all school leadership is how to determine the best way to spend limited resources. How do we determine which technology, programs, and approaches best fit our schools (Bigenho, 2015, p. 20)?

Early computer networks required hard wires and cabling which limited access and mobility. As modern technology has evolved, so has access to networking. The invention of the wireless local area network (WLAN), allowing network access to resources without a physical connection, has allowed for mobility and accessibility to educational technology both in and away from schools. Classroom connectivity (CC) has evolved rapidly over the past decade with the advance of in-classroom networks, such as general wireless communication of computers, and specific proprietary networks to link hand-held devices (e.g., TI Navigator Learning System), transforming the social and communication infrastructure of the classroom. Over a decade ago, several groups foresaw the impact that such technologies could have on transforming the communicative heard of in the everyday classroom (Hegedus, Dalton, & Tapper, 2015, p. 206).

As availability, accessibility, and portability have evolved, so have computer software and its application in schools. Early software was used primarily for educational games. Educational software was seen as a way to individualize instruction.

> Computer technology has long been seen as an answer to the scalability and cost of individualized instruction. Experimentation with technology-supported instructional guidance emerged in the 1970s in the form of computer-assisted instruction (CAI). Based on student responses, these rule-based systems interactively modified the sequence of progression through a series of questions. (Coffin Murray & Perez, 2015, p. 113)

Early educational software was also most prevalent in the elementary setting. As software changed, schools began to embrace computers as a tool to word process at the secondary level in the late 1980s and early 1990s.

The evolution of software and other resource technologies in education advanced the use of technology in the educational setting well beyond word processing and the use of educational software on floppy disks. With advances in network access and the arrival of the Internet, and the ability to access information globally in real time, technology is being infused into the educational arena like never before.

> It all started in the mid-'80s when the big innovation was computer labs. Ten years ago, interactive whiteboards appeared. Around 2010, we started to move toward 1:1 computing. A lot of what we are seeing with BYOD really means that there are going to be classrooms where every student has a computer and where we move from print to digital. (Richards & Dede, 2012, p. 1)

The evolution of technology now has schools and teachers transforming technology into a tool for non-technological teaching and learning. "Through technology, teachers and students can soften the boundaries between life in schools and in communities as well as between their present and future lives. Technology has the potential to expand learning in ways that traditional curriculum cannot" (Smolin & Lawless, 2011, p. 92).

Technology and Student Achievement

Since 2001, No Child Left Behind (NCLB) Federal legislation mandated schools receiving federal funding for Title I programs to use standardized testing to measure student achievement in reading, math, and science. NCLB, and the negative consequences that accompany noncompliance have many school districts across the nation looking for ways to improve student outcomes.

> Understanding why children's outcomes vary so dramatically along race and class lines in America is central to formulating effective education policy interventions. Disagreements about how to improve schooling outcomes for poor children stem in part from different beliefs about what problems underlie the unsatisfactory outcomes found in many of our nation's public schools. (Jacob & Ludwig, 2008, p. 2)

NCLB was the government's attempt to create equity in education, specifically for traditionally underserved populations. "The implementation of the U.S. Department of Education's No Child Left Behind Act (NCLB; Public Law 107-110) has impacted education in a myriad of ways" (Donlevy, 2008; Forte; Gay, 2007; Schraw, 2010; Berrett, Murphy, & Sullivan, 2012, p. 201). One way that NCLB has impacted education is by fostering a new commitment to technology to raise student achievement.

In recent years, technology has become a popular tool that some believe will further engage students in learning and therefore increase student achievement. Technology is seen by many as a way to level the playing field for all students, allowing for equitable access to a quality education, regardless of socioeconomic, ethnic, or academic background. When looking at the impact of technology on student achievement, one must consider there are many factors that may or may not impact learning. Lim et al, (2013) maintain that there is a significant amount of research on the use of technology as a panacea for the achievement gap. Most research suggests that technology is not the sole solution to closing the achievement gap. Just as there are many factors that influence student achievement, there are many factors that influence the use and effectiveness of technology in schools.

> Educational technology's impact on academic achievement should not be measured alone, but with a group of other important factors. Its impact is influenced by software design, the subject area, the specific student population, how the students are grouped, the educator's role and professional training, and the level of student access to the technology (Software Publishers Association, 1998. (Reichstetter, 2002, p. 4).

The influx of technology into the classroom as a teaching and learning tool has become more prevalent as technology has evolved to become more mobile and economically affordable for some school systems.

> Information and communication technologies is viewed as a 'major tool for building knowledge societies' and, particularly, as a mechanism at the school education level that could provide a way to rethink and redesign the educational systems and processes, thus leading to quality education for all. (Sangra & Gonzalez-Sanmamed, 2011, p. 47)

While technology may provide more access to education, the jury is still out on whether technology raises student outcomes. "A convenient criterion for measuring student outcomes is student academic achievement. However, it is very difficult to establish causal relationships between technology use and student academic achievement, because student achievement is influenced by many factors" (Ping Lim, Yong, Tondeur, Ching Sing, & Chin-Chung, 2013, p. 63).

In order for most educators to embrace technology as a tool for learning, and not just as a resource for productivity, they need to see research on the impact on student achievement. "Most educators will expend the effort needed to integrate technology into instruction when, and only when, they are convinced that there will be significant payoffs in terms of student learning outcomes" (Means, 2010, p. 287). Researchers continue to study the relationship between technology and its effect on student achievement. "The general consensus from recent reviews of the research to date is that additional detailed information is needed to assess the impact of 1:1 laptops on teaching and learning" (Dunleavey & Heinecke, 2007, p. 9). There has been little research to support the notion that there is a positive correlation, even though equitable access to technology is a noble effort to enhance the educational experience for all students.

> The seemingly elusive goal of educational technology research is

> the evidence-based demonstration of the effectiveness of educational technology on student learning; compounding this challenge by shifting the perspective back a step to examine student learning through the filter of teacher knowledge and skill, and then back once again to look through a filter of teacher preparation, has proven a puzzle indeed. (Pierson, Shepard, & Leneway, 2009, p. 127)

A 2014 study by Nancy Williams, using performance index scores, failed to provide evidence that 1:1 technology improves student achievement. "Overall achievement, as measured by the performance index score on the OGT, does not exhibit a statistically significant difference for students participating in 1:1 computing programs when compared to student scores for similar high schools without a 1:1 program" (Williams, 2014, p. 74). Technology on its own is not a panacea to closing the achievement gap. Hard evidence of causal effect is not found in the extant research literature. "Because the range of educational technologies is so diverse, from specific software packages to computing devices to online content delivery systems, no single research study can address the general question of whether technology yields improved student outcomes" (Tamim, Bernard, Borokhovski, Abrami, & Schmid, 2011, p 1). While the general question about technology impact may be difficult to answer due to various factors, one common denominator, regardless of software package or specific hardware, is the incorporation of the various technologies. The question, then, becomes whether or not technology, regardless of type, if incorporated properly, can indeed have a positive impact on student achievement, and what constitutes proper incorporation?

Standards of the 21st Century Learner for Educators

According to International Society for Technology Integration (iste.org, 2017), the standards that should be taught by 21st century educators encompass seven core areas in which technology is leveraged to improve student learning are as follows:

1. Learner – Educators continually improve their practice by learning from and with others and exploring proven and promising practices that leverage technology to improve student learning.
2. Leader – Educators seek out opportunities for leadership to support student empowerment and success and to improve teaching and learning.
3. Citizen – Educators inspire students to positively contribute to and responsibly participate in the digital world.
4. Collaborator – Educators dedicate time to collaborate with both colleagues and students to improve practice, discover and share resources and ideas, and solve problems.
5. Designer – Educators design authentic, learner-driven activities and environments that recognize and accommodate learner variability.
6. Facilitator – Educators facilitate learning with technology to support student achievement of the 2016 ISTE Standards for students.
7. Analyst – Educators understand and use data to drive their instruction and support students in achieving their learning goals.

Student Use of Technology

> Through the last decade, students increasingly benefit from online courses and content delivery, podcast lectures, educational apps on mobile tablets, and collaborative activities through social networking platforms. All of these deliveries provide students with incredible freedom over when and how to pursue the learning process. (Rossing, Miller, Cecil, & Stamper, 2012, p. 13)

While the potential for technology to enhance learning exists, recent studies of student perceptions reveal that success in using technology is dependent on the instructor. "Students have attributed negative qualities to instructional technology due to ineffective implementation in classrooms and learning activities" (Armstrong, 2011, p. 224). The emergence of the iPad, as tool to individualize learning, has received positive reviews from both educators and students. While implementation continues to provide challenges for school entities, a recent report from the Government of Alberta (2011) highlighted several perceived positives from 1:1 mobile technology using the iPad.

> Overall, the data gathered indicates that while many teachers, schools and school authorities are struggling with implementation challenges, there is also strong recognition that iPads excel in three areas – improving engagement, supporting multiple ways to access the curriculum (Universal Design for Learning) and enhancing assessment practices. (Government of Alberta, p. 5)

Increased student engagement appears to be an attractive reason for the infiltration of mobile devices in the classroom. Simply purchasing mobile devices does not affect student achievement.

> People certainly are putting courses, curricula, and lesson plans online. This trend is important, but it's hardly new, it will be new only when those courses, curricula, and lesson plans are very different and technology influenced, when they are set up so they can be found and mixed and matched easily, when they are continually iterated and updated, and when the kids have a big say in their creation. (Prensky, 2005)

Educators must also recognize that the increased use of technology may present new challenges for the students as they become more digital in their approach to learning. According to Ziming Liu, (2005), "with the growing amount of digital information available and the increasing amount of time that people spend reading electronic media, the digital environment has begun to affect people's reading behavior. A number of scholars argue that the arrival of digital media, together with the fragmentary nature of hypertext, is threatening sustained reading" (p. 2). It is critical that teachers receive adequate training on the proper and appropriate integration of technology in their classrooms.

"Schools should be investing in a teacher's professional development rather than just purchasing pieces of technology" (Chow, 2015, p.16). There needs to be professional development to establish connections between engagement and achievement. Williams

(2014) suggested that fidelity of professional development implementation may have an impact on student achievement.

> Since implementation fidelity is such an important factor in the successful use of 1:1 computing to improve student achievement, it would be reasonable for Ohio policy makers to link financial incentives/grants for the deployment of 1:1 computing programs to the best practices cited above. This would include the development of a comprehensive plan, professional development prior to and throughout deployment of any devices to students, and ongoing monitoring of adult implementation and student impact measures. (Williams, p. 93)

So what impact can this proposed professional development have on teacher's classroom integration of technology? What role does the teacher's integration play in student engagement using mobile technology in the classroom? "Unfortunately, few large-scale studies have measured both effects of technology on student learning and technology implementation practices" (Means, 2010, p. 288).

Technology Preparedness of Teachers

A 2001 study by Beyerbach, Walsh, and Vannatta found that pre-service teachers felt inadequately prepared to integrate technology in the classroom. "Faculty felt they had exposure to many programs, but insufficient mastery to integrate these into their courses" (Beyerbach et al., p. 116). Wilson and Wright (2009) followed social studies pre-service teachers who had participated in a college program that used multiple technology integration efforts throughout their preparation programs. They concluded that a teacher preparation program, rich in technology experiences, created a foundation on which to build technology enhanced content delivery and pedagogy.

> If a teacher does not know how to use the tools, they may waste time from attempting to troubleshoot the device, or worse, completely disengage the students as they see a teacher who does not know what he or she is doing. (Chow, 2015, p. 11)

Obtaining the appropriate technological and instructional delivery skills entering the teaching profession appears to influence whether a teacher will integrate technology into teaching and learning upon entering the teaching profession. "Knowledge of teaching and learning, as well as evolving attitudes and beliefs, are among the attributes of individual pre-service teachers that inform and influence the decisions they will make and the behaviors they will exhibit as professional educators" (Abbitt, 2001, p. 134). Some teachers are willing and able to infuse technology into their classrooms, but those teachers appear to be in the minority.

> While a minority of teachers appears able to effortlessly 'assimilate' and incorporate digital technologies into their teaching and are more inclined to see the benefits of technology use in their classrooms, many others are seen to reach a stubborn 'accommodation' of technology into existing modes of working. (Perrotta, 2013, p. 316)

Recent studies have used the TPACK Framework to evaluate pre-service teachers' readiness to use technology as an instructional delivery piece. "This initial characterization of pre-service teacher mean TPACK suggest that pre-service teachers have a stable foundation upon which teacher educators can build new knowledge and skills for teaching with technology" (Young, 2012, p. 31).

Barriers to Technology Integration

"Despite an increase in the availability of and exposure to technology in education, teachers are still hesitant to move toward full integration" (Moore-Hays, 2011, p. 12). What factors influence whether or not in-service professionals will integrate technology in their classrooms as a tool to enhance teaching and learning? Several studies analyzed teacher efficacy beliefs about technology integration and the factors or barriers influencing their behaviors. Hew and Brush (2006) identified general barriers to integrating technology into the curriculum to include: resources, institution, subject, culture, attitudes and beliefs, knowledge and skills, and assessment. ChanLin (2007) concluded that integrating technology into teaching involves many issues to include: curriculum, environment, social, and personal factors. Sangra and Gonzalez-Sanmamed (2011) looked at several teachers' perceptions about what aspects of teaching and learning could be improved through the integration of information technologies in the classroom to include: access to broadband technologies, professional development for teachers, and development of high-quality online content.

> Particularly, teachers use technology depending on their perceptions and their trust in the way it can contribute to the teacher and the learning process. Through knowing what they think, we will be closer to understanding what they do or what they might do with technology in their classrooms and in relation to their work (Sangra & Gonzalez-Sanmamed, p. 48).

The implementation of technology has perceived barriers to implementation based on teacher beliefs and attitudes. The concept of a 1:1 learning environment, where every student is provided with an electronic learning device for use in the classroom, school, and at home, may provide additional barriers to successful implementation and integration. Donovan and Green (2010) studied faculty concerns prior to implementation of a 1:1 laptop teacher education program. They concluded that three major issues from a 1:1 laptop learning environment need to be addressed, including faculty readiness, their preparation, and individual differences. Unfortunately, professional development needs are not being addressed to adequately support teachers to successfully integrate technology into teaching and learning. "Many teachers have not been exposed to transformative technology-supported pedagogy because professional development activities have focused primarily on how to merely operate technology" (Hew & Brush, 2006, p. 228). It is critical that research identifies the factors that create barriers to technology integration in the classroom to enhance teaching and learning, specifically in 1:1 teaching and learning environments. "Since a growing body of literature suggests that a high ratio of computers to students (e.g., laptops for every student) may change the teaching and learning dynamics in the classroom (Garthwait & Weller, 2005), it is possible that one-to-one computing learning environments also introduce new barriers" (Hew & Brush, p. 245).

Identifying perceived barriers would allow schools to adequately prepare professional staff to transform instructional delivery, and, ultimately, enhance learning through technology integration. "The lessons that can be learned from reviewing the history of technology integration in the K-12 educational environment is that technology integration is not easy to implement because it represents second order change" (Shattuck, 2007, p. 10). Administrators play a major role in the implementation of second order change in schools and the needs of the teaching staff to overcome perceived barriers to implementation. "How principals perceive their role and their ability to listen to the teachers' needs frequently impacts the implementation process" (Berrett et al., 2012, p. 201).

Shifflet & Weilbacher (2015), in a case study suggest that even though teachers may perceive that technology is useful and enhance learning that it doesn't always manifest itself through their instructional practices. "Ertmer (2005) proposed that a series of contextual factors such as curricular, peer, parental, and administrative expectations may contribute to the appearance of an inconsistency. She noted that even when teachers report to hold constructivist principles other beliefs may become the deciding factor in determining their instructional choices" (Shifflet & Weilbacher, 2015, p. 369). As a variety of mobile devices continue to make their way into schools and onto teachers' and students' desks, it would be prudent to evaluate factors that influence the successful integration of that specific technology as a teaching and learning tool. Schools do not only invest money in technology, but major investments are also made in human capital through staffing and professional development as well.

TPACK

TPACK is the acronym for Technological Pedagogical Content Knowledge. "The TPACK framework builds on Shulman's (1987, 1986) descriptions of PCK to describe how teachers' understanding of educational technologies and PCK interact with one another to produce effective teaching with technology" (Koehler & Mishra, 2009, p. 62).

TPACK is a framework that is used to measure a teacher's knowledge of teaching with technology. The TPACK Framework looks not only at technology knowledge, but includes pedagogy and content knowledge as part of the framework. The TPACK framework can be used as a source of data to determine the correlation between teacher technology readiness and the actual implementation of technology as an instructional delivery tool in the classroom, assuming that the framework is an accurate measure of teacher technology competency. "Pierson (2001) found that effective technology integration included the need for teachers to understand content knowledge, pedagogical content knowledge, and technological content knowledge. TPACK is used to arrange and assess technology integration by combining the different aspects of knowledge" (McDowell, 2013, p. 17). Schmidt et al. (2009-2010) used TPACK as the framework for an assessment instrument to measure TPACK for pre-service teachers. They concluded that, even though their sample size was small, the survey was a reliable measure of TPACK and its factors.

Similarly, Archambault and Crippen (2009) used the framework to survey and measure TPACK for online K-12 distance educators in the United States. "The TPACK framework has a practical appeal, providing an analytical structure for researching what teachers should know and be able to do and highlighting the importance of content knowledge when incorporating the use of technology" (Archambault & Crippen, p. 83). The researchers did note the difficulty in measuring each of the constructs presented in the framework and the challenge of having to differentiate between the constructs themselves, thus pointing out the need for further validation methods to ensure accuracy. In a follow-up study Harris, Grandgenett, and Hofer (2010), examined the psychometric properties of the TPACK, with both pre-service and technology experienced educators, from two different regions of the United States. Harris et al concluded that the TPACK demonstrated high reliability when assessed using inner-rater reliability (86%), test-retest reliability (87%) and internal consistency (Cronbach's Alpha, .911). Additionally, TPACK experts were used to assess the face validity and construct validity of the TPACK, both holistically and by subsection. They determined that the TPACK had good validity.

Groth, Spickler, Bergner, and Bardzell (2009) modified TPACK and used it as a framework for a lesson study (LS-TPACK) in order to perform a qualitative study to measure teachers' TPACK involving the teaching of systems of equations using graphing calculators. The researchers acknowledged that the qualitative approach to the use of the TPACK framework could be clouded by the typical biases associated with a qualitative study. However, they did recognize the effectiveness of the framework as a tool to measure teacher TPACK, regardless of one's philosophical views on the value of a qualitative study versus a quantitative study.

> Even if one holds a purely psychometric assessment paradigm, the LS-TPACK model can be seen as valuable because of its exploratory potential. The construct of TPACK itself is relatively new among the types of teacher knowledge needing assessment. From a psychometric perspective, the in-depth exploration of specific cases and examples can help further define and clarify emergent constructs (American Statistical Association, 2007). Unanticipated and potentially important aspects of the

> TPACK construct can be uncovered as actual teaching practice is observed, documented, and evaluated. (Groth et al., 2009, p. 405)

Mishra and Koehler (2006) used the framework on five years of research focused on teacher professional development and faculty development in higher education. "The TPACK framework allows us not just to understand what effective teaching with technology is about, but it also allows us to make predictions and inferences about contexts under which such good teaching will occur" (p. 1045).

Implementation Model

The literature speaks to the evolution of technology and the integration of technology in schools. The literature also addresses a lack of preparedness of pre-service teachers and the perceived barriers of in-service teachers integrating technology in their classrooms despite student perceptions of the benefits of learning through technology. Tondeur, Van Braak, Sang, Voogt, Fisser, and Ottenbreit-Leftwich (2011) synthesized qualitative studies which focused on pre-service teachers and their preparation to integrate technology in their classrooms. According to Tondeur et al., the research showed that beginning teachers feel they are not well prepared to effectively use technology in their classrooms (e.g., Sang et al., 2010; Tearle & Golder, 2008).

The literature falls short in identifying possible factors to ensure transformative teaching through the use of technology. This may, indeed, be the missing factor that links the use of technology to positive gains in student achievement.

> Yet the evaluation of technology integration, including professional development for technology integration, has done little to define what constitutes effective practices for realizing

> such potential. So although the images of our classrooms have significantly changed due to the ubiquity of technology, and many teachers are incorporating technology in their learning environments, these changes have done little to truly reform education. (Smolin & Lawless, 2011, p. 92).

However, Fullen & Langworthy (2014) posit that the integration of technology should encourage students to be independent learners. They state

> "In new pedagogies we are beginning to see how technology can be used to support the new learning partnerships between and among teacher and students and to accelerate teachers' ability to put student in control of the learning process. The ultimate goal of new pedagogies is for student to become independent learners who are able to design and manage the learning process effectively for themselves (p. 36).

In essence, these changes in pedagogy will lead to the transformative teaching that will foster independent learning which in turn may someday show in impacts on student achievement.

SAMR

The SAMR Model (Substitution Augmentation Modification Redefinition) is a theoretical model that can be used to measure whether teachers are truly transforming practices to effectively implement technology in the classroom. SAMR represents the four stages of moving pedagogical practices as these relate to technology implementation from technology as a substitution to technology and as a way to transform teaching and learning. The four stages are substitution, augmentation, modification, and redefinition. Chou, Block, and Jesness (2012) studied a 1:1 mobile learning environment and began to look at the use of the SAMR Model to link professional development and classroom practice.

> We have witnessed first hand [*sic*], how engrossed the students were with their iPads. Although we have observed that most of the instructional activities stayed at the basic two levels of substitution and augmentation according to Puentedura's SAMR model (2009), given time and more collaboration among teachers, we are confident that we will see more instructional activities that maximize the full potentials of iPads. (Chou, Block, & Jesness, p. 23)

Puentedura (2012) argued that after new technology is introduced in an educational environment, it can take up to three years for faculty to successfully use the technology to modify and redefine learning tasks to the extent that the educational process is truly transformed (as cited by Chell & Dowling, 2013 p. 2).

Fabian and MacLean (2014) used the SAMR model as a measuring tool to determine levels of technology engagement during teaching activities, while performing a study on the benefits and/or issues linked to the use of tablet devices in the classroom. "The practitioners reported that students enjoyed using the tablets regardless of which spectrum of the SAMR model this technology integration fell into" (p. 6). Kara-Soteriou (2013) used the SAMR model and the TPACK framework to study how computer labs were used in the elementary setting and to what extent the activities fell on the SAMR spectrum. Park (2014) also used the SAMR model as a way to measure the use of technology integration, while studying the connection between the use of a professional learning network and technology integration. Philips (n.d.), in his work on evaluating teacher use of technology in the classroom, provided some limitation to use of the SAMR model as a measuring tool.

A third way of considering the effectiveness of digital technology use is by evaluating the activities which incorporate digital technologies through models such as SAMR. The assumption here is that if we can define what an effective use of technology for learning is, then we can replicate it across different contexts; however, a weakness of SAMR is a lack of consideration of second-order barriers such as teacher beliefs and the individuality of classrooms, learners and teachers in contrast to the inherent implication that the use of technology will necessarily lead to enhanced learning outcomes for students (Phillips, n.d., p. 15). To date, there are no studies that have been done to validate the SAMR Model as a valid measuring tool on its own to effectively measure technology integration in the classroom. The SAMR model seems to have come out of Puentedura's experience but not his research. No peer reviewed papers on this model have been authored and published by Puentedura; he has not published any results of the decade of study he claims to have conducted. (Green, 2014, p. 38-39)

As such, the SAMR model should be paired with another theoretical framework, such as TPACK, to measure technology integration in the classroom to improve it as a legitimate measuring tool. Consistent with a review of SAMR, conducted by Hamilton, Rosenberg, & Akcaoglu (2016), the SAMR has some shortcomings as a stand-alone evaluation tool for assessing the level and quality of technology integration. Specifically, they state that (a) the lack of context, (b) the limitation of four the categories, and (c) the focus on the process rather than product, i.e., learning (pp. 5-6) limits the valid conclusions that can be drawn from this model. The SAMR model as a stand-alone does not fully evaluate all the “complexity” of what is occurring in the classroom (p. 434).

Danielson Model

> The two major standards-based evaluation models being implemented across the nation are: (1) Robert Marzano’s Teacher Evaluation Model, consisting of 41 key strategies, and (2) Charlotte Danielson’s Framework for Teaching, which encompasses 76 criteria to judge teacher effectiveness. (Bambrick-Santoyo, 2012). Pennsylvania has selected Danielson’s framework for its mandated teacher evaluation model. (Kwolek, 2014, p. 34)

All educators and evaluators in the state have been trained on using the Danielson Model as the formal observation process for teacher evaluation of classroom practice. It must be noted that this formal observation tool and the rating that is derived from the process is only a percentage of the overall data that are gathered to render a final rating in Pennsylvania. The details of that process are presented in the section on the PA evaluation model. The Danielson Model is a framework for evaluators to look for evidence based examples of best practice within four clearly defined domains and three-to-seven components which make up each domain.

- Domain 1 – Planning and Preparation;
- Domain 2 – Classroom Environment;

- Domain 3 – Instruction; and
- Domain 4 – Professional Responsibilities

Domains 2 and 3 can be described as "on stage", where the evaluator is observing a formal lesson and is focused on non-subjective evidence based practice of components being addressed within each domain. The evaluation rubric provides examples of practice that should be considered when assigning a numeric score to each component and ultimately the domain in which they reside.

- 0- Failing;
- 1- Needs Improvement;
- 2- Proficient; and
- 3- Distinguished

Domains 1 and 4 can be described as "off stage", and are geared toward professional competency and responsibilities. The evaluator is engaged in dialogue with the educator where the educator is asked to provide evidence-based practice within these domains. Once again, the evaluation rubric provides examples of practice that should be considered when assigning a numeric score to each component and their domain. The four domains and 22 components that make up the Danielson Framework are as follows:

- Domain 1 – Planning and Preparation
    - Knowledge of content and pedagogy
    - Demonstrating knowledge of students
    - Setting instructional outcomes
    - Demonstrating knowledge of resources
    - Designing coherent instruction

    - Designing student assessments
- Domain 2 – Classroom Environment
    - Creating an environment of respect and rapport
    - Establishing a culture for learning
    - Managing classroom procedures
    - Managing student behavior
    - Organizing physical space
- Domain 3 – Instruction
    - Communicating with students
    - Questioning and discussion techniques
    - Engaging students in learning
    - Using assessment in instruction
    - Demonstrating flexibility and responsiveness
- Domain 4 – Professional Responsibilities
    - Reflecting on teaching
    - Maintaining accurate records
    - Communicating with families
    - Participating in a professional community
    - Growing professionally
    - Showing Professionalism (Danielson, 2011)

Pennsylvania Evaluation Model

"Until July 2013, there was no mandate for tenured teachers in Pennsylvania to be rated with more than an annual evaluation resulting in a designation of satisfactory or unsatisfactory" (Kwolek, 2014, p. 24). The Pennsylvania Department of Education adopted a new rating form for the purpose of teacher evaluation as a result of Act 82. The rating form uses multiple criteria for the purpose of final teacher rating. Depending on specific subjects taught, the rating form requires evaluators to provide numeric values for rating performance ranging on a scale from zero to three. Each of the following domain areas is rated on that zero to three scale: observation and practice, building level performance, teacher specific data, and elective data.

- Observation and Practice – Danielson Framework for Effective Teaching (2011) – (based on the formal observation process to be completed annually. Tenured teachers can also participate in a differentiated supervision model in lieu of the formal observation process over a three-year cycle);
- Building Level Data – School Performance Profile (based on a variety of measures to produce a local performance score for an individual building within a district to include data on achievement and value-added growth on PSSA and Keystone state standardized tests);
- Teacher Specific Data – PVAAS – Pennsylvania Value-Added Assessment System (based on growth projections for students of teachers in tested subjects (math, science, ELA, algebra I, literature, biology I); and
- Elective Data – SLO – Student Learning Objectives – (based on measures of student achievement selected by the local district)

The final scores for each domain are weighted and used to provide for an overall performance score ranging from 0.00 – 3.00.

- Observation and Practice 50%;
- Building Level Data 15%;
- Teacher Specific Data 15%; and
- Elective Data 20%

A final performance rating for observation and student performance is calculated using the performance score for each domain and applying the weight associated with each of the measured areas. Final performance conversion ratings are as follows:

- 0.00 – 0.49 Failing;
- 0.50 – 1.49 Needs Improvement;
- 1.50 – 2.49 Proficient; and
- 2.50 – 3.00 Distinguished

Summary

As the use of, and the availability of technology have evolved and become more accessible to classroom teachers and the students they teach, many schools across the country initially turned to technology as a tool to increase student achievement, in response to the accountability associated with No Child Left Behind. Overtime, research has evolved from simply examining the impact of technology on student achievement to the pedagogical shift of technology integration to enhance 21st Century teaching and learning. Similarly, the focus has shifted from the early days of desktop computers to the ever-evolving mobile technology that has infiltrated the day to day lives of today's students. Studies on the correlation between technology use, specifically 1:1 technology, and student achievement, have failed to show a strong correlation between the two. The failure to produce a correlation could be directly associated with a lack of teacher preparation and/or desire to utilize technology in the classroom as a true teaching tool. Teacher preparation and the perceived barriers (e.g., lack of access, time constraints, effectiveness on student achievement) to technology integration must be addressed to truly measure the impact of technology on student outcomes. Can a correlation be made between the ways in which students are engaged using the technology and their performance in the classroom? In order to answer that question, the ways in which teachers are using the technology must be determined, as must the factors which lead to their willingness to use technology, in the classroom, in a 1:1 environment, as a teaching tool.

Chapter 3

METHODS

Study Design

The current investigation used multiple measures in an effort to address the following research questions:

1. What are educators' reported efficacy, knowledge, and beliefs about technology integration, as measured by the TPACK?
2. What is the association between the teachers' responses on the TPACK and their SAMR score?
3. What is the association between the teachers' responses on the TPACK and their classroom observation measures on the Danielson domains?
4. Is there an association across the Danielson domains, the SAMR model, and the factors measured by the TPACK?
5. Is there an association between TPACK, SAMR, and/or Danielson Domain 3 and student achievement as measured by teachers' Keystone proficiency average?

The TPACK inventory was administered at the end of the 2015/2016 school year as part of the administration's ongoing evaluation of the technology initiatives. Additionally, observational evidence, via the Danielson, and SAMR measures, was gathered as part of mandated teacher evaluations. Keystone data was garnered from the state reports for the school district.

Chapter 3 provides the details regarding the participants, instrumentation, and procedures for the proposed investigation. Chapter 3 ends with a proposed data analysis that will be used to best answer the research questions associated with this investigation.

Participants

The participants in the study consisted of 49 professional teaching staff and administrators from all grade levels 6-12, and tested content areas, spanning two school buildings in the Central Valley School District. Teachers participating in the study came from Central Valley Middle School (grades 6-8), and Central Valley High School (grades 9-12). The researcher is superintendent of the Central Valley School District and had access to the entire sample. Teachers in grades 6-12 started teaching in a 1:1 learning environment in the 2014-2015 school year. All students in grades 6-12 received iPads in July and August 2014, to be utilized as a learning tool during the 2014-2015 school year and beyond.

Study Setting

Located in central Beaver County, Pennsylvania, Central Valley School District serves the communities of Center Township, Potter Township, and Monaca Borough. Just under 2300 students attend Central Valley School District. Within the district, instruction is provided by a 100% highly- qualified teaching staff. As of the 2015 - 2016 school year, 42% of the district teachers had earned a master's degree, and one teacher had earned a doctoral degree. The following enrollment information, obtained for Central

Valley during the 2015-2016 school year on the Pennsylvania Department of Education School Performance Profile website, described the district accordingly:

Total student enrollment – 2,278

- Center Grange Primary School (Kindergarten - Grade 2) – 504 students;
- Todd Lane Elementary School (Grades 3 - 5) – 551 students;
- Central Valley Middle School (Grades 6 - 8) – 531 students; and
- Central Valley High School (Grades 9 - 12) – 692 students

Enrollment by Ethnicity

- White – 90.96%;
- Black or African-American – 5.36%;
- Multi-Racial – 1.84%;
- Hispanic – 1.36%;
- Asian – 0.40%; and
- Native Hawaiian or Other Pacific Islander - .09%

Enrollment by Student Groups

- Economically Disadvantaged – 28.27%;
- English Language Learner – 0.13%;
- Special Education – 10.40%; and
- Gifted – 1.01%

Enrollment by Gender

- Male – 50.04%
- Female – 49.96%

Descriptive statistics, including gender, experience, content area, and building level, in Chapter 4 will provide a thorough description of who provided data for the current investigation. Only complete data were incorporated into the final analysis.

Instrumentation

The current investigation incorporated four different measurements to assess the association between teachers' teaching effectiveness, their level of technology integration, and their self-efficacy regarding technology. The four measures included (1) the Danielson Framework (Danielson, 2011), (2) the Observed SAMR Integration measure (Puentedura, 2015), (3) TPACK inventory (Mishra & Koehler, 2006) and (4) Pennsylvania Department of Education Keystone Exams for 2015-2016 and 2016-2017. The SAMR Model and Charlotte Danielson's Framework for Effective Teaching were used as the theoretical framework behind the creation of the observation tool used by administrators throughout the study. The SAMR Model (Substitution, Augmentation, Modification, and Redefinition) was used to measure the degree of technology implementation as it pertained to pedagogical shift. Observers determined the degree to which teachers were using technology along the SAMR scale to enhance pedagogy.

Danielson Framework

The Framework provided observational evidence of technology integration and teaching pedagogy. It must be noted that all observers (school administrators) had completed 12 hours of training on observing teaching practices using the Danielson's Framework. The Danielson Framework data were collected as part of classroom walkthroughs. All observers were trained by the local intermediate unit on the use of the Danielson Framework.

SAMR Measure of Technology Integration

The SAMR score for each teacher was collected during the same classroom walk throughs performed by the trained observers. The school district administration trained the observers. For the purposes of this investigation, the administrators indicated whether teachers and/or their students were using technology in their classrooms. The technology was noted by using an S - Substitution, an A - Augmentation, an M - Modification, or an R - Redefinition. If technology was observed being used in the classroom, a further determination was made as to the extent in which technology was being utilized. Teachers/students were placed on a scale ranging from simple substitution to the highest level of engagement described as redefinition. In addition, the observers included a brief descriptor as to how the technology was being used as a justification for their placement on the SAMR scale.

TPACK Self-Efficacy Measure

Teachers were surveyed at the end of the 2015/2016 school year to measure their perspectives on technology implementation in their classroom. There are several surveys that have been created using the TPACK Framework that could be modified for this research project. The TPACK design is a framework used to measure perspectives of teachers and the integration of content, pedagogy and technology in their classrooms. Teachers received recognized selected response surveys adapted from previous studies. The TPACK Framework provide the direction to develop the appropriate survey. The surveys were adapted to recognize the use of the iPad versus other technologies due to the nature of this specific 1:1 technology initiative.

Keystone Exams

All Pennsylvania students are required to take a standardized test upon completion of the following courses; Algebra, Biology, and Literature. These standardized tests (Keystone Exams) are developed by Data Recognition Corporation (DRC) and administered locally on an annual basis. Scores from 2015-2016 and 2016-2017 are used for this current investigation.

Procedures

Each of the teachers in the district were given both an Apple MacBook and Apple iPad in June, 2013, with the expectation of integrating those specific technologies as teaching and learning tools in the 2014-2015 school year. The 2013-2014 school year was utilized as a professional development year for all district staff. It must be noted that any teacher who joined the district after the start of the 2013-2014 school year was excluded from the study due to a lack of exposure to the professional development provided to the rest of the sample throughout that school year. All teachers received ongoing technology training (two hours per month) to the present date. Technology training is provided by in-house teacher-leaders, who have dedicated time in their schedule to plan for and provide professional development.

Survey and observation data collection was conducted during the 2015/2016 school year, however the assessment data was not available until the fall of the 2016-2017 school year.

Validity and Reliability Concerns

The current investigation included data from the entire school district in an effort to eliminate any concerns about selection bias. History could be a threat to validity since teaching professionals at different levels had varied experiences. Circumstances could have changed by the end of the 2014-2015 school year that would change the direction of the 1:1 program. It was possible that people who started in the study were no longer with the district, or in another department or capacity within the district by the end of the study. The survey instruments were reviewed for reliability and these estimates will be reported in Chapter 4.

Researcher bias could be a concern, as the researcher is the superintendent of the district in which the study is taking place. The use of standardized measurement tools, and data collection that were conducted without the direct involvement of the researcher (superintendent) should mitigate any researcher influence. Inter-rater reliability was assessed in an effort to address subjectivity of administrators observing teachers and the implementation of technology in their classrooms. Cronbach's alpha reliability estimates were computed and reported for the Danielson's Framework in Chapter 4.

Proposed Data Analysis

Descriptive statistics were used to analyze the data gathered from the surveys, observations, and interviews. The aggregation of demographic variables such as gender, experience, content area, and building level taught were provided in an effort to establish the representativeness of the sample of participants. SPSS software was used to analyze the data to ensure all statistical assumption tests were tenable. Zero-order correlations and regression type analysis were used to understand the associations between the data sources. Frequency tables and graphs were used to present the results.

Chapter 4

RESULTS

This investigation examined if an association exists between teacher self-efficacy as reported through surveys (TPACK), extent of technology use in the classroom based on principal walkthrough observations (SAMR), teacher evaluation data based on principal evaluation, (Danielson Framework) and student proficient achievement based on Pennsylvania Department of Education mandated Keystone Examinations in Algebra, Biology, and Literature. Data was provided through the following constructs: (a) Teacher self- reported responses on the TPACK survey, (b) the average of two principal observed classroom walkthroughs and reported level of technology use for each teacher observed using the SAMR model, (c) end of year teacher evaluation data submitted by building principals using the Danielson Framework for Effective Teaching Rubric, and (d) the Pennsylvania Department of Education Keystone Assessment results for the 2015-2016 and 2016-2017 school years in Algebra, Biology, and Literature.

The first construct (TPACK) was collected from a slightly modified version of TPACK survey created by Schmidt et al. (2009). The original survey was designed for pre-service teachers. The modifications made the survey specific to current teaching professionals and provided information for the school district's internal purposes. Items such as major and year in college for example were modified to grade level and years of service. Three open response questions were made as optional response items. Participant answers were limited to the following responses: Strongly Disagree, Disagree, Neither Agree or Disagree, Agree, Strongly Agree. Numeric values ranging from 1-5 were assigned to each response:

- Strongly Disagree – 1
- Disagree – 2
- Neither Agree or Disagree – 3
- Agree – 4
- Strongly Agree – 5

The survey was administered online using a Google form. The survey tool is included in Appendix A.

The second construct (SAMR) was collected from a district provided walkthrough evaluation form. The form was populated electronically by six principals as they performed two unannounced walkthrough evaluations of teacher delivered lessons throughout the 2015-2016 school year. Principals were provided training on using the SAMR instrument. Principals recorded observed use of technology during walkthrough observations and assigned a SAMR rating along the defined scale ranging from Substitution to Augmentation to Modification or Redefinition. Numeric values ranging from 0-4 were assigned to each recorded observation:

- No Technology Use – 0
- Substitution – 1
- Augmentation – 2
- Modification – 3

- Redefinition – 4

The observational data was recorded online using a Google form. The average of the two SAMR scores was computed for use in the current investigation. The walkthrough tool is included in Appendix B.

The third construct (Danielson Framework) was gathered by building principals as they administered end of the year evaluations for all professional staff. The Danielson Evaluation Rubric is a requirement of all school districts in the Commonwealth of Pennsylvania. Results for Domains 2 and 3 of the Danielson Rubric were recorded for this investigation as they focus specifically on classroom instruction based on observation data gathered by the building principal during formal classroom observations. The evaluation data was gathered using the Danielson Rubric. The Danielson Framework for Effective Teaching Rubric is included in Appendix C.

The fourth construct (Keystone Results) is provided by the Pennsylvania Department of Education. For the purposes of this investigation, the teacher's average number of students testing proficient was utilized. This data is provided on the state reports for the school district.

Demographics

Complete participant data was available for $n = 47$ teachers, with $n = 16$ males (34%) and $n = 31$ females (66%). Table 1. provides a breakdown of the participants by their building levels.

Table 1.

Gender by Building Level

	BUILDING	
Gender	Middle	High School
MALE	5	11
FEMALE	16	15

As indicated in Table 1, there are *n* = 21 (44.7%) middle school level teachers and *n* = 26 (55.3%) high school level teachers included in the sample of participants. Respondents' years of service as a teacher ranged from one year to more than 20 years. The breakdown of the participants reported years of experience by their building level is provided in Table 2.

Table 2.

Years of Service by Building Level

	BUILDING	
Years	Middle	High School
Less than 5 years	2	3
6 to 10 years	8	4
11 to 20 years	7	14
Greater than 20 years	4	5

Additionally, data indicates that participants' content areas include *n* = 18 (38.3%) in English-Language Arts (ELA), *n* = 12 (25.5%) Mathematics, *n* = 10 (21.3%) Science, and *n* = 7 (14.9%) Social Studies. A breakdown of teacher's content areas by their building level is provided in Table 3.

Table 3.

Content Area by Building Level

	BUILDING	
Content Area	Middle	High School
ELA	12	6
MATH	4	8
SCIENCE	2	8
SOCIAL STUDIES	3	4

Reliability Estimates

A Cronbach's Alpha Test of Internal Consistency was conducted to assess an estimate of the reliability of participant responses to each factor of the TPACK inventory. The results of the analyses are presented in Table 4.

Table 4.

Reliability Estimates for Each TPACK Factor

Factor	Number of Items	α
TK	6	0.912
CK	12	0.846
PK	7	0.865
PCK	3	0.532
TCK	4	0.654
TPK	8	0.624
CK-Math	11	0.738
CK-LA	11	0.904

As indicated in Table 4, the reliability estimates for the different TPACK factors are all within acceptable ranges (α ≥ .50Field, 2013). While the PCK factor reveals the lowest estimate of reliability, this was not surprising since this factor was based on three items. Reliability estimates are influenced by the number of items and the number of scores (participants) providing the data. Since the reliability estimates were within acceptable ranges for each of the factors of the TPACK inventory, the factors scores were computed, by calculating the mean of the responses across all of the items associated with each factor, based on the guidelines of Schmidt, et al. (2009). The means, standard deviation, skewness and kurtosis for each of the factors is provided in Table 5.

Table 5.

Descriptive Statistics for TPACK Factors

	TK	CK	PK	PCK	TCK	TPK
Mean	3.63	3.02	4.51	2.88	3.05	3.81
SD	0.82	1.08	0.43	1.21	1.06	0.56
Skewness	-0.68	-0.32	-0.09	-0.59	-0.80	-0.12
Kurtosis	0.72	-1.30	-1.57	-0.29	-0.57	0.43
Kolmogorov-Smirnov	0.161	0.151	0.233	0.22	0.218	0.109

Based on the descriptive analyses, all the factors scores demonstrate acceptable levels of skewness and kurtosis (|2.0| and |5.0| respectfully) based on guidelines provided by Field

(2013). Kolmogorov-Smirnov was also found to be tenable (Field, 2013). Based on the limited sample size, formal data analysis will be conducted at the $\alpha = .10$ level.

The mean, standard deviation, skewness and kurtosis for the SAMR, and Domain 2 and Domain 3 are provided in Table 6.

Table 6. *Descriptive Statistics for SAMR, Domain 2 and 3 of Danielson*

	SAMR	Domain 2	Domain 3
Mean	1.053	2.000	2.110
Std. Deviation	1.243	0.000	0.315
Skewness	0.644	0.000	2.686
Kurtosis	0.681	0.858	0.858

As indicated in Table 6., there was no variability in the evaluations of teacher participants on Domain 2 (Classroom Environment). Additionally, the variability with the Domain 3 is limited. As such, Domain 2 variable will not provide meaningful information for additional analyses.

Research Question #1

Research question #1 asked "What are educators' reported efficacy, knowledge, and perspectives about technology integration, as measured by the TPACK? As indicated in Table 5, educators reported levels of technology efficacy, knowledge, and perspectives that ranged, on average, from 2.88 (for PCK) to 4.51 (PK). These responses indicate that participants are at or above an average level (average being 3.0 for PCK and PK) of endorsing these items across all factors with the exception of the PCK factor. Interesting, the PCK factor also reveals the highest standard deviation, indicating that there was a wider range of responses to the PCK items, relative to items associated with other factors (Table 5). A one-sample *t* test was conducted in order to examine if these average factor scores differed significantly from the average score. The results of this analyses is presented in Table 7.

Table 7.

TPACK Factor Scores Against Average (3.0)

Factor	t	df	Sig. (2-tailed)	Lower	Upper
TK	5.284	46	.001*	0.393	0.877
CK	0.112	46	.911	-0.299	0.335
PK	24.218	46	.001*	1.389	1.641
PCK	-0.68	46	.500	-0.477	0.236
TCK	0.309	46	.759	-0.264	0.360
TPK	9.899	46	.001*	0.641	0.969
TPACK	5.093	46	.001*	0.291	0.672

Note: * indicates significant at the $\alpha = .10$ level

As indicated above, the participants average factors scores were found to be significantly higher than average (3.0) for the TK, PK, TPK, and TPACK factors.

Research Question #2

Research question #2 asks "What is the association between the teachers' responses, as indicated on the TPACK, and their SAMR score?

A Pearson's Zero-Order Correlation was conducted to assess this association between the SAMR observation scores and each of the factors of TPACK, based on the scores constructed (see above). These results are provided in Table 8.

Table 8.

Correlations Between SAMR and TPACK Scores

	TK	CK	PK	PCK	TCK	TPK	TPACK
SAMR	0.283*	0.123	0.094	0.076	0.068	0.248*	.143

Note: * indicates significant at the α = .10 level

Based on these correlations, only TK and TPK show noteworthy associations with the observed SAMR scores, at an α = .10 level. While the correlations are small to moderate (Field, 2013) there is a lack of power to provide significance at the .05 level. Data was further examined by CORE area. These results are presented in Table 9.

Table 9.

SAMR frequency by CORE area

CORE	0	S	A	M	R
ELA	23.00	7.00	0.00	4.00	1.00
MATH	14.00	3.00	0.00	7.00	0.00
SCIENCE	6.00	2.00	0.00	12.00	0.00
SOCIAL STUDIES	8.00	2.00	0.00	4.00	0.00

As indicated above, these frequencies indicate that during walkthroughs, either very little technology integration was observed, or Modification level of integration was recorded. As indicated in Figure 1., greatest integration was observed in the science classes.

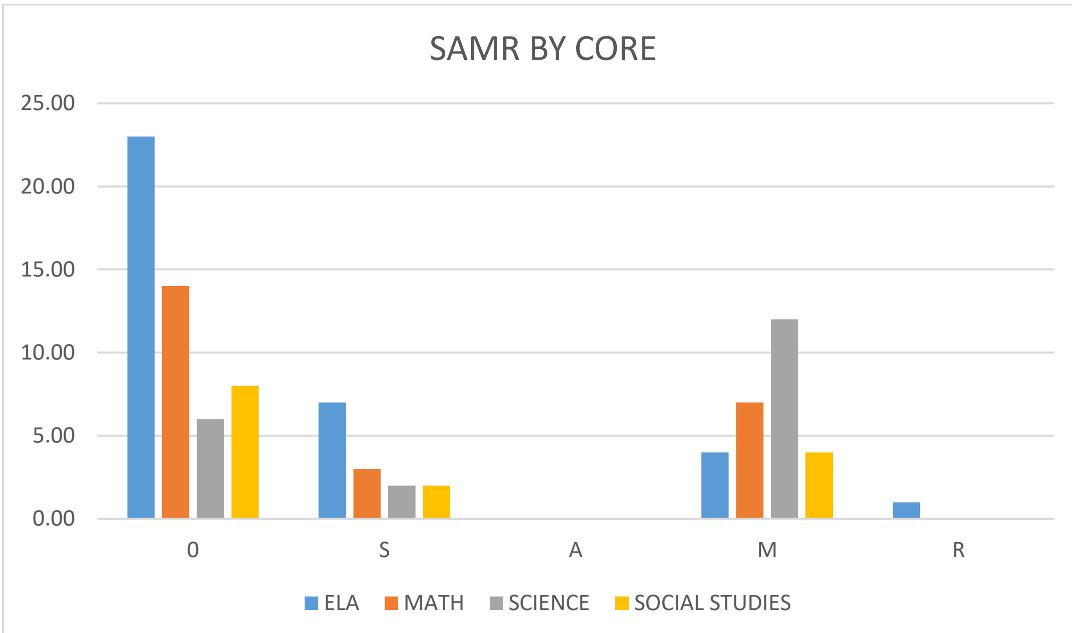

Figure 1. SAMR by CORE

Additional analysis looked at the content areas TPACK scores to understand these associations more thoroughly. These results are provided in Table 10.

Table 10.

Content Area Specific TPACK Scores

Content Area	TK	CK	PK	PCK	TCK	TPK	TPACK
ELA	3.667	3.065	4.644	2.963	3.264	3.676	3.618
MATH	3.500	2.375	4.500	2.194	1.833	3.944	2.802
SCIENCE	3.750	3.808	4.380	3.900	3.875	4.067	3.963
SOCIAL STU	3.619	2.869	4.400	2.381	3.393	3.524	3.607

As indicated above, PK revealed the strongest endorsement of their abilities across the different factors overall, specifically for ELA. Science teachers' endorsement of the PK and the TPK factors both exceeded 4.0. The lowest endorsement was found for Math, on the TCK factor. This is graphically illustrated in Figure 2.

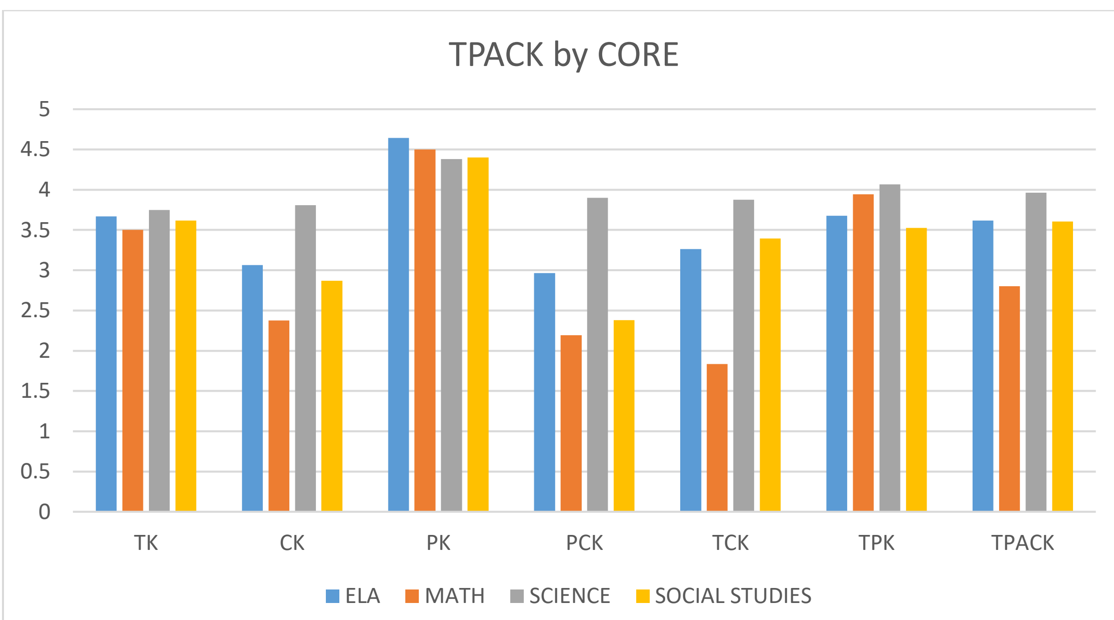

Figure 2. TPACK BY CORE

Research Question #3

Research question #3 asked “What is the association between the teachers’ responses, as indicated in the TPACK, and their classroom observation measures on the Danielson domains? To answer this question, zero-order correlations were conducted, and are presented in Table 11.

Table 11.

Domain 3 and TPACK Responses

	TK	CK	PK	PCK	TCK	TPK	TPACK
Domain 3	0.064	-0.146	0.034	-0.131	-0.194	-0.178	-0.167

As indicated in Table 11, no statistically or practically significant associations were found between the TPACK measures and the Danielson’s Domain 3.

Research Question #4

Research question # 4 asks “Is there an association across the Danielson Framework, the SAMR model, and the factors measured by the TPACK?” A zero-order correlation between SAMR and Domain 3 indicates a correlation of $r = -.194$, a small negative non-significant correlation. As indicated above the correlation between Domain 3 and the TPACK are non-significant and small; the correlation between SAMR and TPACK were only noteworthy for the TK and TPK (see Table 8.)

Research Question #5

Research question #5 asks "Is there an association between TPACK, SAMR, and/or Danielson Domain 3, and student achievement as measured by teacher's Keystone proficiency averages for their classes?" Due to the lack of variability in Domain 3 scores, associations were not computed. The results indicate there is little to no association between the variables, based on the available Keystone data. This occurred because for the teachers with Keystone data, all Domain 3 data was the same (2). The results for the relationship between the Keystone average proficiency and the TPACK responses are presented in Table 12.

Table 12.

Correlation of Keystone Data, SAMR, and TPACK Factors

Test Year	1516	1617
SAMR	-0.283	-0.199
TK	0.186	-0.377
CK	0.054	-0.01
PK	0.209	0.119
PCK	-0.120	-0.062
TCK	0.050	0.111
TPK	0.451	-0.149
TPACK	-0.284	-0.23

As indicated above, none of the relationships were found to be statistically significant. Although the TPK for 15/16 is a positive moderate relationship. A more meaningful analysis is the overall average of proficient performing students, as first-time test takers, from 2013/14 through 2016/17, across the district. These results are presented in Table 13.

Table 13.

Percentage of Proficient Performing Students

	2013-14	2014-15	2015-16	2016-17
Algebra	34.00%	53.00%	67.00%	60.00%
Biology	27.00%	55.00%	72.00%	64.00%
Literature	24.00%	67.00%	71.00%	70.00%

As indicated above, teachers received iPads at the end of 2013-2014, and students received iPads during 2014-2015. The change in the percent proficient has increased substantially beginning with the 2014-2015 end of school year assessments. These outcomes are also illustrated in Figure 3.

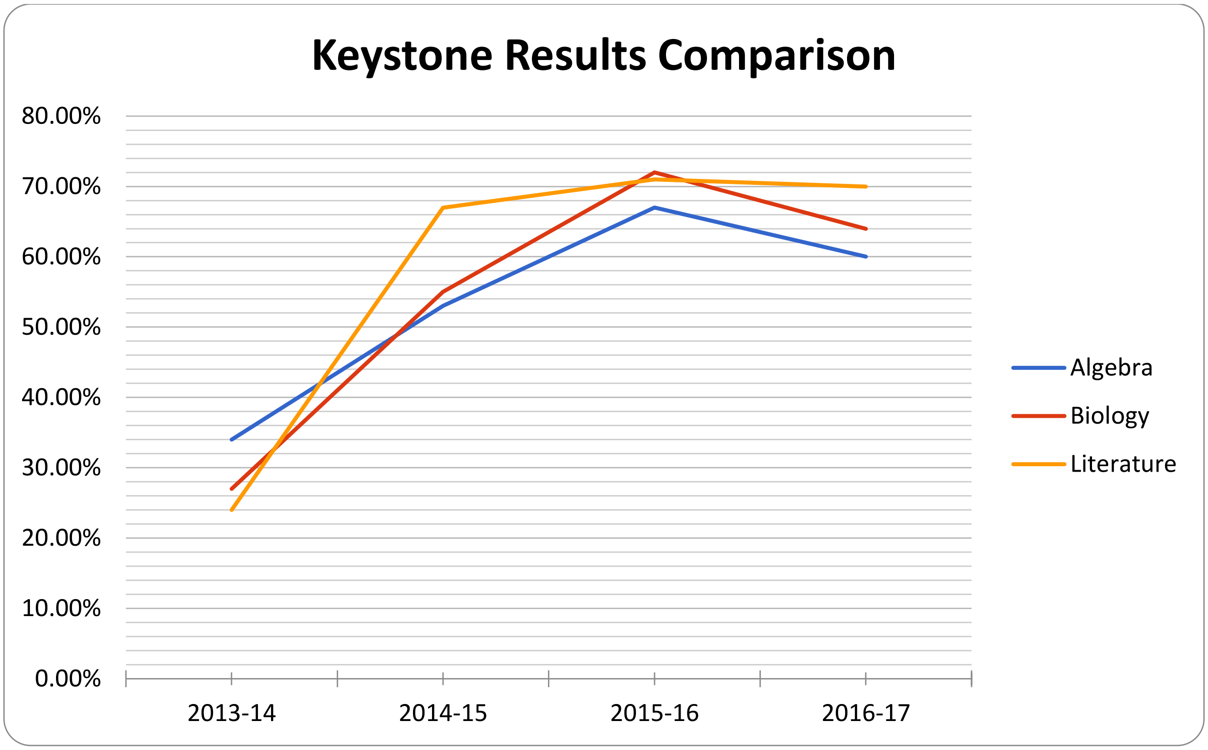

Figure 3. *Keystone Results*

Summary

The results of analysis conducted to answer five research questions as presented in Chapter 4, include:

1. What are educators' reported efficacy, knowledge, and perspectives about technology integration, as measured by the TPACK?
2. What is the association between the teachers' responses, as indicated on the TPACK, and their SAMR score?
3. What is the association between the teachers' responses, as indicated in the TPACK, and their classroom observation measures on the Danielson domains?
4. Is there an association across the Danielson domains, the SAMR model, and the factors measured by the TPACK?

5. Is there an association between TPACK, SAMR, and/or Danielson Domain 3 and student achievement as measured by teachers' Keystone proficiency averages?

Results indicate that on most areas of the TPACK, teachers are providing at or above average endorsements across the different factors of the TPACK. Three areas, TK, PK, and TPK, teachers' responses were statistically higher than an average expected endorsement of 3.0. Teachers' TPACK responses were found to be significantly associated to their SAMR for the TK and TPK factors. Examination of these responses from teachers in the core of Science was consistently the highest area of endorsement across most factors of the TPACK, followed by ELA, followed by Math, followed by Social Studies (as indicated in Figure 2.) The association of the TPACK scores to the Danielson Domain 2 and Domain 3 presented some challenges as there was no variability in the Domain 2 scores and little variability in the Domain 3 scores. This lack of variability made it difficult to draw any information from these scores. There were no significant correlations found between the SAMR, TPACK and Keystone average proficiency rates, however, a moderate relationship was revealed for the TPK factors and the 2015/2016 Keystone data.

Chapter 5

DISCUSSION AND CONCLUSION

Public education has come under a tremendous amount of scrutiny in recent years to provide equity in education for the masses. Districts are being held accountable for the academic achievement of all students regardless of gender, race, ethnicity, socioeconomic background, learning disability, et cetera. Unfunded mandates such as No Child Left Behind (NCLB 2001) and the latest reauthorization of the Elementary and Secondary Education Act (ESEA 1965 as cited by ESSA, 2017), the Every Student Succeeds Act (ESSA 2015 as cited by ESSA 2017), have required schools to address the achievement gap that exists amongst the historically underperforming subgroups of students mentioned previously.

Many districts have turned to technology in an attempt to close the achievement gap. Technology has become more available to schools in recent years. Modern technology has also evolved and improved since its earliest introduction to education. In addition, technology has become a staple in our society whether in education, the workforce, or everyday life. Twenty years ago Cody, Crandler, & Engel (1997) predicted that technology would continue to expand in education not only related to pedagogy but as a requirement of society in general. Twenty years later, Fullan and Langworthy (2014) recognize a technology revolution in schools to be used as an avenue to transform pedagogy and learning while creating a fundamental change in education. “Our schools and our pedagogies need to inspire and to ensure that all students are capable of independent learning and purposeful action in the world, and have not only the foundation, but also the practical experiences and technical skills to create valuable futures for themselves and their societies" (Fullan & Langworthy, 2014, p 78).

As was highlighted throughout Chapter 2, there is no concrete evidence that technology on its own can or will improve student achievement. "Where technology is used, research findings on its impact on learner outcomes are disappointing" (Fullan & Langworthy, 2014, p. 1). Numerous studies suggest that there are too many variables that can effect student achievement to draw any direct correlation to technology. Tamim et al., (2011) suggest that the various types of hardware, software, delivery systems, et cetera, make it difficult to identify a causal relationship between technology and student achievement as well. Other studies to include a Reichstetter (2002) study, recognize the educator and their professional training as variables for consideration when trying to measure student achievement outcomes.

With all of the attention given to student achievement and the significant investment districts are making toward technology as a means to close the achievement gap this study focused on the teacher as a variable to the implementation of technology in the classroom. Can we make any connection between the teacher and technology and student achievement?

The current investigation focused on self-efficacy, professional development, and observed practices as they relate to technology integration and any possible correlation to student outcomes on Pennsylvania mandated state Keystone Exams. TPACK surveys, SAMR observations, and teacher evaluation data were used to see if a connection might be made. The following is a summary of those results.

QUESTION 1

What are educators' reported efficacy, knowledge, and beliefs about technology integration, as measured by the TPACK?

Results indicate that on most factors of the TPACK, teachers are providing at or above average endorsements. Teacher responses to the TK, PK, and TPK factors were statistically higher than an average expected endorsement of 3.0.

Studies presented in Chapter 2 indicated that many teachers feel unprepared to integrate technology in the classroom. Beyerbach et al., (2001) cite that teachers, pre-service teachers in this case, are exposed to technology but not to a level of mastery which may limit their perceived abilities to implement across their content areas. Young (2012) offers that TPACK suggests that pre-service teachers have a foundation in technology that would allow skills to be built upon to strengthen instructional delivery.

Exposure to technology is one factor that may influence TPACK survey responses. Sangra and Gonzalez-Sanmamed (2011) cite professional development as a key factor for in-service teachers' integration of informational technologies in the classroom. According to Hew & Brush (2006), professional development opportunities for teachers need to expand beyond the operating systems themselves to transformational application of the technology.

The TPACK framework can be used as tool by districts to measure not only self-perceived technology knowledge but as a self-measure of content and pedagogical knowledge that can be used to determine individual needs of faculty members in an organization. That information can then be used to create more exposure and provide appropriate and meaningful professional develop opportunities to enhance teacher TPCK to increase transformational teaching in the classroom enhanced by the use of technology.

In the current investigation, the data revealed that the teacher reported TPACK scores are above average in the areas that include technology. This trend is contrary to the literature suggesting that teachers are unprepared to deliver technology in their classrooms. One would have to take a closer look at this specific district to draw some assumptions as to why the staff feels comfortable with technology.

Each member of the teaching staff received a MAC laptop and Apple iPad one full year before students in the school were provided electronic devices. In addition, each member of the teaching staff receives technology training during district mandated professional development days five times a year. In addition, a minimum of two workshops are offered to staff over the summer months. Finally, each teacher is provided technology training, by their respective departments, a minimum of two hours every month. This training is embedded into their normal work day, and amounts to approximately 18 hours of technology training during the school year above and beyond the typical district provided professional development days and summer workshops. Therefore, the responses to the TPACK inventory likely reflect the large time and financial commitment made by the participating school district to technology integration professional development.

QUESTION 2

What is the association between the teachers' responses on the TPACK and their SAMR score?

Based on these correlations, only TK and TPK show noteworthy associations with the observed SAMR scores. Math and science teachers show the largest frequency of higher level technology use as indicated on the SAMR scale. It is possible that math and science lend themselves to higher level integration based on content related to those two core content areas. Math and science may traditionally lend themselves to a more hands on inquiry based approach.

The SAMR Model was used as an observational tool to determine the extent at which technology was actually being used in the classroom and to what extent by the instructor and the students during an informal unannounced walkthrough observation. Puentedura (2012) suggests that it can take up to three years after exposure to technology before instruction moves from basic implementation to something that is considered more transformational.

Once again a closer look at the district in this study may provide help in providing assumptions related to SAMR observed technology delivery in the classroom. The amount of ongoing professional development provided throughout the year was highlighted in the previous section. In addition, this district undertook a digital curriculum journey in each of three core content areas (math, science, ELA) prior to this study. Specifically, starting with ELA then followed by math, and science respectively, teachers were assigned one planning period a day for the sole purpose of reviewing standards, vetting open educational resources, and developing digital textbooks tied to the National/PA Common Core State

Standards. One year was set aside for the creation of the digital content followed by delivery in the classroom with the students the following year. Approximately 120-180 hours per year were spent by teachers studying content standards and content resources. One might conclude that curriculum work could be tied to content knowledge and that content knowledge might indeed make the teaching staff better practitioners. Add to that concept that the work is being created with the devices that they are expected to use with the students should increase the likelihood that the technology would be used on a day to day basis in the classroom.

QUESTION 3

What is the association between the teachers' responses on the TPACK and their classroom observation measures on the Danielson domains?

As indicated in Table 11, no associations were found between the TPACK measures and the Danielson's Domain 3 (Instruction). This is likely due to the low variability in the Domain 3 scores.

Charlotte Danielson's Framework for Teaching is a standards-based evaluation model that was used by all building administrators as a formal evaluation tool for all teaching professionals (Danielson, 2011). This mandated evaluation tool was adopted by the Pennsylvania Department of Education. For the purposes of this study data was collected from Domains 2 and 3. Domains 2 and 3 allow the observer to gather non-subjective evidence-based practice of instructional delivery during a formal lesson.

These observations allow principals to measure instructional practices of which the use of instructional technology is embedded within the domains.

Results indicate that there is little to no variability of scores assessed by the observers. Virtually all of the teachers observed received a score of proficient (2) on their final observation from the building principal. The lack of variability raises serious question about the validity and reliability of the tool to provide a non-subjective evidence based evaluation of observed instructional delivery practices in the classroom during the formal observation.

There appears to be an issue with how the current evaluation tool is being used by principals in this district. One might question how every teacher observed can be rated not only the same with regard to competency but all proficient as well. One would think that some teachers would be stronger than others and that on any given day not all teachers would perform the same.

QUESTION 4

Is there an association across the Danielson domains, the SAMR model, and the factors measured by the TPACK?

Once gain the lack of variability across Domain 3 of the Danielson Model make any attempt at showing a correlation as non-significant. The lack of variability in responses made it difficult to draw any conclusions. One would not expect all observations to yield the same results. Just as there is variability in the TPACK responses and the SAMR observed practices, similar variability would be expected in their reporting. It appears that more training may be needed in the area of principal observation. The educational leaders in the district should be tasked with recognizing good instructional practice.

QUESTION 5

Is there an association between TPACK, SAMR, and/or Danielson Domain 3 and student achievement as measured by teachers' Keystone proficiency average?

There were no significant correlations found between the SAMR, TPACK and Keystone average proficiency rates, however, a moderate relationship was revealed for the TPK factors and the 2015/2016 Keystone data. As indicated above this falls in line with previous studies on the impact of technology on student achievement (e.g., Lim, Zhao, Tondeur, Chai, & Tsai 2013; Williams 2014). The moderate relationship between TPK factors and 2015/2016 Keystone data could be related to the professional development and curriculum work discussed throughout this paper.

There are non-significant results with regard to increased student achievement and the TPACK and SAMR measures. While the 2015-2016 data shows a positive moderate relationship with the TPK (.451) that might be attributed to a significant amount of professional development and curriculum work around the 1:1 technology initiative and the creation of district created digital textbooks using open educational resources. This would fall in line with the literature presented throughout this study on technology use and its impact on student achievement. And, as indicated in Figure 4., the Roadmap for professional development and digital content development used by the school district is a reflective model.

Digital Content and Professional Development Roadmap

		2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
9-12	ELA	Acquisition and Initial PD	Content Development Mid-Day (Daily)	Digital Content Year 1	PD Academic Study Hall	PD Academic Study Hall	Content Revisit Mid-Day	PD Academic Study Hall	PD Academic Study Hall	PD Academic Study Hall	Content Revisit Mid-Day
9-12	Math	Acquisition and Initial PD	PD Academic Study Hall	Content Development Mid-Day (Daily)	Digital Content Year 1	PD Academic Study Hall	PD Academic Study Hall	Content Revisit Mid-Day	PD Academic Study Hall	PD Academic Study Hall	PD Academic Study Hall
9-12	Science	Acquisition and Initial PD	PD Academic Study Hall	PD Academic Study Hall	Content Development Mid-Day (Daily)	Digital Content Year 1	PD Academic Study Hall	PD Academic Study Hall	Content Revisit Mid-Day	PD Academic Study Hall	PD Academic Study Hall
9-12	Social Studies	Acquisition and Initial PD	PD Academic Study Hall	PD Academic Study Hall	PD Academic Study Hall	Content Development Mid-Day (Daily)	Digital Content Year 1	PD Academic Study Hall	PD Academic Study Hall	Content Revisit Mid-Day	PD Academic Study Hall
9-12	Business-Technology	Acquisition and Initial PD	PD Academic Study Hall	PD Academic Study Hall	PD Academic Study Hall	PD Academic Study Hall	Content Development Pull-Out (Monthly)	Digital Content Year 1	PD Academic Study Hall	PD Academic Study Hall	PD Academic Study Hall
9-12	World Language	Acquisition and Initial PD	PD Academic Study Hall	PD Academic Study Hall	PD Academic Study Hall	PD Academic Study Hall	PD Academic Study Hall	Content Development Pull-Out (Monthly)	Digital Content Year 1	PD Academic Study Hall	PD Academic Study Hall
9-12	Specials	Acquisition and Initial PD	PD Academic Study Hall	PD Academic Study Hall	PD Academic Study Hall	PD Academic Study Hall	PD Academic Study Hall	Content Development Pull-Out (Monthly)	Digital Content Year 1	PD Academic Study Hall	PD Academic Study Hall
6-8	ELA	Acquisition and Initial PD	Content Development Thursdays (Weekly)	Digital Content Year 1	PD Warrior Wednesdays	Content Revisit Pull-Out (Quarterly)	Content Revisit Pull-Out (Quarterly)	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays
6-8	Math	Acquisition and Initial PD	PD Warrior Wednesdays	Content Development Thursdays (Weekly)	Digital Content Year 1	Content Revisit Pull-Out (Quarterly)	Content Redevelopment Pull-Out (Bimonthly)	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays
6-8	Science (Includes 5)	Acquisition and Initial PD	PD Warrior Wednesdays	PD Warrior Wednesdays	Content Development Pull-Out (Bimonthly)	Digital Content Year 1	Content Revisit Pull-Out (Quarterly)	Content Revisit Pull-Out (Quarterly)	Content Revisit Pull-Out (Quarterly)	PD Warrior Wednesdays	PD Warrior Wednesdays
6-8	Social Studies	Acquisition and Initial PD	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays	Content Development Pull-Out (Bimonthly)	Digital Content Year 1	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays
6-8	Business-Technology	Acquisition and Initial PD	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays	Content Development Pull-Out (Monthly)	Digital Content Year 1	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays
6-8	World Language	Acquisition and Initial PD	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays	Content Development Pull-Out (Monthly)	Digital Content Year 1	PD Warrior Wednesdays	PD Warrior Wednesdays
6-8	Specials	Acquisition and Initial PD	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays	PD Warrior Wednesdays	Content Development Pull-Out (Monthly)	Digital Content Year 1	PD Warrior Wednesdays	PD Warrior Wednesdays
3-5	ELA	Acquisition and Initial PD	PD Morning Time	PD Morning Time	PD Morning Time	Content Alignment Pull-Out (Bimonthly)	Content Alignment Pull-Out (Quarterly)	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time
3-5	Math	Acquisition and Initial PD	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time	Content Alignment Pull-Out (Bimonthly)	Content Alignment Pull-Out (Quarterly)	PD Morning Time	PD Morning Time	PD Morning Time
3-5	Science	Acquisition and Initial PD	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time
3-5	Social Studies	Acquisition and Initial PD	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time
3-5	Business-Technology	Acquisition and Initial PD	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time	Content Development Pull-Out (Monthly)	Digital Content Year 1	PD Morning Time	PD Morning Time	PD Morning Time
3-5	Specials	Acquisition and Initial PD	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time	PD Morning Time	Content Development Pull-Out (Monthly)	Digital Content Year 1	PD Morning Time	PD Morning Time

Figure 4. District PD Roadmap

It should be noted that in addition to the professional development and digital content creation indicated above, Biology and Algebra were developed with ELA during 2014/2015 school year.

This professional development and digital content development is potentially responsible for the results presented in Table 13. From 2013-14 through 2016-17, which coincides with the implementation of the 1:1 initiative and the professional development activities associated with the initiative, student achievement on a whole has increased substantially.

The studied district appears committed to ongoing professional development (in house) in curriculum, instruction, and technology as evidenced by the curriculum work associated with the 1:1 initiative related to the creation of digital content and standards based digital textbooks. One might posit that the student academic performance growth is directly correlated to the time and resources dedicated to making the teachers better practitioners. Curriculum work strengthens content knowledge. Pedagogy is enhanced through the time spent receiving professional development on instructional practices related to curriculum and delivery through technology devices. Finally, the technology expertise allows the teaching staff to provide transformational learning to their students, allowing them to master 21st century learning skills that engages them in their current coursework and as demonstrated on Keystone examinations by first time test takers.

Limitations

There are potential limitations to this study. The lack of variability with regard to formal observation results within Domains 2 and 3 of the Danielson Model raise question as to the validly and reliability of those scores. While each of the observers received training through the local intermediate unit and within the district on how to implement the observational practice it is possible that there is potential bias within the group observing. Having multiple principals observe and rate each teacher in those areas could help strengthen the inter-rater reliability. It appears that the lack of variability on observational data could be a systemic problem. Statewide observational data could provide insight whether the local assessors' numbers correlate with other principals across the state.

Sample size could be a limitation when trying to determine correlation between TPACK, SAMR, and student achievement. The sample size shrinks significantly when narrowed down to the participants who took the survey, were observed formally and informally, and taught a Keystone tested course. The lack of sample data impacts the power of the analysis to find significant results. In the future PSSA data could be added to the study which would increase the sample size significantly.

Finally, each participant in the study was observed informally twice using the SAMR Model. An increase in the number of informal observations would increase the sample size and potentially strengthen the data. As with the Danielson Model recommendation, multiple principals could provide the informal walkthroughs for each individual teacher in order to lessen the likelihood of bias and improve upon inter-rater reliability.

Future Research

TPACK results indicate that teachers self-reported efficacy numbers are at or above average across all areas surveyed, with technology knowledge (TK), pedagogical knowledge (PK), and technological pedagogical knowledge (TPK) average factor scores significantly higher than the average (3.0). This might indicate that professional development activities provided to the participants have them trained to overcome some of the historical barriers to integration of technology in the classroom. A closer review of the specific professional development activities and surveys related to those factors may allow districts to focus on those specific activities and future research could identify whether those specific activities if continued could increase future TPACK scores. Additionally, the SAMR results indicate a noteworthy association between the (TK) and (TPK) and observed technology use in the classroom during informal observations. Once again, specific focus on professional development activities related to those factors moving forward increase likelihood of not only technology use but higher lever use on the SAMR scale. Additionally, science teachers showed the highest frequency of potentially transformational technology use (modification and redefinition) during SAMR walkthroughs who also revealed the strongest endorsement of the (PK) and (TPK) factors both exceeding (4.0). A study focusing on science teachers only may allow for a more in depth look at technology professional development for science teachers related to TPACK, SAMR, and student achievement on the Keystone and PSSA exams for science K-12.

There has definitely been an impact on student achievement in this district since the inception of the 1:1 initiative which is evidenced by the Keystone result, not necessarily tied to any specific variable in this study. There may be some blueprint here that is directly related to the types and frequency of professional development offered to the teaching staff and/or the curriculum work tied to the National/PA Common Core Standards being driven through the use of technology devices. Future studies could focus on this professional development model and future achievement results to determine if the gains recorded are sustainable in future years.

Lastly, this study may open the door for a closer examination of the state mandated teacher evaluation system. The teacher evaluation system in theory was supposed to identify struggling teachers. The lack of variability reported by principal observers raises serious questions as to the effectiveness of this evaluation system. An examination of the variability in teacher evaluations across the state would provide insight on whether this problem is systemic or specific to the district studied in the current investigation.

Conclusions

This study focused on self-efficacy, professional development, and observed practices as they relate to technology integration and any possible correlation to student outcomes on Pennsylvania mandated state Keystone Exams. While the results indicate that there is no correlation tying all of those variables together, there are some findings worth a closer look. Teachers in this study indicated a level of comfortability with regard to technology. The district has dedicated time and resources related to technology training for staff since the beginning of their 1:1 initiative which may be having a positive impact on teacher perception about the use of technology in their classrooms. SAMR observations confirm that teachers are indeed implementing technology in their classrooms. In many some cases toward the upper end of the SAMR scale beyond simple substitution toward modification and redefinition. While this correlation cannot be tied directly to student achievement, the district has seen an increase in achievement scores dating back to the start of the 1:1 initiative. This district's blue print for technology integration and how well it is prepared to sustain and improve upon the current levels of academic achievement has been established on a foundation of commitment on the part of the leadership, strategic and ongoing professional development, and a tremendous investment in each students' future.

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Appendix A

Technology, Content and Pedagogy Survey

Thank you for taking time to complete this questionnaire. Please answer each question to the best of your knowledge. Your thoughtfulness and candid responses will be greatly appreciated.

Your email address (**eeimiller@centralvalleysd.net**) will be recorded when you submit this form. Not **eeimiller**? Sign out

* Required

1. **2. Years of Service** *

Mark only one oval.

- ( ) Less Than 5 Years
- ( ) 6 to 10 Years
- ( ) 11 to 20 Years
- ( ) Greater Than 20 Years

2. **3. Area of Specialization** *

Mark only one oval.

- ( ) Secondary Mathematics
- ( ) Secondary Social Studies
- ( ) Secondary Science
- ( ) Secondary Literacy
- ( ) Elementary/Primary

3. **4. TK (Technology Knowledge)** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
I know how to solve my own technical problems.	( )	( )	( )	( )	( )
I can learn technology easily.	( )	( )	( )	( )	( )
I keep up with important new technologies.	( )	( )	( )	( )	( )
I frequently play around with technology.	( )	( )	( )	( )	( )
I have the technical skills I need to use technology.	( )	( )	( )	( )	( )
I have had sufficient opportunities to work with different technologies.	( )	( )	( )	( )	( )

Appendix A

4. **5.1 - CK (Content Knowledge) - Math** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	Not Applicable
I have sufficient knowledge about mathematics.	⬭	⬭	⬭	⬭	⬭	⬭
I can use a mathematical way of thinking.	⬭	⬭	⬭	⬭	⬭	⬭
I have various ways and strategies of developing my understanding of mathematics.	⬭	⬭	⬭	⬭	⬭	⬭

5. **5.2 - CK (Content Knowledge) - Social Studies** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	Not Applicable
I have sufficient knowledge about social studies.	⬭	⬭	⬭	⬭	⬭	⬭
I can use a historical way of thinking.	⬭	⬭	⬭	⬭	⬭	⬭
I have various ways and strategies of developing my understanding of social studies.	⬭	⬭	⬭	⬭	⬭	⬭

6. **5.3 - CK (Content Knowledge) - Science** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	Not Applicable
I have sufficient knowledge about science.	⬭	⬭	⬭	⬭	⬭	⬭
I can use a scientific way of thinking.	⬭	⬭	⬭	⬭	⬭	⬭
I have various ways and strategies of developing my understanding of science.	⬭	⬭	⬭	⬭	⬭	⬭

Appendix A

7. **5.4 - CK (Content Knowledge) - Literacy** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	Not Applicable
I have sufficient knowledge about literacy.						
I can use a literary way of thinking.						
I have various ways and strategies of developing my understanding of literacy.						

8. **6 - PK (Pedagogical Knowledge)** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
I know how to assess student performance in the classroom.					
I can adapt my teaching based-upon what students currently understand or do not understand.					
I can adapt my teaching style to different learners.					
I can assess student learning in multiple ways.					
I can use a wide range of teaching approaches in a classroom setting (collaborative learning, direct instruction, inquiry learning, problem/project based learning, etc.).					
I am familiar with common student understandings and misconceptions.					
I know how to organize and maintain classroom management.					

Appendix A

9. **7 - PCK (Pedagogical Content Knowledge)** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	Not Applicable
I know how to select effective teaching approaches to guide student thinking and learning in mathematics.						
I know how to select effective teaching approaches to guide student thinking and learning in social studies.						
I know how to select effective teaching approaches to guide student thinking and learning in science.						
I know how to select effective teaching approaches to guide student thinking and learning in literacy.						

10. **8 - TCK (Technological Content Knowledge)** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	Not Applicable
I know about technologies that I can use for understanding and doing mathematics.						
I know about technologies that I can use for understanding and doing social studies.						
I know about technologies that I can use for understanding and doing science.						
I know about technologies that I can use for understanding and doing literacy.						

Appendix A

11. **9 - TPK (Technological Pedagogical Knowledge)** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
I can choose technologies that enhance the teaching approaches for a lesson.	⬭	⬭	⬭	⬭	⬭
I can choose technologies that enhance students' learning for a lesson.	⬭	⬭	⬭	⬭	⬭
District provided professional development has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.	⬭	⬭	⬭	⬭	⬭
My building principal(s) has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.	⬭	⬭	⬭	⬭	⬭
I am thinking critically about how to use technology in my classroom.	⬭	⬭	⬭	⬭	⬭
I can adapt the use of the technologies that I am learning about to different teaching activites.	⬭	⬭	⬭	⬭	⬭

12. **10.1 - TPACK (Technological, Pedagogical and Content Knowledge)** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	Not Applicable
I can teach lessons that appropriately combine mathematics, technologies and teaching approaches.	⬭	⬭	⬭	⬭	⬭	⬭
I can teach lessons that appropriately combine social studies, technologies and teaching approaches.	⬭	⬭	⬭	⬭	⬭	⬭
I can teach lessons that appropriately combine science, technologies and teaching approaches.	⬭	⬭	⬭	⬭	⬭	⬭
I can teach lessons that appropriately combine literacy, technologies and teaching approaches.	⬭	⬭	⬭	⬭	⬭	⬭

Appendix A

13. **10.2 - TPACK (Technological, Pedagogical and Content Knowledge)** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.	⬭	⬭	⬭	⬭	⬭
I can use strategies that combine content, technologies and teaching approaches that I learned about in my district provided professional development.	⬭	⬭	⬭	⬭	⬭
I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my school and/or district.	⬭	⬭	⬭	⬭	⬭
I can choose technologies that enhance the content for a lesson.	⬭	⬭	⬭	⬭	⬭

14. **11.1 - Models of TPACK (Technological, Pedagogical and Content Knowledge)** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
My district provided professional development trainers appropriately model combining content, technologies and teaching approaches in their trainings.	⬭	⬭	⬭	⬭	⬭
My building principal(s) professional development trainers appropriately model combining content, technologies and teaching approaches after walkthroughs or formal observations.	⬭	⬭	⬭	⬭	⬭

Appendix A

15. **11.2 - Models of TPACK (Technological, Pedagogical and Content Knowledge)** *

Mark only one oval per row.

	25% or Less	26% - 50%	51% - 75%	76% - 100%	Strongly Agree
In general, approximately what percentage of your district provided trainers have provided an effective model of combining content, technologies and teach approaches in their teaching?	◯	◯	◯	◯	◯
In general, approximately what percentage of your district school administrators have suggested effective model of combining content, technologies and teaching approaches in your teaching?	◯	◯	◯	◯	◯

16. **12.1 - (Optional) Describe a specific episode where a district provided professional development trainer effectively demonstrated or modeled combining content, technologies and teaching approaches in a classroom lesson. Please include in your description what content was being taught, what technology was used, and what teaching approach(es) was implemented.**

This question is optional.

17. **12.2 - (Optional) Describe a specific episode where your building principal(s) effectively suggested examples combining content, technologies and teaching approaches in a classroom lesson. Please include your description what content was taught, what technology was used and what teaching approaches.**

This question is optional.

Appendix A

7/6/2017 Technology, Content and Pedagogy Survey

18. **12.3 - (Optional) Describe a specific episode where you effectively demonstrated or modeled combining content, technologies and teaching approaches in a classroom lesson. Please include in your description what content you taught, what technology you used, and what teaching approach(es) you implemented. If you have not had the opportunity to teach a lesson, please indicate that you have not.**

This question is optional.

Send me a copy of my responses.

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https://docs.google.com/a/centralvalleysd.net/forms/d/1mWxAz5_OIBk8VSWgyZSEX8vj_HKf8SGSzQE_itJFn0I/edit 8/8

Appendix B

Central Valley School District Informal Walk-Through Observation Tool

Your username (**nperry@centralvalleysd.net**) will be recorded when you submit this form. Not **nperry**? Sign out

* Required

Informal Walk-Through Observation Tool

CENTRAL VALLEY
SCHOOL DISTRICT

Observer

Observer First Name *

Observer Last Name *

Observer Email Address *

Teacher and Class

Teacher First Name *

Teacher Last Name *

Teacher Email Address *

Appendix B

Date *

mm/dd/yyyy

Building *

Grade

Content Area *

Period/Time

Observation

2a.Creating a Climate of Respect and Rapport *

Positive & Friendly Interactions, Warmth & Caring, Politeness, Encouragement

2b. Creating a Culture for Learning *

Expectations, Quality of Work, Effort & Persistence, Belief in the value of work

2c.Managing Classroom Procedures *

Smooth functioning of all routines, Students carryout routines, little or No loss of instruction time

2d. Managing Student Behavior *

Clear standards of conduct, Awareness of student conduct, Fairness, Absence of Misbehavior, Reinforcement of Positive Behavior

2e. Organizing of Physical Space *

Pleasant, inviting, safe environment, Accessibility for all, Arrangement & use of resources

3a. Communicating with Students *

Clarity of Lesson purpose, Clear Directions & Procedures, Absence of Content Errors, Students

Appendix B

understand content

[▾]

3b. Using Questioning and Discussion Techniques *

Questions of High Cognitive Challenge, Effective use of responses & ideas, Discussion with teacher stepping out of central role

[▾]

3c. Engaging Students in Learning *

Activities aligned to lesson goals, highly motivated, Students working over watching, high level student thinking

[▾]

3d. Assessing Student Learning *

Evidence of student understanding, specifically created questions, monitor student learning and providing feedback, assessing work against criteria

[▾]

3e. Demonstrating Flexibility and Responsiveness *

Incorporating of student interests and events of the day, adjustment if student lack of understanding, seizing on a teachable moment

[▾]

Technology Usage *

(SAMR: Substitution, Augmentation, Modification, Redefinition)

- [ ] Substitution
- [ ] Augmentation
- [ ] Modification
- [ ] Redefinition

Brief Description of Technology Use

Additional Comments

Appendix B

Checkbox if Requesting a Follow-Up Conference *

- Need Follow-Up Conference
- No Follow-Up Needed

- Send me a copy of my responses.

Submit

Never submit passwords through Google Forms.

Powered by
Google Forms

This form was created inside of Central Valley School District.
Report Abuse - Terms of Service - Additional Terms

Appendix B

District 220 SAMR Activity Scale for Technology Opportunities

Task	Substitution	Augmentation	Modification	Redefinition
Definition	*Substitution because no functional changes have been added*	*Augmentation because the task hasn't changed, but additional functions are afforded by the technology tool.*	*Modification because the technology tools allow for a redesign of the original task.*	*Redefinition because without the use of technology, these processes would not be conceivable. The activity has been transformed.*
Writing (Puentedura's original SAMR example was "creating reports")*	Word processing without any functions more than hand-writing	Word processing with additional functions like spell check, cut and paste, online submission, etc.	Word processing with integrated visual additions such as charts, tables, graphs, photos, etc.	Word processing with visual additions constructed via collaboration, revised with peer editing and/or posted online to incorporate an authentic audience
*Reading**	Reading text online	Reading text online includes links to dictionary definitions of words, websites with additional information, etc.	Reading text online includes textual, visual, and audio tools such as clicking words to see visual depictions or hear pronunciations, etc. to help students understand the text.	Reading text online includes textual, visual, and audio tools such as text-to-speech capabilities, animations, etc. to help students understand the text
*Note-Taking***	Taking notes online merely by typing rather than writing	Taking notes that include visuals such as: drawings, annotations, and photos	Taking notes that include visual and audio notes, links to information from the Internet, animations, etc.	Taking notes that include visual and audio notes, links to information from the Internet, animations, etc. and sharing them live via blogs with connections to authentic audiences or with peers and/or the teacher via Google Docs
*Researching***	Using a web browser to search for and collect information on the Internet	Using a web browser to search for and collect information on the Internet and to bookmark them for future reference	Using a web browser to search for and collect information on the Internet and to bookmark, annotate, and compare and contrast them	Using a web browser to search for and collect information on the Internet and to bookmark, annotate, compare and contrast them and ultimately share the links and a criticism of them
*Presenting***	Creating a presentation using a presentation tool	Creating a presentation with visuals such as photos, videos, animations, etc. or audio such as sound effects, narration, etc.	Creating a presentation with visuals and audio as part of a mixed multimedia presentation	Creating a presentation with visuals and audio that features collaboration, interactive audience participation, is shared online to an authentic audience, is presented to a live virtual audience, etc.

**Adapted from Puentedura (2006)*
***Adapted from Budd (2014)*

Appendix C

Youngstown
STATE UNIVERSITY

One University Plaza, Youngstown, Ohio 44555
Office of Research
330.941.2377
www.ysu.edu

November 15, 2017

Dr. Karen Larwin, Principal Investigator
Mr. Nick Perry, Co-investigator
Department of Counseling, School Psychology and Educational Leadership
UNIVERSITY

RE: HSRC PROTOCOL NUMBER: 040-2018
TITLE: Teachers Attitudes and Beliefs about Successfully Integrating Technology in their Classroom During a 1:1 Technology Initiative and Student Achievement

Dear Dr. Larwin and Mr. Perry:

The Institutional Review Board has reviewed the abovementioned protocol and determined that it is exempt from full committee review based on a DHHS Category 4 exemption.

Any changes in your research activity should be promptly reported to the Institutional Review Board and may not be initiated without IRB approval except where necessary to eliminate hazard to human subjects. Any unanticipated problems involving risks to subjects should also be promptly reported to the IRB.

The IRB would like to extend its best wishes to you in the conduct of this study.

Sincerely,

Mr. Michael Hripko
Associate Vice President for Research
Authorized Institutional Official

MAH:cc

c: Dr. Jake Protivnak, Chair
Department of Counseling, School Psychology and Educational Leadership