The Impact of TPACK, SAMR, and Teacher Effectiveness on Student Academic Growth

in

Eighth Grade Language Art and Mathematics

by

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Submitted in Partial Fulfillment of the Requirements

for the Degree of

Doctor of Education

in the

Educational Leadership Program

YOUNGSTOWN STATE UNIVERSITY

December 2017

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ACKNOWLEDGMENTS

My gratitude for the guidance, commitment, and knowledge of the YSU faculty cannot be expressed enough. When finishing the research seemed impossible, the YSU faculty provided comment, feedback, and encouragement. I am profoundly thankful for my dissertation committee--Dr. Lauren Cummins, Dr. John F. Ziegler, and Dr. Salvatore A. Sanders. Their support, critiques and challenges are unparalleled. Accolades to Dr. Karen Larwin, my committee chair. Without her dedicated support, I would not have been able to navigate the research project. She has been instrumental in completing my journey. I have never met anyone more dedicated to the success of students than Dr. Larwin.

To Dr. Dean Maynard and my Intermediate Unit family, your encouragement and support is deeply appreciated. You never hesitated when I needed assistance in understanding a concept or locating a piece of data. Thank you for helping me grow in my understanding of education.

Completion of this dissertation would not have been possible without the undying support of my extended family. I would like to thank my mother and father who, throughout my life, have always demonstrated the value of tenacity and the power of never giving up. A special thank you to my sisters, who were always there to cover for me when there were family obligations. To my children, I am grateful for your understanding and supporting me on the roads I travel. I extend my eternal gratitude to all of you.

Finally, I must thank my wife Judy. Over the span of decades, she has stood tall in her encouragement and support of my educational endeavors. Her countless hours of proof reading and listening to me complain have not gone without notice. Any success I have achieved is as much her doing as mine.

ABSTRACT

School districts in the United Stated are investing large sums of money in educational technology. The investment is predicted to continue, with an increase in spending due to the explosion of 1-to-1 technology implementations such as iPads and Chromebooks. The additional funding available through the Federal E-Rate program significantly contributes to the expansion of classroom technology. However, research has found that singularly examining the impact technology has on student learning shows there is no consistent result. Other research has acknowledged this shortcoming with technology and has focused on teacher technology use skills, how teachers integrate technology in the classroom, teacher evaluation systems, and educational value-added systems. The research results of these factors indicate individually they can influence classroom learning. This study examined the impact of multiple variables on student academic growth. The variables were a teacher's self-efficacy of their Technology, Pedagogy, and Content Knowledge (TPACK) skills (gathered via a survey), the level of Substitution, Augmentation, Modification, and Redefinition (SAMR) obtained in the classroom (reported through principal observation), and teacher effectiveness rating (end of year principal evaluation forms based on the Pennsylvania Teacher Evaluation Model). The study demographic was Northwestern Pennsylvania and the schools were located within the service area of the same educational service agency. Eight eighth grade language arts and mathematics teachers were included in the study. The results indicated two relationships. The first was between TK (Technology Knowledge) and Danielson's Domain Two (Classroom Environment). The second was between Danielson's Domain Three (Instruction) and the 2017 PVAAS PSSA Academic Growth Index.

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Chapter 1

Schools across the United States are investing large sums of money in student centered instructional technology. Spending on educational technology has been steadily increasing over the past decade. Spending is expected to reach $19 billion by 2019 (Nagel, 2014). Initiatives such as President Obama's ConnectEd and the Federal Communications Commission E-Rate program have been catalysts in the renewed efforts by school districts to implement 1-to-1 initiatives. Taxpayers, parents, and legislators are questioning the effectiveness and rate of return, which is measured in student achievement and academic growth from these large expenditures. Simultaneously, new teacher evaluation systems have been initiated that measure teacher performance in a multitude of professional areas, including components from school profile data (such as value-added assessment results). This study examined the combined impact of teacher technology self-efficacy, the level of technology integration, and educator effectiveness on student academic growth.

Educational technology has been a factor in U. S. schools for hundreds of years. Educational technology (more specifically, instructional technology) includes many types of devices, such pencil, paper, abacus, chalk, blackboard and flash cards (Mishra & Kohler, 2008). In recent decades, the focus of educational technology has generally been aimed at the internet and electronic devices, such as computers, tablets, smartphones, interactive whiteboards, and a plethora of other modern electronic devices. The goal of educational technology and the deployment of all these different device types is to improve student learning.

As instructional technology has become more personalized, schools have become more interested in technology initiatives and the impact these technologies can have on student achievement. Since the introduction of devices (such as the Apple iPad and iPhone) manufacturers have diverted their product lines to meet the insatiable demand for these devices by consumers. Although not designed specifically for education, the iPad and similar devices quickly found a home in classrooms across the United States. Proponents of 1-to-1 school-based deployments advocate from the standpoint that technology is a tool (like a pencil) and students should not be asked to share a pencil and only have access to it on pencil lab day. Opponents of 1-to-1 deployments argue that like a microscope, a tablet or laptop is needed only for special functions. Since schools do not provide a microscope for every student, there is no need to provide a computer for every student. Both sides of this debate have merit, but schools continue to deploy technology in large quantities and at a very rapid pace. The continued deployment of technology can be attributed to the benefits schools believe technology delivers. Technology provides the opportunity for distance learning, remediation strategies, blended learning, personalized learning, and a wealth of open education resources (Koba, 2010; Harold, 2016). Due to all these perceived benefits, there does not appear to be a desire for schools to divert from these initiatives.

Since the first computers arrived in classrooms, there has been an ongoing challenge faced by technologists and school district administrators. One of the challenges is appropriately preparing teachers to teach with technology. Technology integration can be complex and difficult for teachers to master. Quick and short professional development sessions are not the answer to long-term teacher understanding and integration of technology (Hammer & West Virginia Department of Education, 2013). Researchers have been investigating multiple approaches to create an effective and sustainable methodology to prepare both in-service and pre-service teachers for technology rich classrooms. Mishra and Koehler (2008) posited that the Technology, Pedagogy, Content Knowledge (TPACK) framework is critical for teacher success in a classroom with technology. Their model builds on Shulman's (1986) Pedagogy, Content, and Knowledge (PCK) model by adding technology. Mishra and Koehler (2008) were adamant that technology, pedagogy, and content are closely integrated and successful learning in current day classrooms depends on all three elements. Puentedura (2014a) believed the TPACK framework leads to teachers having the ability to challenge students at the different levels of his Substitution, Augmentation, Modification, and Redefinition (SAMR) model and completely change the capabilities of classroom technology.

Although technology deployments are very attractive, the research shows the most critical factor in classroom success is teachers (Stronge, Ward, & Grant, 2011). Both the U.S. Department of Education (USDE) and the Pennsylvania Department of Education (PDE) subscribe to this tenet. Pennsylvania has received over $1 billion in Title II, Part A SEA (State Education Association) Awards since 2005 (USDEa, 2014) to create and implement a new teacher evaluation system. Teachers play a significant role in student learning. Therefore, one can see why states, such as Pennsylvania, are working diligently to implement teacher evaluation systems that take into account numerous aspects of the learning environment. One such aspect would be value-added measures which can increase the accuracy of teacher evaluation systems (Malinowski, 2011).

Statement of the Problem

Schools expend sums of money, estimated as large as $5 billion per year (Upadhyaya, 2013), on educational and instructional technology. Spending is predicted to increase to $19 billion, annually, by 2019 (Nagel, 2014). Teachers are, and have been, the most important factor in student achievement (Teacher Quality, 2010; Stronge et al., 2011). The specific problem addressed is determining the impact of teacher technology self-efficacy, SAMR level, and teacher effectiveness had on student academic growth (Koehler & Mishra, 2009; Stronge et al., 2011). In a study conducted by Stronge et al. (2011), "one common finding emerge[d]: Teachers have a measurable impact on student learning" (p. 348). The problem of teacher technology self-efficacy is informed by the TPACK framework, which considers teacher pedagogical, content, and technological knowledge (Koehler & Mishra, 2009). SAMR level is informed by the SAMR framework, which considers four levels of technology integration in the classroom (Puentedura, 2010). Teacher effectiveness is informed by the Danielson Framework for Teaching, which is based on four domains of educator effectiveness (Danielson, 2015). Teacher effectiveness is further informed, for this study, by the Pennsylvania Value-added Assessment System (PVAAS), which is based on the Education Value-Added Assessment System (EVAAS) model, and is utilized to determine teacher influence on student academic growth (Pennsylvania Department of Education, 2015).

Teacher technology self-efficacy, SAMR level, and teacher effectiveness have been previously studied separately. The literature search revealed no previous studies were conducted relating to measuring in-service teacher technology self-efficacy (through the TPACK framework), SAMR level (through the SAMR model), and teacher effectiveness (through the PA Educator Evaluation model) and their relationship to student academic growth. Examining in-service teacher technology self-efficacy, SAMR level, and teacher effectiveness will assist school districts in developing appropriate professional development that will impact student academic growth (Koehler & Mishra, 2009).

Research Questions

The research questions in this study were based on the gap in the research regarding the individual and combined impact of teacher technology self-efficacy, level of SAMR achieved in the classroom, and teacher effectiveness on student academic growth. The following research questions in this study will be answered:

1. Does a teacher's technology self-efficacy influence the level of SAMR practiced in the classroom?
2. Does a teacher's technology self-efficacy influence the teacher's effectiveness rating?
3. Does a teacher's technology self-efficacy and teacher effectiveness rating influence student academic growth?

Based on the findings of previous research relating to teacher technology self-efficacy, it is reasonable to assume the results of this study will also show teacher technology self-efficacy having a statistically significant influence on three of the proposed research questions.

Methodology

This research utilized a quantitative approach to gather and analyze data to answer the research questions. Data were gathered to analyze teacher technology self-efficacy

(TPACK), the level of SAMR integrations, and teacher effectiveness ratings. Additional confounding variables such as gender, years of teaching, years utilizing a 1-to-1 technology deployment, etc., were also gathered. Alford (1998) defined three types of paradigmatic research designs: (a) historical, (b) multivariate, and (c) interpretive. One of the designs will be dominate and in the foreground, while one or more of the other designs may occur in the background. The proposed research was best served by a foreground multivariate argument.

Theoretical Frameworks

There are numerous aspects of this research and each aspect was investigated from a specific theoretical framework. Mishra's and Koehler's (2008) TPACK framework was the basis for measuring teacher technology self-efficacy. The TPACK framework posits that a teacher's technology self-efficacy will be higher when a teacher has been exposed to professional development designed to increase understanding of the relationship between pedagogy, content knowledge and technology. A modified SAMR level matrix was utilized to examine the level of technology integration within the classroom. The modified survey included elements from Bloom's Revised Taxonomy to assist principals not familiar with SAMR in completing the matrix. SAMR and Bloom's are focused on increasing the learning and rigor occurring with the use of technology in the classroom. Finally, the Pennsylvania Educator Effectiveness framework was the foundation for examining teacher effectiveness. Within the Pennsylvania Educator Effectiveness model is the Danielson Framework for Teaching (Pennsylvania Department of Education, 2014B). The Danielson Framework dissects the elements of best practices in four main areas for teachers to achieve higher student performance in the classroom.

The three variables (TPACK self-efficacy, SAMR level, and teacher evaluation) are all related to teachers and how they view themselves and their classroom teaching. In our technology rich classrooms, these three variables may have an impact on each other and student academic growth. Each of these variables independently influence what happens in the classroom; however, little is known about the composite influence these variables may have on student academic growth. These variables, as well as one-to-one initiatives in schools, are the core of this research.

Assumptions

For the purpose of this study, it was assumed that all participants would answer survey questions correctly and provide accurate and meaningful classroom artifacts. It was further assumed that the survey questions were meaningful and accurately represented the participant's experiences and beliefs regarding TPACK, SAMR, and Educator Effectiveness.

Limitations

There are several limitations associated with this study. The survey tools utilized to gather data were based on eighth grade math and language arts content and pedagogy. Content knowledge is a critical factor in measuring TPACK (Mishra & Koehler, 2008; Niess, 2011), and therefore, each tool to measure TPACK needed to be verified for validity and reliability. The same is true for measuring the SAMR level. The researcher utilized a tool to measure the SAMR level that was created and tested by the researcher and other parties. The availability of SAMR measurement tools is limited. While this is a limitation, restricting the investigation to eighth grade mathematics and language arts served as a design control that will increase the overall conclusion validity of the proposed investigation.

Furthermore, the basis of this research was not to examine the effect of professional development on teacher technology use. Data were gathered to determine the amount of professional development received related to SAMR and teacher effectiveness. However, a limitation of this study is identified in differing levels of related professional development and the frameworks used to deliver professional development, which may have some impact on the results of this study.

Additionally, within classrooms there are many facets of the learning environment that will affect the student growth either negatively or positively. Although the schools are similar, this is not a guarantee funding levels are the same, that similar content is being delivered at the same time, or that individual school demographics are consistent with each other. Each district, school building, and classroom will have unique opportunities and untold challenges that directly influence instruction and learning. One such factor is how schools prepare for the annual Pennsylvania exams. Depending on the school system, significant amounts of instructional time is spent on specifically addressing the test rather than covering the content area. The tests used by Pennsylvania to generate the PVAAS scores are standardized and, therefore, immediately are under suspicion for not accurately measuring student performance, growth or knowledge.

Scope

The schools selected for this research were all served by the same educational service agency in Northwest Pennsylvania. Common core school data from the National

Center for Education Statistics (NCES), was gathered for schools within the Education Service Agency (ESA) service area. The grade configuration of the schools selected varied from serving grades k-8, 5-8, 6-8, and 7-12. Each selected school was required to serve grade 8. School locale included city, rural, suburb, and town. Title 1 schools occurred 2 times more often than non-title 1 schools in the data set.

Nation free and reduced lunch data from NCES was used to calculate a school's e-rate discount percentage. The free and reduced student count is divided by the total number of students in the school to determine the percentage of students with free and reduced lunch. The Universal Services Administrative Company (USAC) has created a discount matrix based on a school's e-rate local designation and percentage of free and reduced lunches (USAC, 2016). The e-rate locale can be either urban or rural. E-Rate has two categories of funding. Category one is for internet and related expenses and category two is for equipment to support technology, such as wireless network infrastructure. For the purposes of this study, category one discounts are considered since these discounts have been in existence for a longer period of time. The higher a school's percentage of eligible students for the National School Lunch Program, the greater discount a school received for category one services (USAC, 2016). USAC equates the percentage of eligible students to the income level of the school population. Schools were assigned to one of three e-rate percentage groups: (a) Group 1- 0 to 29%; (b) Group 2- 30-59%; and (c) Group 3 - 60 % and above.

Although this study was not focused on classroom technology, the influence technology may have on student academic growth must be considered. This study gathered information related to the types of technology available to the classroom, how often the technology was available, and if the school had a one-to-one deployment where students were allowed to take the computer home. With so many schools planning a 1-to-1 implementation and the number of school within the ESA in the process of deploying 1-to-1 technology, it will be valuable to identify the differences in TPACK, SAMR, and teacher evaluation between the different types of technology implementations.

Bring your own devices (BYOD) is a phenomenon that is being considered by districts. BYOD is attractive to districts struggling to provide technology for every student. Pearson (2015) found that more than three in five elementary and middle school students own a tablet. Students also use smartphones more as they get older (Pearson, 2015). Cristol and Gimbert (2014) discovered some gains in student performance when students used their own devices, However, they also acknowledge that the introduction of student owned devices in the classroom presents an array of challenges. The many unknowns associated with BYOD, combined with the other limitations of this study, makes excluding BYOD implementation in this study a sound research decision.

Definition of Terms

The following key terms are defined for the purpose of this study:

Bloom's Revised Taxonomy: A taxonomy designed to help classify educational system goals through the two dimensions of cognitive processes and the knowledge dimension (Wilson, 2013; Krathwohl, 2002; Amer, 2006)

E-Rate: A Federal Communications Commission (FCC) program administered by the Universal Service Administrative Company (USAC) that provides funds to schools to help pay for internet connections and the internal networking infrastructure based on a school's participation in the national school lunch program (FCC, 2016)

Framework for Teaching: Is from the Danielson Framework and accounts for 50% of the teacher rating in Pennsylvania's Teacher Effectiveness (PTE) model (Danielson, 2011)

Pennsylvania Educator Effectiveness Model: Pennsylvania's method of evaluating teachers. The model is based partially on the Danielson Framework, along with building level data, teacher-specific data, and elective data (Pennsylvania Department of Education, 2014b).

Pennsylvania Value-added Assessment System (PVAAS): A statistical analysis of Pennsylvania state assessment data which provides Pennsylvania districts and schools with academic growth data (Pennsylvania Department of Education-PVASS, 2015).

SAMR Model: SAMR is a model created by Puentedura (2010) to identify the level of technology integration within a classroom. The model is divided into two parts—enhancement and transformation. Enhancement includes Substitution and Augmentation. Transformation includes Modification and Redefinition (Common Sense Media, 2015).

Technology, Pedagogy, and Content Knowledge (TPACK): A framework developed for enhancing professional development to improve teacher technology self-efficacy. The framework is also utilized to help create tools to measure a teacher's TPACK level (Koehler & Mishra, 2009).

Summary

Schools, with the help of programs such as the Federal E-Rate and ConnectEd, are investing heavily in educational technology. This investment is accompanied by the commitment of schools to focus on classroom technology implementation strategies. These strategies must address the implementation, maintenance, and replacement of the technology itself. Poole (2011) and the American Institutes for Research (2014) outline best practices for districts to achieve successful technology implementations. Part of the challenge is the instructional integration strategies. At the core of successful instruction is the teacher. Teacher professional development is critical for achieving seamless technology integration within the classroom. Schools that have achieved higher levels of technology integration focus on teachers and their professional development needs. Part of the professional development must address new learning paradigms and new instructional processes that technology makes possible. Both the school and the community must embrace the cultural change the influx of technology will require. Planning to integrate technology and maintain the same approaches used in the classroom today most likely will not result in the expected outcomes the administration is looking for. The technology plan requires a complete and exhaustive approach to addressing all the key factors in achieving a successful technology integration with a high value of investment (VOI) return on taxpayer funds.

At the same time, states and school districts are moving to new teacher evaluation models that hold teachers more accountable for student academic growth. These two initiatives have a common interest in student achievement. This chapter provides an overview of the current school environment, while also sharing the challenges facing school leaders. The problem has been well defined, as has the methodology to investigate answers to the proposed research questions and hypotheses. The assumptions, limitations, and scope of the research have been reviewed and demonstrated. Key definitions have been provided to assist the reader in clarifying the terms used within this specific study. The next chapter will provide a review of the literature related to TPACK, SAMR, Teacher Effectiveness, Value-added assessment, and 1-to-1 technology initiatives. Lastly, the researcher's critical evaluation and interpretation of the literature gap will be included.

Chapter 2

Literature Review

Instructional technology spending is predicted to increase to $19 billion, annually, by 2019. Fueling this expansion is President Obama's 2013 ConnectEd initiative and the FCC's 2014 overhaul of the Federal E-Rate program. ConnectEd strives to have 99% of all schools connected to broadband internet within five years. The E-Rate overhaul increases available dollars to school districts to purchase internet connectivity, wireless and wired networking equipment, firewalls, etc. Administrators, school boards, taxpayers, and parents are critically questioning if substantial spending on technology has a corresponding positive impact on student learning as schools implement their technology initiatives.

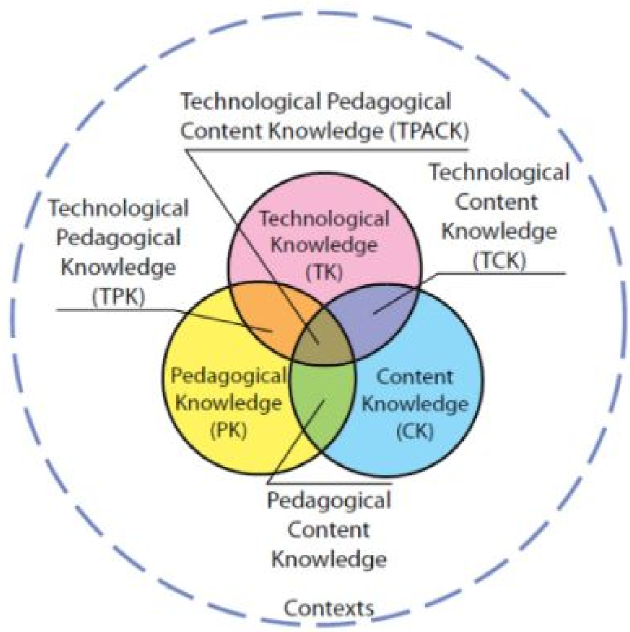
There is no expectation that schools will abandon educational technology. The Horizon Report (New Media Consortium, 2014) expects schools to rapidly adopt Bring Your Own Device (BYOD) policies over the next 12 months, which will significantly impact students and classroom teachers (p. 45). Simultaneously, the FCC dramatically overhauled the Federal E-Rate program in 2014. The overhaul shifts funding from traditional telephony services to supporting school systems when creating a wireless and wired infrastructure in their buildings that can support 1-to-1 device initiatives. The E-Rate fund increased from $2.5 billion to $3.9 billion for the 2015-2016 school year. In addition, the 2015-2016 and 2016-2017 school years will each have an additional $1 billion to use for connecting schools to the internet (J. Tritt-Schell, personal communication, December 12, 2014). These additional funds are not causing districts to reduce their budgeted educational technology spending. Rather, districts are leveraging the available funds to accelerate the deployment of educational technology plans. At least two districts within the ESA service area used their available E-Rate funds to install new wireless networking infrastructure to accommodate their planned 1-to-1 student device initiatives.

Regardless of the funding source, districts are still under scrutiny to show the value of educational technology. In Pennsylvania, data has been accumulated regarding educational technology implementation through grant programs such as Link-2-Learn, Classroom for the Future, and Act 183. Each of these grants required districts to dedicate specific amounts of the grant to teacher professional development. These funds provided much needed technology training for teachers during the infancy of education technology integration in the classroom. Over the past decade, in an effort to assist in establishing how teachers utilize technology, researchers have created frameworks to assist in understanding effective implementation of educational technology.

The TPACK Framework

TPACK was introduced by Mishra and Koehler in 2005 and is an extension of Lee Shulman's Pedagogical Content Knowledge framework (Koehler, Mishra, & Cain, 2008). Koehler (2015) stated "Technological Pedagogical Content Knowledge (TPACK) attempts to identify the nature of knowledge required by teachers for technology integration in their teaching, while addressing the complex, multifaceted and situated nature of teacher knowledge" (para. 1). The TPACK framework describes the knowledge required by teachers in order to create and deliver curriculum and instruction, while simultaneously guiding student thinking and learning with digital technologies (Neiss, 2011). There is a relationship between content, pedagogy, and technology and this relationship is a key component in effective teaching (Koehler & Mishra, 2009). With the integration of technology into most classrooms, a teacher's technology knowledge is a critical construct to be considered. Figure 1 shows the TPACK model and the seven constructs within the model.

Figure 1. TPACK Model and Constructs (Koehler, 2012)



The significance of the TPACK framework is the overlap of the three main constructs—Technology Knowledge (TK), Content Knowledge (CK), and Pedagogical Knowledge (PK). The seven constructs of the TPACK framework are defined in Table 1.

Table 1. *Seven Constructs of the TPACK Framework*

TPACK Construct	**Definition**
Technology Knowledge (TK)	The knowledge and mastery level an educator possesses to use and plan to use technology in the classroom. Knowing when not to use technology is part of the mastery level as well. TK is always in a state of flux (Koehler, Mishra, & Cain (2013).
Pedagogical Knowledge (PK)	The knowledge and mastery level an educator possesses with regard to classroom management, taxonomies, planning, and assessment.
Content Knowledge (CK)	The knowledge and mastery of subject content. It includes concepts, theories, ideas, frameworks, evidence, and proof of established practices, including ways to develop such knowledge.
Pedagogical Content Knowledge (PCK)	Pedagogical Content Knowledge is the intersection and interaction of pedagogy and content knowledge covering essential knowledge of teaching and learning content-based curricula, as well as assessment and reporting of that learning (Harris, Mishra, & Koehler, 2009).
Technological Pedagogical Knowledge (TPK)	Technological Pedagogical Knowledge is an understanding of how teaching and learning change when particular technologies are used. This knowledge includes knowing a range of technological tools and resources as they relate to appropriate pedagogical designs and strategies.
Technological Content Knowledge (TCK)	Technological content knowledge is the understanding of how technology and content influence and constrain each other. Educators need to understand which technologies are best suited for addressing a specific subject-matter, while remembering that content dictates or shapes specific educational technological uses and vice versa.
Technological Pedagogical Content Knowledge (TPACK)	Technological Pedagogical Content Knowledge is deeply skilled teaching. Unlike the three individual concepts of Pedagogy, Content, and Technology, TPACK requires a comprehensive understanding of how the three concepts come together creating the best technological and pedagogical learning experience that is closely connected by content.

Pre-service teacher programs have developed extensive curriculum around Shulman's PCK framework (Niess, 2011). However, as technology became more prevalent in schools during the first years of the 21st century, research and understanding began to develop around the role of technology in the learning process. Teaching with technology presents many challenges- from understanding how to use the technology to creating appropriate learning strategies for using the technology—it is a "wicked" problem (Rittel & Webber, 1973). Unfortunately, there are no solutions to wicked problems. Instead, educators must look to best practices that utilize their expert knowledge to address the complexities of learners and school environments within their unique classrooms. In the TPACK framework, technology is added to compliment the pedagogy and content constructs. Since technology is a constant variable, there is no definitive solution to a technology integration problem (Mishra & Koehler, 2008).

One challenge facing the TPACK framework is that the seven constructs can be complex. Researchers have developed numerous tools to measure a teacher's TPACK level. However, creating a tool that is both valid and reliable has been difficult. This challenge stems from trying to oversimplify the influence specific content areas have on achieving a higher level of TPACK understanding (Mishra & Koelher, 2008; Niess, 2011). Measuring TPACK for in-service teachers can be accomplished through self-reports (surveys, interviews, or reflective journals), observations (classroom observations) or through teaching artifacts (lesson plans and student work) (Agyei & Keengwe, 2014). The measurement results can be influenced by teacher self-efficacy, content area, and school climate, as well as the tool itself.

Most TPACK measurements are designed to examine individual teachers rather than groups of teachers. Schmidt et al. (2009) created a self-assessment survey for pre-service teachers. A vital part of the tool created by Schmidt et al. (2009) was its purpose of measuring pre-service teacher understanding of TPACK rather than teachers' attitudes or teachers' technology use and integration. The latter would be more accurate in establishing the level of teacher self-efficacy with technology. Although there is a paucity of literature regarding measuring TPACK of in-service teachers, Schmidt et al. (2009) findings indicated the importance of what is actually being measured in TPACK research related to this research.

Mishra's and Koehler's (2008) TPACK Framework is an extension of Shulman's (1986) PCK model. Although many researchers agree with Mishra's and Koehler's explicit definition of technology knowledge and how it is critical to addressing good teaching with technology, there are other researchers who posit that TPACK is too complex, and a separate technology construct is not required. Brantley-Dias and Ertmer (2013) argued that technology knowledge is not an entity unto itself. Rather, technology knowledge is, for all purposes, part pedagogical and content knowledge. Brantley-Dias and Ertmer (2013) claimed that Shulman's Pedagogical-Content Knowledge construct already includes technology since "a teacher's curricular content knowledge [includes] the knowledge of instructional materials that are useful for teaching a certain content including materials such as software, visual materials, and films, among others" (p. 106). There is debate arguing that technology is only temporary and, that as technology use in classrooms becomes more ubiquitous, technology knowledge will be absorbed by CK, PK, or PCK, and special consideration for technology will not be required (Brentley-Dias

& Ertmer, 2013). Furthermore, Brantley-Dias and Ertmer (2013) posited focusing more on TPACK rather than TK, TPK, and TCK since numerous studies have not been able to identify and measure the technology constructs at all. The TPACK framework may be "too big" and its constructs "too small" (Brantley-Dias & Ertmer, 2013, p. 104).

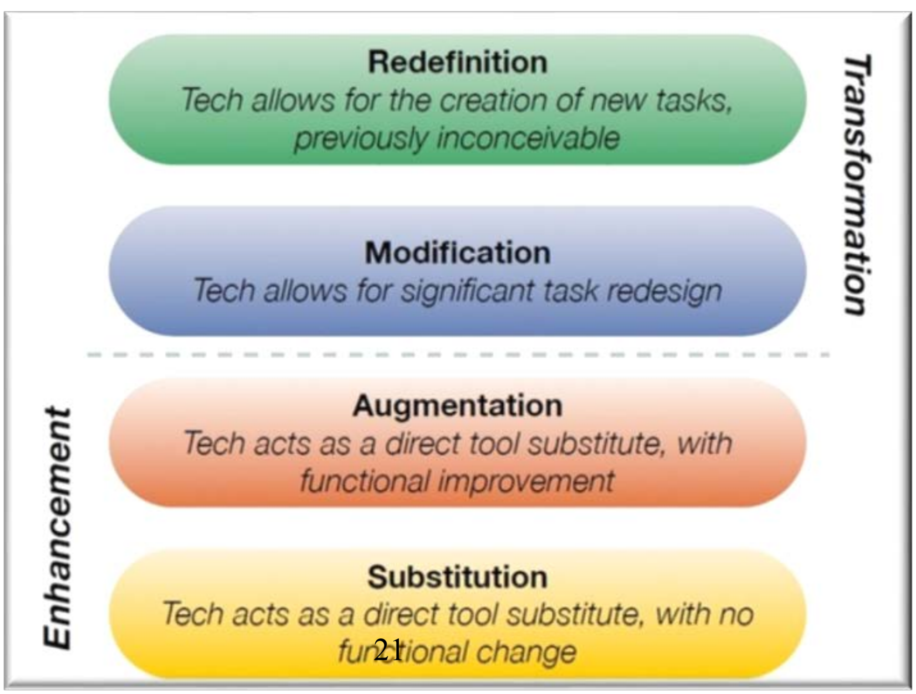
The literature clearly identifies the measurement of TPACK for in-service teachers as a challenge. Researchers such as Niess (2013) and Zelkowski, Gleason, Cox, and Bismark (2013) discovered the importance of content specific questioning in achieving TPACK analysis. Utilizing general terms to describe the technology use by teachers results in generalities that most likely do not equate to a teacher's actual understanding and use of the TPACK framework. Landry (2010) conducted research on creating a tool to measure middle school math teacher TPACK. Landry (2010) utilized Schmidt et al.'s (2009) survey tool and modified the TPACK questions to be specific to middle school math, which resulted in the M-TPACK survey. The results indicated the modified survey was both reliable and valid (Landry, 2010). The reliability and validity were confirmed through quantitative methods by comparing a known TPACK survey to Landry's M-Pack survey. Zelkowski et al. (2013) conducted research on measuring TPACK constructs for pre-service science teachers. The researchers created the survey and tested it for validity and reliability. The results found the survey tool was valid and reliable for secondary math pre-service teachers.

Based on existing literature, it is evident that the TPACK framework is complex and difficult to measure. The existing literature reveals there is a great deal of research on the framework, with much of the research based on how to best provide pre-service teachers with the skills necessary to be successful in teaching with technology. Content has been identified as a critical element in establishing these required skills, as well as supporting the measurement of TPACK constructs. Content areas are unique and require different pedagogical and technological approaches for successful learning. Therefore, utilizing the TPACK framework in the development of teacher knowledge does not mandate a single approach to technology integration (Harris et al., 2009). However, it is clear the measurement of TPACK and is more accurate when content specific inquiry is utilized.

The SAMR Model

The SAMR model was created by Puentedura in 2006. SAMR is a model for teachers to determine how they are using technology in their instruction (Common Sense Media, 2015). Figure 2 graphically represents the four levels of technology use in the classroom.

Figure 2. Four Levels of Classroom Technology (Schrock, 2013)



The four levels are subdivided into two sections. The first section is enhancement. Contained within enhancement are substitution and augmentation levels. These two levels are generally the first experience teachers have when teaching with technology. Early grants, such as the Pennsylvania Link-2-Learn funds, provided for mandatory expenditures in professional development to help usher technology into the classroom. However, early adoption of technology generally resulted in teachers reaching only the substitution or augmentation levels. The second section is transformation. Contained within transformation is modification and redefinition. The division in the model between augmentation and modification is a threshold that an educator must cross in order to leverage the learning potential of technology. Although teachers should strive to be in the transformation section (modification and redefinition) the vast majority of the time, it is not likely teachers can constantly achieve the redefinition level in a classroom. Attaining this level is the goal, and teachers need to focus on the goal when developing learning activities (Puentedura, 2014).

A challenge facing teachers attempting to attain higher levels on the SAMR framework is understanding which of the four levels a specific lesson addresses (Puentedura, 2014). The compactness of the SAMR model is a contributing factor to the challenge faced by teachers. It can be difficult for teachers to determine which level of the SAMR model their lesson is addressing with such a plethora of technology choices (Puentedura, 2014). The SAMR framework is relatively new and is focused on the level of technology integration in the classroom. Most teachers have not had formal training on SAMR, but instead have been exposed to either the original Bloom's Taxonomy (1956) or the revised Bloom's Taxonomy (2001).

Bloom's Taxonomy was first introduced in 1956 by Benjamin Bloom and others (Wilson, 2013). Originally, the taxonomy was used to classify curricular objectives and test to see the breadth, or the lack of breadth, of the objectives (Amer, 2006; Krathwohl, 2002). The original Bloom's Taxonomy was divided into six categories: knowledge, comprehension, application, analysis, synthesis, and evaluation (Wilson, 2013; Krathwohl, 2002, Amer, 2006). The revised Bloom's Taxonomy still consists of six categories, but they have been modified to reflect developments in educational and psychological literature (Amer, 2006). The new categories are remembering, understanding, applying, analyzing, evaluating, and creating. Figure 3 graphically represents the original and revised taxonomies.

Figure 3. Original and Revised Bloom's Taxonomy (Maxvibrant, n.d.)

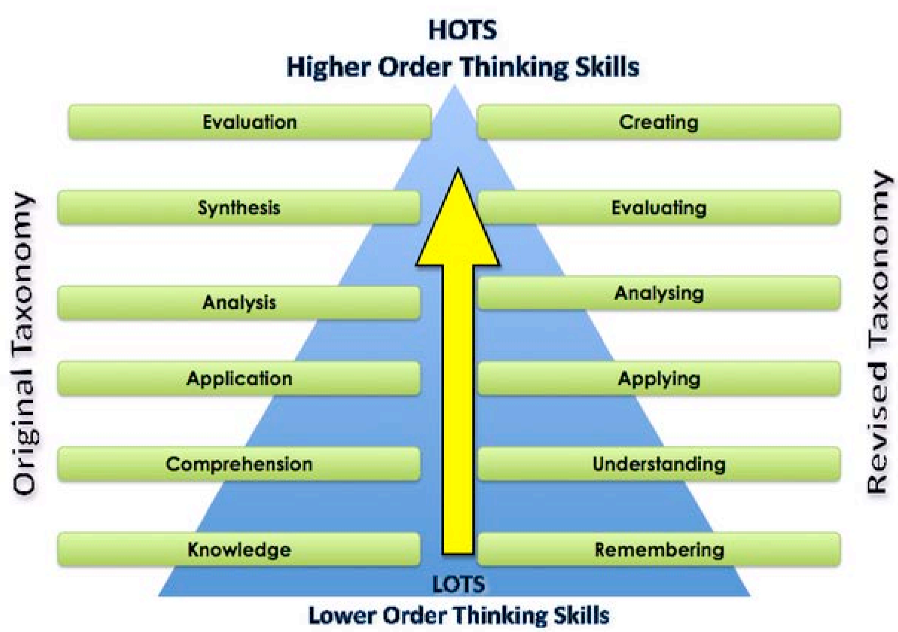


Figure 3 also shows that Boom's Taxonomy progresses from lower order thinking skills to higher order thinking skills. There was an inherent understanding that each class or category was increasingly complex and that each class was presumed to include all the behaviors of the less complex classes (Amer, 2006; Krathwohl, 2002). The taxonomy was believed to be hierarchical and students could not get to the evaluation level without progressing through the other perquisite levels (Amar, 2006, Krathwohl, 2002).

In approximately 2000, David Krathwohl (one of the original authors of Bloom's Taxonomy) and Lorin Anderson (a student of Benjamin Bloom) started work on revising Bloom's Taxonomy (Amer, 2006). The revision included changes in wording from nouns to verbs, renaming of some of the components, and repositioning of the last two categories (Wilson, 2013). However, the most dramatic change in the taxonomy is the creation of two dimensions. Originally, knowledge was defined as both a noun and a verb, which forced an unidimensionality to the taxonomy at the expense of knowledge (Krathwohl, 2002). By applying both nouns and verbs to define knowledge, a knowledge dimension and a cognitive dimension were created. Previously, only the cognitive dimension was defined. Table 2 shows the complete two-dimensional Taxonomy Table, with both the knowledge dimension and the cognitive process dimension.

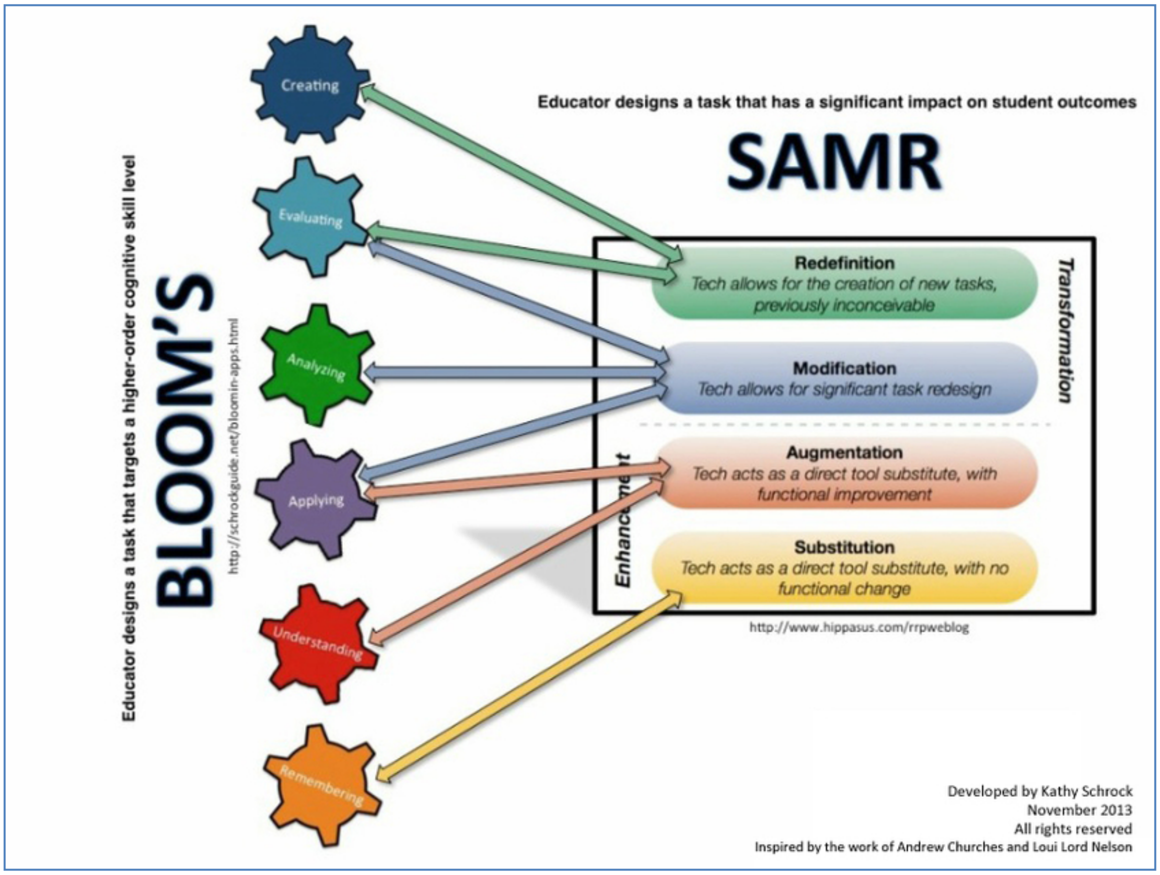
Table 2. *The Cognitive Process Dimension - The Two-Dimensional Taxonomy Table*

Knowledge Dimension	1. Remember	2. Understand	3. Apply	4. Analyze	5. Evaluate	6. Create
A. Factual Knowledge						
B. Conceptual Knowledge						
C. Procedural Knowledge						
D. Metacognitive Knowledge						

In the revised taxonomy, it is also acknowledged that learning objectives can, indeed, overlap different categories within the two-dimensional taxonomy table (Amar, 2006; Krathwohl, 2002).

Puentedura (2014A) and Schrock (2016) posited that combining SAMR and Bloom's Taxonomy is a method teachers can utilize to help identify which level of the SAMR model a specific lesson is functioning. The relationship between SAMR and Bloom's Taxonomy is shown in Figure 4.

Figure 4. Relationship between SAMR and Bloom's Taxonomy (Schrock, 2013)



The model shown in Figure 4 depicts how the six categories of the Revised Bloom's Taxonomy relate to the four levels of SAMR. One aspect the model tends to reinforce is the hierarchical nature of Bloom's Taxonomy. Even though the revised Bloom's Taxonomy does permit some leeway in progressing through the categories (Almer, 2006), it is still rigid in how much a teacher can move from lower order thinking to higher order thinking without touching the other categories. SAMR, however, does not require a sequential or hierarchical application (Puendetura, 2014A). Movement between the different levels of SAMR can occur within or between lessons.

Another aspect the model in Figure 4 portrays is that SAMR is not just a scale of technology integration, but also a scale of pedagogical engagement (Swanson, 2014). The coupling of SAMR and Bloom's creates a natural drive to the upper, or higher order thinking levels of each framework (Puendetura, 2014). For example, a lesson that is identified at the redefinition level of SAMR may not have anything to do with technology, but rather, is supported by story-telling, real-world problem solving and/or thoughtful investigations (Swanson, 2014). As a result of this flexibility, lessons higher in the SAMR model and, thus, higher in Bloom's Taxonomy, produce higher results based on pedagogical content (Swanson, 2014; Puentedura, 2014). Due to this integration and flexibility, it is impossible to enter a classroom and determine what SAMR level a lesson is operating at without understanding how the lesson fits in the overall curriculum (Swanson, 2014).

Puentedura (2014) posited that, although the higher levels of SAMR equate to higher levels of Bloom's Taxonomy, the association does not necessarily need to exist. The levels of integration depend on what is needed. For example, redefinition does not require creating—as it could be only necessary and appropriate to use remembering (Puentedura, 2014). The integration of Bloom's and SAMR is to help teachers visualize what technology, pedagogy, and content might look like in a lesson that addresses higher order thinking. It is not intended to be rigid and unmoving. One should not consider the lines in Figure 4 and assume these lines are unable to move between the different categories of Bloom's Revised Taxonomy and the levels of SAMR.

SAMR (including the revised Bloom's Taxonomy) and TPACK are complimentary frameworks. The redefinition level in the SAMR framework requires close examination of the seven constructs within the TPACK framework. Teachers need to have an understanding of their TPACK skills in order to create new tasks for learning at the redefinition level in SAMR. Expert teachers (consciously and unconsciously) simultaneously integrate technology, pedagogy, and content every time they teach (Mishra & Koehler, 2008).

SAMR, as well as TPACK, are considered essential frameworks with respect to successful technology integration in classrooms. Early adopters (before 2000) of educational technology did not receive the amount of professional development or pre-service training to manage and understand the relationship between pedagogy, content, and technology. Without these skills, achieving the redefinition level within the SAMR framework was elusive to many teachers.

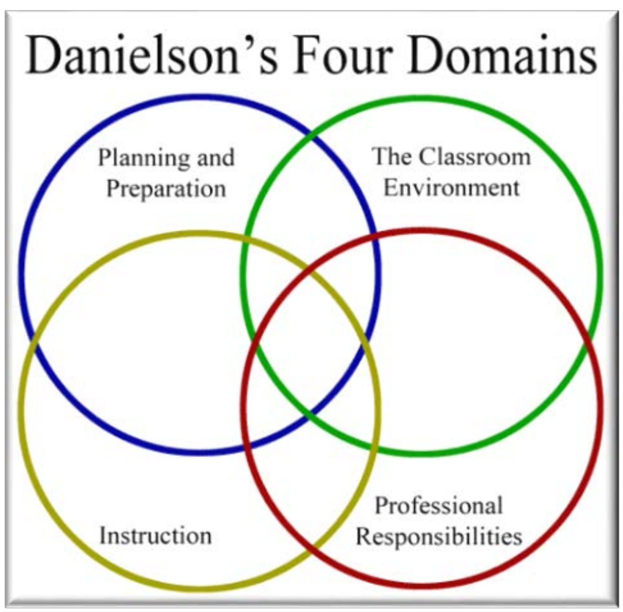
Teacher Evaluation/Effectiveness

The passage of the No Child Left Behind Act of 2001 initiated a federal focus on implementing rigorous teacher evaluation systems. Federal grants were created to assist states in establishing or enhancing evaluation systems to improve teacher and principal quality (USDE, 2014a). Since 2005, Pennsylvania has received over $1 billion in Title II, Part A SEA Awards (USDE, 2014b).

Pennsylvania enacted Act 82 in June of 2013. Act 82 provides for educator effectiveness based on four domains (PA Bulletin, 2013, para.9). The four domains are based on the Danielson Group's Framework for Teaching. The Framework for Teaching has, by merit and by default, become part of the foundation for efforts to improve teacher evaluation in the U.S. (Milanowski, 2011). The purpose of educator effectiveness is to provide a method to more effectively evaluate classroom teacher performance and ultimately impact student learning, achievement, and growth (PA Bulletin, 2013, para. 18). Teachers are the single most important ingredient in student success (New Jersey State Advisory Committee to the U.S. Commission on Civil Rights, 2010) and the educator effectiveness evaluation seeks to improve teaching through observation and multiple data points. Examining the evaluation results provides administration with a method to understand which teachers are being more successful in the classroom and ultimately resulting in more successful students.

The four domains of the Danielson Framework are shown in Figure 5. The framework consists of four domains: (1) planning and preparation, (2) the classroom environment, (3) instruction, and (4) professional responsibilities.

Figure 5. Four Domains of the Danielson Framework (Hartman, 2012)



The domains are subdivided into 22 components and 76 smaller elements (Danielson Group, 2013). In the Pennsylvania Educator Effectiveness model, the Danielson Framework accounts for 50% of a teacher's effectiveness score. The four domains are part of the observation and practice component of teacher effectiveness.

There are three other major components that comprise the remainder of the teacher effectiveness score in Pennsylvania. First, there is Building Level Data/School Performance Profile that accounts for 15% of the teacher's rating. This effectiveness measure examines data such as indicators of academic achievement (PSSA, PASA, Keystone exams, & SAT/ACT), indicators of closing the achievement gap for all learners (progress towards proficiency for all students who take PSSA, PASA, and/or Keystone exams), indicators of closing the achievement gap for historically underperforming students (students with disabilities, English language learners, and economically disadvantaged students), indicators of academic growth (PVASS), and other academic indicators (Pennsylvania Department of Education, 2014a). Second, there is Teacher Specific Data that accounts for 15% of the teacher rating. This effectiveness measure examines student performance on assessments, PVASS 3-year rolling average, IEP goals progress, and LEA developed rubrics. Finally, there is elective data that account for 20% of a teacher's rating. This effective measure examines items such as district designed assessments and examinations, nationally recognized standardized tests, industry certification examinations, student projects and student portfolios pursuit to local requirements.

The previously defined teacher effectiveness model is called the Formal Observation mode (Pennsylvania Department of Education, 2013). In addition to formal observation, the PDE also provides a Differentiated Supervision mode. The Differentiated Supervision mode recognizes the amount of time and intensity the Formal Observation mode requires and allows for consideration of the level of experience, the effectiveness, and professionalism of teachers (Pennsylvania Department of Education, 2013). Within the Differentiated Supervision mode, there are three possible modes to choose from: (1) peer coaching, (2) self-directed/action research, and (3) portfolio mode (Pennsylvania Department of Education, 2013; PSEA, 2016; Kwolek, 2014). As with the Formal Observation mode, Differentiated Supervision requires alignment with the four domains of the Danielson Framework for Teaching, and the principal must provide ratings in all four domains (Pennsylvania Department of Education, 2103; PSEA, 2016). Many teachers want to use the Differentiated Supervision mode; however, teachers are required to participate in the Formal Observation mode once every evaluation cycle (which can be between three or four years depending on the district) (Pennsylvania Department of Education, 2013, PSEA, 2016).

Teachers play a significant role in student learning. The product of teaching is student achievement and teachers have a measurable impact on student learning (Stronge et al., 2011). The intent of teacher evaluation systems is to improve student achievement (Kwolek, 2014). However, teaching is a complex phenomenon involving a high-level of integration between pedagogy, content, school contexts and learning characteristics. Teacher evaluation systems must keep the interaction foremost in determining what constitutes an accurate and fair methodology of rating teachers. When high-stake evaluations are used, careful consideration should be given to the validity of using teacher input, the teaching process, and student learning as measures of teacher performance (Stronge et al., 2011; Kwolek, 2014)).

The Pennsylvania Educator Effectiveness model is one of many evaluation systems based on the Danielson Framework. Although Pennsylvania has three additional components to their evaluation, the observation/practice component accounts for 50% of a teacher's rating. Considering the high percentage of teacher ratings the Danielson Framework is utilized for indicates the belief that Pennsylvania's framework has the ability to accurately measure teacher performance. Malinowski (2011) examined Danielson's Framework for Teaching (FFT) found:

> the evidence…so far on the FFT is limited, but it does suggest that using evaluation scores for consequential decisions can be justified, and that at least some of the practices described by the FFT are associated with student learning, at least as the latter is represented by value-added"
> (p. 28).

Value-Added Measures

Pennsylvania, like other states, goes beyond Danielson's framework for teaching and uses the Pennsylvania Value-Added Assessment System (PVAAS) as a tool to measure teacher performance. PVAAS is based on the EVAAS methodology. Value-added measures can be a number of different testing options from locally created assessments to commercially available standardized test and end of year tests (Pennsylvania Department of Education, 2014a). For teacher evaluation, Pennsylvania has chosen a three-year, rolling average of PVAAS scores as the value-added measure.

Implementation of PVAAS scores in teacher evaluation is still in its infancy across Pennsylvania. PVASS three-year rolling average data are just starting to be collected. As part of a teacher evaluation tool, some researchers believe there is too much uncertainty in value-added systems to be an accurate part of the evaluation score. Kwolak (2014) posited that "other major influencers on student outcomes are content variables" that do not accurately represent teacher effectiveness (p. 14). In Pennsylvania, there has been controversy over the timeliness and accuracy of PVASS and the impact it has overall on teacher evaluations.

Value-added measures can incorporate different covariates, such as demographic characteristics, and use different estimation approaches (Gill, English, Furgeson, & McCullough, 2014). PVAAS is intended to measure student learning for both individual students and groups of students (Pennsylvania Department of Education, 2015). A significant aspect of value-added systems, such as PVAAS, is the differentiation between achievement and growth. Achievement is defined to; (1) measure a student's performance at one single point in time, (2) have a high correlation to a student's demographic characteristics, (3) use standards as method to compare student performance, and (4) be a significant factor in post-secondary opportunities for students. Alternatively, growth is defined to: (1) measure a student's growth across time (across multiple years), (2) not correlate to a student's demographic characteristics, (3) only compare student performance to his/her own previous performance, and (4) be critical in ensuring a student's future academic success (Pennsylvania Department of Education, 2014a). By providing both measures (achievement and growth), schools and teachers can better understand the impact they make on students.

1-to-1 Technology Deployments

Schools have attempted to utilize technology to transform learning since the implementation of the first personal computers. Since the early 1980s, technology has been infiltrating the school environment with the last two decades seeing the greatest implementation of technology to improve student learning. The introduction of devices, such as the Apple iPad and the inexpensive Google Chromebooks, has rekindled many school districts' desires to plunge ahead with 1-to-1 initiatives. The literature is very clear that technology, itself, has no impact on student learning or achievement (Delgado, Wardlow, McKnight, & O'Malley, 2015; Takahashi, 2011). There have been studies which discovered improvements in learning, but the consistency and replicability of these studies has been difficult. These studies do not indicate that the use of technology in schools lack value, merit, or positive influence. Researching technology's impact on students is influenced by a multitude of confounding and covariate variables. Recent research is starting to recognize these challenges and has begun adjusting methodologies to address them.

Lynch (2015) identified four major contributions technology has made to the classroom: (1) collaboration, (2) information gathering, (3) remote learning, and (4) teacher preparation. The Kurzweil Blog Team (2015) defined five positive effects technology has had on teaching and learning: (1) supplementing teaching tools, (2) motivating students to learn, (3) creating environments that permit students to learn at their own pace, (4) identifying additional resources for students, and (5) preparing students for the future. All of these contributions and effects may be true; however, there is a paucity in the research to support these claims. Nonetheless, research is indicating that technology is an influencer in areas such as student engagement, reduced discipline issues, and instructional practices (Williams & Larwin, 2016; Russell, Bell, & Higgins, 2004). Zucker (2004) developed a framework for researching 1-to-1 initiatives. With Zucker's (2004) expectations that the critical features of 1-to-1 initiatives vary, the critical features of differing technologies should not be expected to be identical. Williams and Larwin (2016) discovered that differing critical features were not the leading factor in successful 1-to-1 implementation; rather, they posited implementation fidelity is a greater factor in the success of 1-to-1 implementation than the device itself, and can lead to a greater impact on student learning. Other technology leaders and school officials have concurred with implementation being a key factor in 1-to-1 success (Schaffhauser, 2014).

Many districts have been successful in separating 1-to-1 initiatives from student achievement. These districts have focused on the other positives technology provides students (Lynch, 2015; Kurzweil Blog Team, 2015). Based on much of the research, these districts are most likely correct in distancing student achievement and learning from technology. However, if student learning is the goal of education and districts are expending large sums of money (on devices, networking, and professional development), the relationship between technology and student learning cannot be totally ignored. Williams and Larwin (2016) found that 1-to-1 initiatives reduce discipline issues, increase attendance, generally improve language arts scores, do not consistently change math scores, and lead to instructional practice changes (2016). Russel et al. (2004) also discovered that writing occurred six times more often in 1-to-1 scenarios versus shared laptop carts, and that the structure of the classroom changed with 1-to-1 deployments.

When 1-to-1 deployments are utilized, and the students are allowed to take the devices home, there is also an impact on learning. Russell et al. (2004) found that students in a 1-to-1 initiative were more likely to use the technology at home for more academic purposes than students in the shared laptop scenario (students only had the devices for one week, every five weeks). Teachers in the 1-to-1 initiative were more inclined to create lessons and assignments centered on the use of technology and, therefore, may influence the students' use of technology at home—the 1-to-1 students needed to do more academic work because it was required. However, Williams and Larwin (2016) discovered that taking technology home had a positive impact on performance.

A key discovery is the change in instructional practices and the classroom structure (Williams & Larwin, 2016; Russel, 2004). These changes are represented in increased student engagement, levels of inquiry, depth of understanding, motivation, and self-esteem (Schaffhauser, 2014; Ohara 2014), which are all related to increased student performance. Of particular interest is the relationship between changes in instructional practice, classroom structure and the levels of the Revised Bloom's Taxonomy and SAMR utilized within the classroom. Although this research is not about 1-to-1 technology, it is a variable to be considered in the analysis with many schools who are in the process of 1-to-1 deployments.

Learning Processes and Technology

The TPACK and SAMR frameworks, as well as the Danielson Educator Effectiveness model, measure levels of teacher self-efficacy, technology integration, and educator effectiveness in the classroom. However, technology changes learning process and opportunities within the classroom. Technology expands learning opportunities, tears down classroom walls and barriers, and causes a shift in the role of teachers and students (Purdue University Online, 2017). Brady (2015) noted that technology, with its increased collaboration qualities and inherent ability to extend student contact and engagement beyond the confines of the local school building (USDE, 2016), provides for a genuine learning experience. Students experience greater access to information and increase their information gathering skills with technology. These underlying aspects of technology integration in schools are critical for students in the 21st century; However, these technology benefits may influence student achievement and growth but may not be represented in the results of PVAAS data.

Twenty-First Century Skills

As we are rapidly ascending through the second decade of the 21st century, there is still discussion about what 21st century skills students need to possess in order to be successful. Although 21st century skills can easily be associated with the needs of the 21st century work place, 21st century skills are not new (Brusic &Shearer, 2014; Rotherham & Willinham, 2009). Critical thinking, problem solving, collaboration, and creativity have been around since the 1980s when the National Aeronautics and Space Administration (NASA) funded the Mission 21 program (Brusic et al., 2014). What is new is the technological advancements since the 1980s that change how schools approach developing 21st century skills. Rotherham and Willinham (2009) were concerned that learning these skills is still more by luck and not by design. Today, the approach to 21st century skills needs to be universal, with schools being very deliberate in changing teaching strategies.

Berry states that 21st century learning must include the 3 Cs of creativity, communication, and collaboration (Rich et al., 2010). Cator posited that critical thinking skills must also be included (Rich et al. 2010). Others would suggest there are seven Cs including cross-culture understanding, computing/ICT literacy, and career and learning self-reliance (Education 2020, 2017). However, the accelerated changes in our society and work places make defining 21st century skills difficult. Chen stated that 21st century learning should not be controversial as “it is simply an effort to define modern learning using modern tools” (Rich et al., 2010). Chen and Muson noted that there is a difference in knowing things and finding out things—student must be able to locate, acquire, and create knowledge (Rich et al., 2010).

Stanbury (2011) identified five characteristics of effective 21st century educators: (a) anticipates the future, (b) is a life-long learner, (c) fosters peer relationships, (d) teaches and assesses all levels of learners, and (e) is able to discern between effective and non-effective technology. These characteristics have varying levels of difficulty. Specifically, rapid technology changes make it difficult for teachers to be able to easily discern between effective and ineffective technologies. The TPACK framework and the SAMR/Bloom’s Revised Taxonomy can assist teachers in understanding technology’s role and effectiveness. In conjunction with Bloom’s Revised Taxonomy, the International Society of Technology in Education (ISTE) outlines the core skills students require thought the ISTE NETS protocol (Education 2020). These relationships identify the interconnectedness of teachers, students, technology, and learning processes, as well as the potential for relationships between these elements.

Literature Gap

The TPACK framework is designed to help prepare teachers to integrate technology successfully by not isolating technology training and understanding. Rather, it makes technology a critical ally of pedagogy and content in the learning process. TPACK evaluation is intended to measure the level of teacher self-efficacy towards technology, pedagogy, and content in the creation and delivery of learning experiences.

The SAMR framework considers the level of technology integration within the classroom. It is specific to understanding at what level of technology integration a teacher is utilizing within specific assignments and the classroom as a whole. SAMR and TPACK are tightly coupled, with each framework contributing to the success of the other. For example, as teachers create learning experiences using the TPACK framework, their use of technology will be determined by which level of the SAMR model the planned activity best utilizes.

Educator effectiveness/evaluation has been examined and determined to be a key factor in some areas of student learning (Stronge et al., 2011). States continue to migrate towards more rigorous teacher evaluation systems and use these systems to make critical decisions regarding teachers. Milenowski (2011) stated that the Danielson Framework for teaching does have influence on at least some aspects of student learning--specifically when value-added measures are involved. In Pennsylvania, the teacher effectiveness model does not explicitly identify technology as a component of the evaluation. However, as school districts continue to invest in technology, specifically 1-to-1 deployments, there must be some understanding established as to the impact teachers have when utilizing technology to influence student learning. Value-added measures, as part of teacher evaluation models, indicate that this type of measurement has some merit in identifying teacher effectiveness.

This study is significant in that it focuses on examining multiple factors that influence student academic growth. Specifically, this study examined the relationships between teacher evaluation, TPACK self-efficacy, level of SAMR integration, and student academic growth. The literature reveals a paucity of research that examines student academic growth from the perspective of aggregating these variables.

Summary

This chapter has examined the research base for the TPACK and SAMR frameworks, the Pennsylvania Teacher Evaluation model based on the Danielson Framework, and the Pennsylvania Value Add Assessment System (PVASS). Research indicates that these frameworks have some influence on student academic growth.

The literature indicates that TPACK, although considered complex by some researchers and practitioners, is a best-practice framework to elevate teachers to understanding the relationship between technology, pedagogy, and content. The measurement of TPACK understanding is content based, and it can be difficult to establish measures for TCK and TPK. However, carefully constructed surveys can accurately measure TPACK within specific content areas.

Educator effectiveness/evaluation has been well established as a method to identify teachers who will impact student academic growth the most. In Pennsylvania, the Danielson Framework for Teaching accounts for 50% of a teacher's evaluation. There are also three additional aspects of the Pennsylvania Educator Evaluation model that account for the other 50%. One element is student academic growth through the PVAAS system. The ability for the FFT to influence student academic growth (at least, when value-added measures are considered) and the value-added measure of PVAAS warrants further investigation and understanding of technology's impact on student academic growth. The following chapter discusses the methodology utilized in this research study to investigate the relationship of TPACK, SAMR, teacher effectiveness, 1-to-1 technology deployments, and student academic growth.

Chapter 3

Methodology

There has been a plethora of studies that indicate technology, itself, does not impact student learning. Factors such as the teacher, professional development, access to technology, and students are all influencers in student learning. For purposes of this study, student learning is defined as student academic growth based on the Pennsylvania Value-added Assessment System (PVASS). The purpose of this study is to examine the impact Teacher Technology Self-efficacy (TPACK), the teachers' recorded SAMR level, and Teacher Effectiveness have on student academic growth (PVASS).

A quantitative approach was used for this research. A main tenet of quantitative research is to answer specific hypotheses or theories through the gathering of numeric data. The resulting statistical analysis can be used to identify relationships and generalize findings. All data collected in this research project was represented by nominal, ordinal, or ratio scale measures. Other approaches, such as qualitative and mix method, were considered. However, these methods do not adequately address the specific hypotheses this research sought to answer, as they are designed to be oriented towards understanding the viewpoint of participants. The quantitative method provided descriptive and inferential statistics which, with careful analysis, renders the potential for generalizable findings.

Study setting

This study examined the impact on student academic growth scores measured via the Pennsylvania Value-added Assessment System (PVASS). There were two different growth methodologies used in PVAAS--one for grades 3-8, tested consecutively (English Language Arts/Literacy, and Math), and one for subjects not tested across grades, such as science (in grades four and 11). This study focused on PVAAS scores in eighth grade for literacy and math. Testing for literacy and math are completed every year for grades three through eight, with the focus of this study on grade eight teachers.

Population and Sampling Plan.

There was variability between school districts with regard to teacher training, teacher evaluation scoring, student population, and technology implementation approaches. Of these, technology implementation is the most difficult to account for. Each district deploys a different strategy, timeframe, and strategic goals when implementing technology. Therefore, the different approaches could significantly affect the variables in this study. Variability was reduced by selecting schools that are served by the same educational service agency in Northwest Pennsylvania. The educational service agency (ESA) helps reduce the variability, through the common training of principals, on teacher evaluations. Furthermore, the ESA also provides training to school district staff on instructional technologies across curricular areas, resulting in some common training between districts.

Schools within the ESA service area with similar data were selected using the information from the National Center for Education Statistics (NCES) public school common core data. The data examined from NCES to determine participation was (1) grade span of the school, which must include grade 8, (2) locale, (3) Title I school status, and (4) free and reduced lunch eligibility. The free and reduced lunch eligibility was translated into the Federal E-Rate discount percentage for comparison of schools. To meet the primary selection criteria, eighth grade must have been part of the school's grade span. There must have been two or more schools that had the same locale classification, Title I classification, and approximate E-Rate discount percentage. For example, there must have been at least two schools with a rural locale, were Title I, and were in the same E-Rate discount group. The E-Rate discount groups are: (1) 0-29%, (2) 30-59%, and (3) 60% and over.

Instrumentation

Four instruments (TPACK Survey, SAMR/Blooms Survey, Teacher Evaluation and PVAAS data) were utilized to gather data in this research study. The four instruments are a combination of surveys, completed evaluation forms, and state generated teacher specific data on academic growth. Data were gathered only for eighth grade mathematics and language arts teachers within the participating schools.

Teacher TPACK Survey

Teacher Self-efficacy, with regard to the teacher's TPACK level, were gathered using a modified survey created by Schmidt et al. (2009) for pre-service teachers. A copy of the modified inventory is provided in Appendix A. The questions specific to undergraduate college courses taken and experiences were removed. The changes made to the Schmidt et al. (2009) survey by Landry (2010) that addressed content specific to mathematics were included. In addition, content specific questions regarding language arts/literacy were added. Teachers answered the TPACK survey questions using one of the following options: Strongly Disagree, Disagree, Neither Agree or

Disagree, Agree, Strongly Agree. The answers for TPACK specific data were translated into nominal data using this method:

- No answer = 0;
- Strongly Disagree = 1;
- Disagree = 2;
- Neither Agree or Disagree = 3;
- Agree = 4; and
- Strongly Agree = 5

Additionally, other data gathered from the TPACK survey were translated as outlined in Table 3.

Table 3. *Demographic Data to be Collected with TPACK Inventory*

Question	Answer values	Nominal Values
Gender	Male Female	1 2
Age range	21-28 29-35 36-42 43-51 52-61 62 and older	1 2 3 4 5 6
Years in Teaching	1-4 5-10 11-20 Over 20	1 2 3 4
Hours of Professional Development	1-9 hours 10-20 hours Over 20 hours	1 2 3

The psychometric properties of the TPACK survey were not reported and indicated. Reliability estimates were computed with the study sample and provided in Chapter 4.

SAMR Level

The level of SAMR a teacher is achieving was gathered through principal reporting during the final teacher evaluation of the school year. To help assist in determining the SAMR level, Bloom's Revised Taxonomy was utilized. The Revised Bloom's Taxonomy is described in Table 4.

Table 4. *The Revised Bloom's Taxonomy*

Bloom's Revised Taxonomy Level
Creating Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
Evaluating Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.
Analyzing Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.
Applying Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.
Understanding Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.
Remembering Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.

The SAMR framework is defined in Table 5.

Table 5. *The SAMR Framework*

SAMR Level
Redefinition Technology allows for the creation of new tasks previously inconceivable.
Modification Technology allows for significant task redesign.
Augmentation Technology acts as a direct tool substitute with functional improvement.
Substitution Technology acts as a direct tool substitute with no functional change.

Principals were asked to select the level of SAMR they believed was most frequently obtained in classroom lessons based on observations in the classroom and by other classroom artifacts, such as lesson plans. Principals were asked to use the Revised Bloom's/SAMR evaluation matrix to select the level. A copy of the Revised Bloom's/SAMR evaluation matrix can be found in Appendix B.

Teacher Evaluations

Pennsylvania Educator Effectiveness evaluation data was collected for the participating teachers. Only the Classroom Teacher Observation and Practice elements were gathered, since they represent the four domains of the Danielson Framework for Teaching. Other data represented on the evaluation form were disregarded. The PDE identified two modes of supervision for teacher effectiveness—formal observation and differentiated supervision. The formal observation mode is accomplished through formal and informal observations measured by research-supported best practices. A collaborative reflection of the observed data results in a focused approach to creating a professional development designed to improve instructional practices and positively influence student achievement. The differentiated supervision mode considers factors such as level of experience, the effectiveness and professionalism of teachers, as well as the passion and time commitment to utilizing formal observation. A large component of differentiated supervision is teachers creating action plans that will address professional development and are oriented towards teacher specific needs and interests. However, districts are not required to implement differentiated supervision according to the Pennsylvania Department of Education.

Districts can determine their protocols for assigning or offering the two different modes of teacher effectiveness. A building may have a mix of the two evaluation modes occurring simultaneously. Regardless, both modes require a score to be completed for each teacher in the four domains every year. For the purpose of this study, if a teacher was evaluated using the formal observation mode, their observation-type data was set to 1. Teachers evaluated utilizing the differentiated supervision mode had their observation-type data set to 2. Only the final year end evaluation data were gathered.

Pennsylvania Value-Added Assessment System

PVASS is part of Pennsylvania Educator Effectiveness. The PVAAS scores were based on building level schools. However, due to implementation issues with PVAAS scores, utilizing the PVAAS rating within the Educator Effectiveness model was controversial at this juncture in time. The PVAAS scores collected were the three-year rolling average and were teacher specific. Teachers who did not have three years of data to create the rolling average still had PVAAS scores. PVAAS scores were gathered for each class section the teacher instructs.

This research is not concerned with the specific type of technology utilized in the classroom. Technology can be a plethora of devices and tools that may be utilized to achieve any of the levels in the SAMR framework. Teachers were tracked as having a 1-to-1 initiative (value of 1) or not (value of 2) for analysis purposes. Teachers utilizing Bring Your Own Device models had a value of 3 assigned to them.

Data Collection

Data collection was based on the 16-17 school year. Teacher evaluation data, SAMR level, TPACK surveys, and PVAAS data were collected during and for the same school year. PVAAS data also included results from the 15-16 school year. Data collection took place from January through August of the school year. The teacher surveys to measure TPACK took place from March through June of the evaluation year. The TPACK survey was lengthy and required approximately 15 minutes for teachers to complete. The survey included a conditional question to determine if the participant was a language arts or mathematics teacher. Depending on their answer, the participant was given the appropriate questions for the content area they taught.

Teacher evaluations can contain multiple sets of data gathered throughout the school year, depending on the mode of supervision. Teacher evaluation scores were gathered for the current school year, using only the final evaluations. Depending on the school procedures and timeline, principals could complete the final teacher evaluation from April through the end of the school year. The evaluation data gathered throughout the school year was interesting and provided insight into the teacher evaluation process and teacher growth; however, this research was only concerned with the overall evaluation rating of the teacher for the entire year. Part of the final teacher evaluation also included the principals completing the SAMR level matrix. The completed matric was attached to the final teacher evaluation forms. Principals were to select the level of SAMR most often achieved in the classroom based on classroom observations and other classroom artifacts, such as lesson plans. Since SAMR is not always understood or practiced in all districts, the SAMR level matrix included Bloom's Revised Taxonomy to help determine an appropriate SAMR level.

Teacher specific PVAAS scores were gathered for the most recently reported PVAAS data. PVAAS data are generally provided to schools in late summer or early fall. PVAAS scores were collected for all groups of math and language arts students for which a teacher was responsible. The formula the PDE used to determine if a teacher receives a PVASS score for a specific group of students can result in some groups not having PVAAS data. Groups of students with no PVAAS score were removed from the research.

The compete research plan is summarized in Table 6.

Table 6. *The Research Plan*

Timeframe	Description	Data to Collect/Process to review
January 2017	Meet with Superintendents to confirm participation in the research. Confirm middle schools participating.	Review the research project and what will be needed from participants.
March - June 2017	Meet with participating principals - With the number of potential schools, this may be virtual.	Review the research project and how they will record their SAMR observation within the educator effectiveness process. We will also discuss providing the teacher specific PVAAS scores. Principals will complete an additional SAMR report, which consists of circling the level of SAMR they most often observe in the classroom.
March - June 2017	Contact participating teachers—With the number of potential participants, this may be virtual.	Review the research project and explain the TPACK survey they will be required to complete. The survey will be given online using either Survey Monkey or Google forms. Teachers will also be informed about what and how their educator effectiveness scores and teacher specific PVAAS scores will be gathered
April - May 2017	Principals complete educator effectiveness evaluations including the additional SAMR element.	Copies of the educator effectiveness form and SAMR reporting for each

		teacher will be gathered. This will be the teacher educator effectiveness score for the 2016-17 school year.
March – June 2017	Teacher TPACK Surveys will be gathered.	The content specific survey data will be gathered. The results will reflect their self-efficacy for the 16-17 school year
June – October 2017	Teacher specific PVAAS data will be gathered.	The Pennsylvania Department of Education (PDE) will provide the PVAAS data to schools between June and October 2017. The timing of this data is subject to PDE release. Data will be for the 15-16 and 16-17 school year.
October 2017	Analyze data.	

Data Analysis

Appropriate methods of data analysis were used to establish the quality of this quantitative study. The data analysis was guided by the research questions. Descriptive and inferential statistics were appropriately utilized, taking into account the data types of the information collected. Regression analysis was used to further examine identified correlations.

Limitations

The weakness of this study is the reliance on Principal reporting on SAMR. Principals may be familiar with the Revised Bloom's Taxonomy, but may not be familiar with the SAMR model. The method of gathering data to determine the SAMR level can be confusing and requires principals to consider all of a teacher's instructional practices and quantify them for an entire year. The complexity may result in inaccurate reporting.

The sample population is based on a region defined by the boundaries of an Educational Service Agency (ESA). ESAs, especially entities serving rural populations, generally cover large geographic areas. There are differences between districts in the ESA service area that have not been accounted for in our selection process. These differences may indirectly affect the data gathered, such as teacher effectiveness scores. Although the ESA and the PDE provided training to principals in the ESA service area regarding completion of the Teacher Evaluation form, this does not eliminate inter-rater reliability issues. The Teacher Effectiveness model permits school districts to have some flexibility in the evaluation process that could influence the scores within the Danielson Framework for teachers.

Professional development is another area of weakness in the study. Every district is at a different point in their technology deployments and, therefore, most likely providing differing levels of professional develop opportunities and levels of rigor. One district may not focus on TPACK understanding, while another may spend a great deal of effort focusing on the TPACK elements. The same must be considered for SAMR. Districts may not address what SAMR is or have not equated it to the Revised Bloom's Taxonomy. These differences could affect teacher self-efficacy with regard to TPACK and principal reporting of SAMR data.

This research focuses solely on the teacher side of the classroom. Students do have some influence on the PVAAS data reported. However, student perceptions are not considered in how instruction influences student academic growth. As a result, any conclusions reached will be limited to the fact that only student summative PVAAS data, which measures student proficiency of academic standards (PSSA, 2017), is being used in analysis. Although criteria to select similar schools were utilized, the criteria were not designed to focus on student information and resulted in schools being selected that are generally the same demographically.

Chapter 4

Results

The current investigation sought to examine the impact of teacher technology self-efficacy (TPACK), the level of technology use in the classroom (SAMR), and teacher effectiveness (teacher evaluation) on student academic growth in eighth grade language arts and mathematics (PVAAS Growth Index). Data was provided from four primary variables: (1) Teacher Technology Self-efficacy (TPACK surveys), (2) Principal reported SAMR observations, (3) Principal year-end observations of teachers based on the Danielson Framework, and (4) Pennsylvania Department of Education generated PVASS student academic growth data. All data was based on the 2016-17 school year. PVAAS student academic growth scores included 2016 and 2017 results.

The first variable, Teacher Self-efficacy (with regard to the teacher's TPACK level) was gathered using a modified survey created by Schmidt et al. (2009) for pre-service teachers. The changes made to the Schmidt et al. (2009) survey by Landry (2010) addressed content specific to mathematics were included. In addition, content-specific questions regarding language arts/literacy were added. Teachers answered the TPACK survey questions using one of the following options: Strongly Disagree, Disagree, Neither Agree or Disagree, Agree, Strongly Agree. The answers for TPACK specific data were translated into nominal data using the following method:

- No answer = 0;
- Strongly Disagree = 1;
- Disagree = 2;
- Neither Agree or Disagree = 3;
- Agree = 4; and
- Strongly Agree = 5

The survey was administered using the online Survey Monkey tool. A copy of the modified inventory is provided in Appendix A.

The second variable, Principal SAMR Rating, was gathered through a paper-based evaluation tool. Principals indicated the level of SAMR (Substitution, Augmentation, Modification, or Redefinition) most often observed by the principal in the classroom of the participating teacher. The Principal SAMR Rating was translated into nominal data using the following method:

- Substitution = 1;
- Augmentation = 2;
- Modification = 3; and
- Redefinition = 4

A copy of the Principal SAMR evaluation tool is provided in Appendix B.

The third variable, Teacher Evaluation, was gathered from teacher year end evaluation forms. Principals across Pennsylvania have been trained to complete evaluations using the Danielson Framework. All participating districts used the four domains of the Danielson Framework. However, three districts provided an overall score for each domain and three provided only the individual item scores within the domain. For consistency, an average score was calculated for each domain from the individual item scores for the respective domain.

The fourth variable, PVAAS student academic growth scores, were gathered from the PVASS Teacher Value-added report. The Teacher Value-added report is generated at the building Principal level within the Pennsylvania PVAAS system. The report includes both academic growth measures and an academic growth index. The Academic Growth Index was used for analyses. An example of the Teacher Value-added report is provided in Appendix C.

The intended population for this investigation included 17 school districts served by an educational service agency in northwest Pennsylvania. The initial school contact for the study was the District Superintendent. Superintendents were introduced to the research project at a monthly Superintendent Action Committee (SAC) meeting. Initial interest was high, and a participation packet was distributed to each Superintendent. An example of the participation packet is included in Appendix D. After multiple months of repeated invitations to participate, only three school districts provided permission to collect data from their professional teaching staff. Therefore, the resulting sampling frame was eight teachers. A total of six teachers responded, giving a 75% response rate.

Demographics

Participants self-reported that four were female and two were male. Table 7 provides the reported age distribution for the participants.

Table 7. *Age Distribution*

Age	Frequency	Percent
21-28	1	16.7
29-35	1	16.7
36-42	2	33.3
52-61	2	33.3

Respondents indicated that four have taught for 5-10 years, while two have taught for more than 21 years. One-half of the respondents indicated that they teach language arts while the other half teach mathematics.

Regarding technology professional development, three respondents indicated that they have had nine or fewer hours of technology professional development while three indicated that they have had more than ten hours of technology professional development. One respondent indicated the existence of a 1-to-1 program at their grade level, while the remaining five respondents indicated no 1-to-1 program. Fifty percent indicated that technology is available on mobile carts, while one respondent indicated having computers in the classroom. The remaining respondent indicated "I may use a mobile cart in my classroom or take my students to one of two computer labs."

Preliminary Analysis

Cronbach's Alpha (α) test of internal consistency was used to estimate the reliability of participant responses to the identified factors of the TPACK framework. The results of this analyses are presented in Table 8.

Table 8. *Reliability Estimates Based on Cronbach's Alpha*

Factor	Number of Items	α
TK	6	0.769
PK	8	0.914
PCK	3	0.698
TPK	8	0.970
CK-Math	11	0.738
CK-LA	11	0.904

As indicated above, all of the factors have an acceptable to excellent level of reliability according to Field (2013). Since all levels of reliability are within an acceptable range, the factor scores were computed via means, based on the guidelines of Schmidt, Baran, Mishra, Koeler, and Shin (2009) and Landry (2010). The descriptive statistics for the resulting factors are presented in Table 9.

Table 9. *Factor Descriptive Statistics*

Factor	Mean	SD	Skewness	Kurtosis
TK Factor	3.524	0.540	0.755	1.100
PK Factor	4.354	0.663	-0.944	0.163
PCK Factor	4.222	0.655	-0.254	-1.828
TPK Factor	3.521	0.860	-1.152	1.856
CK Factor	4.046	0.455	0.000	-2.972

Based on the above descriptive analyses, the factors appear to be normally distributed with acceptable levels of skewness and kurtosis (|2.0| and |5.0| respectfully, Field 2013). One-sample Kolmogorov-Smirnov Test also indicates that a normal distribution is tenable (p=.200) based on established guidelines (Field, 2013).

Research Questions

Research question one: *Does a teacher's technology self-efficacy influence the level of SAMR practiced in the classroom?* Data for this question were provided from two sources: (1) Principal's observation of teacher SAMR levels during walk-through observations, and (2) teacher reported technology self-efficacy factor scores (as indicated above). A Pearson's Zero Order correlational analyses was conducted in order to explore if associations exist between these scores. These data are provided in Table 10.

Table 10. *Correlation between SAMR level and TPACK Factors*

	SAMR Correlation	Sig.
TKFactor	0.328	0.525
PKFactor	-0.409	0.421
PCKFactor	-0.585	0.222
TPKFactor	-0.457	0.362
CKFactor	-0.716	0.110

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

As indicated above, none of the TPACK factors are significantly correlated with the SAMR levels observed by the Principals. Since there are no significant correlations, additional analyses of this data would be futile.

Research question two: *Does a teacher's technology self-efficacy influence the teacher's effectiveness rating?* Data for this question were provided from two variables: (1) Teacher's effectiveness ratings based on the four levels of the Danielson model, and (2) Teacher reported technology self-efficacy factor scores (as indicated above). A Pearson's Zero Order correlational analyses was conducted in order to explore if associations exist between these scores. These data are provided in Table 11.

Table 11. *Correlation Between TPACK and Danielson Category Averages*

	Danielson Domains			
	1	2	3	4
TKFactor	0.659	.906*	-0.225	-0.013
PKFactor	0.414	0.071	0.372	0.320
PCKFactor	0.230	0.000	0.166	0.365
TPKFactor	0.234	0.194	0.140	0.448
CK Factor	0.122	-0.395	0.401	0.396

* Correlation is significant at the 0.05 level (2-tailed).

As indicated above, only Danielson Domain Two revealed a significant correlation with the TK Factor. It was not expected that category one and four would reveal a relationship because these are non-instructional domains. Based on these analyses, a regression is appropriate to further examine the relationship between the TK factor and the Danielson Domain Two. The significant regression model is therefore stated:

$$Y_i = b_0 + b_1X_1 + e_1$$

This model indicates that for teacher "i", the expected Danielson Domain Two score will be equal to the slope intercept (b_0), plus the slope for TK Factor Score (b_1X_1), and error associated with participant i (e_1). Based on the results from the current investigation, the resulting model is:

$$Y_i=.087+\text{TK Factor Score } (.682)$$

Based on the regression analysis, the TK factor response explain 82% (R^2=.82) of the variance in the Danielson domain two scores.

Research question three: *Does a teacher's technology self-efficacy and teacher effectiveness rating influence student academic growth?* Data for this question were provided from three variables: (1) Teacher's effectiveness ratings based on Danielson's Framework domains two and three, (2) Teacher reported technology self-efficacy factor scores (as indicated above) and (3) PVAAS academic growth index scores for 2016 and 2017. A Pearson's Zero Order correlational analyses was conducted in order to explore if associations exist between these scores. These data are provided in Table 12.

Table 12. *Correlation Between TPACK, Danielson Category Averages, and PVAAS Index*

	PVASS16	PVASS17
SAMR	-0.044	0.548
TKFactor	0.192	-0.310
PKFactor	0.169	-0.197
PCKFactor	0.257	-0.430
TPKFactor	-0.033	-0.425
CK	0.353	-0.147
2Ave	0.006	-0.288
3Ave	-0.001	0.796*

* Correlation is significant at the 0.05 level (2-tailed).

As indicated above, the only significant relationship to the PVAAS Index was revealed between Danielson Domain three average and the PVAAS 2017 Index ($\alpha<.10$ due to sample size). Based on these analyses, a regression is appropriate to further examine the relationship between the PVAAS 2017 Index and the Danielson Domain Three. The significant regression model is therefore stated:

$$Y_i = b_0 + b_1X_1 + e_1$$

This model indicates that for teacher "i", the expected PVAAS 17 Index will be equal the slope intercept (b_0), plus the slope for Danielson Domain Three Average (b_1X_1), and error associated with participant i (e_1). Based on the results from the current investigation, the resulting model is:

$$Y_i = -6.144 + \text{Danielson Domain Three Average} * (3.496)$$

Based on the regression analysis, the Danielson Domain Three Average response explain 63.4% (R^2=.634) of the variance in the PVAAS 2017 Index. A complete copy of the results is provided in Appendix E.

Summary

Chapter four conducted analyses to answer three research questions:

1. *Does a teacher's technology self-efficacy influence the level of SAMR practiced in the classroom?*
2. *Does a teacher's technology self-efficacy influence the teacher's effectiveness rating?*
3. *Does a teacher's technology self-efficacy and teacher effectiveness rating influence student academic growth?*

Descriptive statistics were conducted to provide summary information about the research participants. Preliminary analyses were conducted to determine the reliability of the data. Cronbach's Alpha (α) test of internal consistency was used to estimate the reliability of the TPACK factors. Cronbach's Alpha (α) indicted that scales were highly reliable (Field, 2013). A Pearson's Zero Order correlational analyses were conducted for each of the research questions.

The Pearson's Zero Order correlation results indicated there were no significant correlations between the TPACK factors and the SAMR scores. The Pearson's Zero Order correlational analysis for TPACK factors and Teacher Evaluation factors, revealed only one significant correlation between the TK factor and Danielson's Domain Two. To further examine the identified correlation, a regression analysis was conducted. The regression analysis revealed that the TK Factor explains 82% (R^2=.82) of the variance in the Danielson domain two scores. The Pearson's Zero Order correlational analysis for the TPACK factors, Teacher Evaluation factors, and PVAAS 2016 and 2017 scores, reveal a significant correlation between Danielson's Domain Three and the PVAAS 2017 scores. To further examine this relationship, a regression analysis was conducted. The regression analysis revealed that Danielson's domain three explains 63.4% (R^2=.634) of the variance in the PVAAS 2017 Index.

Chapter 5

Discussion

This chapter discusses the overall research project. A brief summary of how the research materialized will be presented followed by: (a) examination of the data gathering process, (b) review of the three research question results, and (c) a summary of the research project. Within the discussion of the three research questions, specific limitations to each variable will be addressed, along with the implications for future research.

Schools are investing large sums of money in student centered instructional technology. Nagel (2014) predicted the increase in instructional technology purchases over the past decade to continue, with spending expected to reach $19 billion by 2019. Other initiatives, such as the Federal E-rate Modernization Order of 2014 (Federal Communications Commission, 2014) have contributed to the renewed effort by school districts to implement 1-to-1 programs. Simultaneously, new teacher evaluation systems are being implemented to measure teacher performance in a multitude of professional areas, including components from school performance data (such as value-added assessment results). Tax payers, parents, and legislators are questioning the effectiveness and rate of return by these resources. These questions place teachers, principals, and district administrations under scrutiny regarding student achievement and academic growth. The intent of this research was to examine the following research questions:

1. Does a teacher's technology self-efficacy influence the level of SAMR practiced in the classroom?

2. Does a teacher's technology self-efficacy influence the teacher's effectiveness rating?
3. Does a teacher's technology self-efficacy and teacher effectiveness rating influence student academic growth?

Educational technology is not new to schools and has been a factor in the education process for hundreds of years. Educational technology (more specifically, instructional technology) includes many types of devices, such as pencils, abacus, chalk, blackboards, and flash cards (Mishra & Kohler, 2008). However, the focus, recently, has been more oriented towards computers, tablets, smartphones, interactive whiteboards, and a plethora of other modern electronic devices. Proponents of 1-to-1 deployments support the use of educational technology in the same fashion as a pencil. Opponents will argue that computers and tablets should be used in the same manner as specialty equipment, such as a microscope. Both sides of this debate have merit, but schools continue to deploy technology in large quantities and at a very rapid pace. Upadhyaya (2013) estimated that as much as $5 billion per year is spent on educational and instructional technology and Nagel (2014) predicted the spending to increase to $19 billion by 2019. There does not seem to be any indication that schools will be diverting from their technology initiatives.

The goal of educational technology and the deployment of all these different types of technology is to improve student learning. In a study conducted by Stronge, Ward, and Grant (2011), "one common finding emerge[d]: Teachers have measureable impact on student learning" (p. 348). Teacher Quality (2010) and Stronge et al. (2011) asserted that teachers are, and have been, the most important factor in student achievement.

Research has looked at constructs that influence teacher technology self-efficacy (TPACK), the level of technology integration (SAMR), and teacher effectiveness (Danielson Framework). These constructs have been examined independently with a considerable amount of research on the TPACK Framework and the Danielson Framework. There is a paucity of research relating to SAMR. Similarly, no research was found examining TPACK, SAMR, and Teacher Effectiveness with relationship to Student Academic Performance.

Data Gathering

The design of this research included teacher specific data used for calculating school performance profiles (such as the Danielson Effectiveness Scores and the PVAAS Student Academic Growth Index). This information is sensitive and there is an ongoing debate over the accuracy of some of the data gathered through the Pennsylvania Department of Education processes. Due to the sensitivity of the data at both the district and teacher levels, district participation was approached through district superintendents. Initial discussions with superintendents indicated strong support for the research and the potential findings. However, after the initial discussions, superintendents started to decline participation because: (a) they felt it was too much additional work to ask the building principals to be responsible for, (b) they were not willing to approach their collective bargaining units about sharing the data, or (c) their collective bargaining units were not willing to participate. A former principal posited that the hefty requirements of the principals might lead to some districts not participating (personal communication, August 25, 2016). Three districts did complete all the required paperwork. The districts provided the contact information for building principals and teachers.

Teachers completed and returned their participation forms in a timely manner. Teachers were assigned participation numbers and the TPACK survey link was distributed to the teachers through e-Mail. Most teachers completed the TPACK survey timely, but several teachers required additional follow up. The TPACK survey responses were all completed prior to the release of the May 2017 PVAAS test scores (PVAAS scores were made available to school districts through the PVAAS portal on October 19, 2017). There were no comments received from participating teachers about the length of, or difficulty with completing, the TPACK survey. The instructions to teachers stated the survey should take approximately 10 minutes to complete. Based on the timestamps in the survey results, the time to complete the survey was six to 30 minutes. The version of the TPACK survey for this research may have required additional time to complete because of the additional content specific questions being asked. Researchers such as Niess (2013) and Zelkowski, Gleason, Cox, and Bismark (2013) discovered the importance of content specific questioning in achieving an increase in TPACK reliability.

Principals were required to provide two additional pieces of information for each participating teacher: (a) a copy of the teacher's evaluation form, and (b) a copy of the SAMR matrix. The teacher evaluation forms were submitted timely, but the format was slightly different for each district. The format differences did not affect determining the Danielson Domain Scores for the teachers. The SAMR matrix did create confusion for two of the principals. One principal misunderstood who was to complete the SAMR matrix—the teacher or the principal. The clarification was made regarding the principal's needing to complete the form. Another principal was unclear that they were only to select the level of SAMR most observed over the course of the year (one selection). Clarification was made regarding selecting the one level of SAMR most often observed in the classroom.

Principals were clear on which one of the PVAAS reports were required to produce the needed student achievement scores. All principals were able to generate the same report with the same PSSA scores. Some of the schools do both PSSA and Keystone tests. In districts where both tests are given, the PVAAS teacher report generated a separate report for both PSSA and Keystones. Keystone exams were discarded for this research. Also, not all teachers had the three-year rolling average available. Since all teachers had 2016 and 2017 PVAAS PSSA scores available, only two years of scores were utilized.

Implications from Data Collection

Teacher evaluations and PVAAS are extremely individualized information and the expectation was teacher participation may have been diminished due to this individualization. Securing participation was much more challenging than the actual collection of TPACK surveys, SAMR Matrices, Teacher Evaluations, and PVAAS PSSA scores. Superintendents appeared to have deep concerns over principal workloads and collective bargaining unit support. The districts that participated indicated no concerns over the collection of data or the security used to protect individual teacher information. The researcher received no concerns from participating teachers. Based on the sampling frame of eight teachers and a 75% response rate, teachers appear to be willing to participate in research utilizing teacher specific data.

Future Research

The small sample size obtained for this research may have some influence on the actual data analysis and therefore, some relationships may have been unidentified. A simple power analysis calculation, based on Total sample size = $[(Z_{\alpha} + Z_{\beta})/C]^2 + 3$ (Field, 2013) indicates that 53 participants would have been needed to find significant results between SAMR and TK Factor (see Table 10). So, the lack of sample size did hinder the potential conclusions of this research. Teachers and principals did not indicate any concerns over the data collection or the type of data collected. The reluctance of superintendents and collective bargaining units to participate warrants further investigation. Rotherham and Willinham (2009) were concerned that learning 21st century skills is still more by luck and not by design. Superintendents and collective bargaining units may be uncomfortable with how their district approaches professional development to improve both teacher and student 21st century skills. This discomfort may fuel concerns that any analysis of data related to technology will cast an unpopular view upon teachers and schools. Identifying the concerning factors may provide the opportunity for future researchers to increase the number of participating districts and teachers.

The results of the current research will also provide concrete examples of how the research was conducted, how the data was secured, and how the results were reported. Superintendents and collective bargaining units should feel more at ease with future research once they are confident the results do not permit the identification of any particular school district, school building, or individual teacher. The research was based on the aggregate information of eighth grade language arts and mathematics teachers.

The research questions were designed to evaluate TPACK, SAMR, teacher effectiveness and PVAAS student academic growth scores (using PSSA data) for the group of teachers. The results did not report specific teacher results.

TPACK and SAMR

Research question one asked: *Does a teacher's technology self-efficacy influence the level of SAMR practiced in the classroom?* The results of this examination identified no correlation between the teacher self-reported TPACK and the level of SAMR practiced in the classroom. The preliminary analysis of the TPACK scores indicated an acceptable to excellent level of reliability (Field, 2013). The reliability results were expected because the TPACK survey was modeled on a previous survey constructed and tested for content specific to mathematics (Landry, 2010). Language arts content questions were created using the same model as used for mathematics. Neiss (2013) and Zelkowski, Gleason, Cox, and Bismark (2013) discovered the importance of content specific questioning in achieving TPACK analysis. The modified TPACK survey for this research contained content specific questions. During the survey, teachers were asked which curricular area they taught, and the appropriate questions were presented.

SAMR ratings were provided by principal observation. Principals were to consider the level of SAMR most frequently observed in the classroom throughout the school year. Five of the principal ratings selected a SAMR level of substitution or augmentation. Only one rating selected modification. There were no redefinition ratings. Puentedura (2014) noted attaining the redefinition level is the goal and teachers need to focus on the goal when developing learning activities. As the literature review indicated, identifying the level of SAMR reached in the classroom can be difficult. Puentedura

(2014) posited that, although the higher levels of SAMR equate to higher levels of Bloom's Taxonomy, the association does not necessarily need to exist. The use of the Revised Bloom's Taxonomy was implemented to help identify areas where learning objectives can overlap different categories (Amar, 2006; Krathwohl, 2002). Principals not familiar with SAMR can leverage their understanding of technology integration by using the matrix in Appendix B to help determine the SAMR level most often observed in the classroom. The challenge for principals is the Revised Bloom's Taxonomy permits some leeway in progressing through the levels (Almer 2006), but it is still rigid in how much a teacher can move from lower ordering thinking to higher order thinking. SAMR, however, does not required a sequential or hierarchical application (Puentendura, 2014A).

Limitations

Based on the analysis conducted, the TPACK survey was reliable and valid. However, principals consistently rated teachers at the lower end of technology integration on the SAMR Matrix. There are several factors that may have contributed to the SAMR ratings. First, principals were asked to determine one SAMR rating for the entire year. The number of actual observations performed by the principals likely varied between districts and agreed upon collective bargaining unit teacher observations. It is possible that principals only observed teachers on days when technology was being used at the recorded SAMR ratings. Second, principals may not understand the different levels of the SAMR model. In areas where learning objects overlapped different categories, principals may have arbitrarily selected the lower SAMR rating (even with the guidance of the Revised Bloom's Taxonomy). Third, only one of the participating teachers had a 1-to-1 technology deployment. Without the technology prevalent in the classroom, the level of SAMR obtained in the classroom may be adversely affected. Common Sense Media (2015) identifies SAMR as a model for teachers to determine how they are using technology in their instruction. If observations of teacher SAMR level did not occur in the computer labs or other technology supplied areas of the school, the principal may have felt inclined to select a SAMR rating at a lower level. Finally, no information was gathered regarding how familiar principals were with the Revised Bloom's Taxonomy or SAMR frameworks. In conjunction with understanding either of the frameworks, being able to recognize the different levels of SAMR in a lesson should be considered.

Although teachers did not provide their own SAMR rating, teacher understanding of the SAMR framework and the differing levels of technology integration should be considered. Teachers who understand the framework and how instruction changes at the different levels may influence the principal SAMR ratings. One of the questions asked in the TPACK survey was "In the last three (3) years, how many hours of professional development have you received directly related to technology integration in your curricular area?" Fifty percent of participants said 0-9 hours and 50% said 10-20 hours. In both instances, this is not a large amount of professional development on a complex topic.

Future Research

The TPACK framework is well defined and has been used successfully in research projects. The SAMR framework has not been as extensively examined in the field, especially when examined with other factors such as TPACK. Future research will need to address the potential principal rating biases due to the complexity of the framework and the wide margin for interpretation of SAMR levels. Professional training for the participating principals could be utilized to ensure all principals are familiar with both SAMR and the Revised Bloom's Taxonomy. Instruction in how to identify the different SAMR and Revised Bloom's Taxonomy levels will also lead to data that are more reliable.

Increasing the participation size will also have an impact on the results. In the current research, only one school had a 1-to-1 deployment. It was not possible to examine if 1-to-1 initiatives resulted in principals having a different view and rating methodology than schools without 1-to-1. With larger participation, other relationships may present themselves. The three participating districts did not provide the diversity of school settings initially anticipated.

TPACK and Teacher Effectiveness

Research question two asked: *Does a teacher's technology self-efficacy influence the teacher's effectiveness rating?* The analysis of TPACK and Teacher Effectiveness ratings indicated a significant correlation between Technology Knowledge (TK) and Teacher Effectiveness ratings in Danielson's Domain Two (Classroom Environment). The analysis indicated that the TK Factor explained 82% (R^2=.82) of the variance in Danielson's Domain Two scores. Milanowski (2011) posits that the Danielson Framework for Teaching has, by merit and default, become part of the foundation for efforts to improve teacher evaluations in the U.S. Identifying Technology Knowledge (TK) as a significant factor in Danielson Domain Two scores is significant. With schools continuing to deploy 1-to-1 technology implementations, the influence of TK on teacher effectiveness should influence technology professional learning opportunities for teachers. Although there are proponents and opponents of the Pennsylvania Department of Education's implementation and use of the Danielson Framework, it is the methodology to be used for teacher evaluation in Pennsylvania. In this study, only the four domains of the Danielson Framework for Teaching were utilized.

Limitations

Based on the analysis conducted, the TPACK survey was reliable and valid. However, the Danielson Framework for Teaching scores was gathered from district level forms and all forms contained the same four primary domains. Some forms included sub-domain scores but did not provide the principal with the opportunity to rate the overall domain. Where sub-domain scores were available, the average of the sub-domain scores were used for the primary domain scores. Performing this calculation resulted in Danielson Domain Scores that were not integers.

Principals throughout Pennsylvania have been extensively trained on how to evaluate teachers using the Danielson Framework. All principals in this research would have received their Danielson training from the same educational service agency. This common training provided similar understanding of the framework and consistency in completing the Teacher Effectiveness Forms. In reviewing the Teacher Effectiveness Scores, principals consistently scored teachers as proficient (four of six in Domain One, five of six in Domain Two, five of six in Domain Three, and six of six in Domain Four). The consistency in principal reported scores could be attributed to: (a) the common training, (b) principals are reluctant to score teachers as "Needs improvement", or (c) the small sample size.

Future Research

TPACK and Teacher Effectiveness (based on the Danielson Framework for Teaching) are both well-defined. Both these constructs have been extensively examined in the research and there is a plethora of research surrounding each. Future research will need to focus on a larger participation rate. It appears teachers are willing to participate in research using their individual Teacher Effectiveness Scores. However, based on the data gathered in this study, all the participating teachers were rated proficient or distinguished. Teachers who do not score as well on Teacher Effectiveness may not be as willing to share their scores.

TPACK, Teacher Effectiveness, and Student Academic Growth

Research question three asked: *Does a teacher's technology self-efficacy and teacher effectiveness rating influence student academic growth?* The purpose of assessing teacher effectiveness is to provide a method to more effectively evaluate classroom teacher performance and ultimately impact student learning, achievement, and growth (PA Bulletin, 2013, para. 18). The results of this analysis indicate the only significant relationship was between Danielson's Domain Three (Instruction) and the 2017 PVAAS PSSA Academic Growth Index. Danielson's Domain Three explained 63.4 % (R^2=.634) of the variance in the 2017 PVAAS PSSA Academic Growth Index. Stronge et.al (2011) and Teacher Quality (2010) suggest teachers are, and have been, the most important factor in student academic success. The results of research question three support their claim. Danielson Domain Three is about instruction in the classroom and how teachers interact with students, how students are engaged, and the teacher's overall delivery of instruction.

One would expect Danielson Domains Two and Three to have relationships with the PVAAS PSSA Academic Growth Index every year. However, analysis of research question three did not reveal the relationship for the 2016 results. Undoubtedly, there are a multitude of factors that contribute to any given group of students' performances on high-stakes tests. The results of research question three indicate the importance of multi-year comparisons of test scores for evaluating teachers.

Limitations

As with the other research questions, based on the analysis conducted, the TPACK survey was reliable and valid. Teacher Effectiveness, based on the Danielson Framework for Teaching, has the ability to accurately measure teacher effectiveness. Malinowski (2011) asserts that at least some of the practices describes in the Danielson Framework for Teaching can be used for evaluation. Since the four Danielson Domains are subdivided into 22 components and 76 smaller elements (Danielson Group, 2013), the Domain Scores for individual teachers may mask deeper relationships between TPACK and Teacher Effectiveness.

Kwolak (2014) asserted that value-added measures can be influenced by other major variables on student outcomes (such as content variables) that do not accurately reflect teacher effectiveness. This research only utilized the four Domain Scores and discarded any value-added scores in the Pennsylvania Techer Effectiveness Model. However, principals were trained to complete the entire evaluation model and, therefore, value-added covariates may influence a principal's Domain Score.

Future Research

The Danielson Framework for Teaching is well established and has been examined extensively in the literature. Areas of concern have been identified that have potential influence in Domain Scores. In this research, principals consistently reported similar Domain Scores across all four domains. Researchers should examine how the 22 components and 76 smaller elements can help minimize differences in principal Domain Score reporting.

Summary

Schools continue to expend large sums of money deploying instruction technology. Schools do not appear to be changing their deployment plans, even as questions arise as to the benefits and results of technology in the classroom. Federal resources, such as the E-Rate program, provide funding to implement the infrastructure to support 1-to-1 initiatives at very little cost to taxpayers (Federal Communications Commission, 2014). Proponents of technology deployments state instructional technology has been in the classroom for hundreds of years and modern electronic technology is just a replacement for chalkboards, flip cards, and other previously used tools. Opponents state the technology is only needed for specific purposes. Each side of this debate has valid positions.

The intent of this research was to examine if variables measuring teacher technology self-efficacy (TPACK), level of classroom integration (SAMR), and Teacher Effectiveness (based on the Danielson Framework for Teaching) influenced student academic growth. The research intended to include a much larger array of school districts and teachers than what actually transpired. The nature of the data collected was teacher-specific and confidential, resulting in a lower than expected participation rate. However, the districts that participated in the research had a 75% teacher participation rate. Even though the sample size was relatively small, the research is a valuable source of information in understanding any relationship among TPACK, SAMR, Teacher Effectiveness, and PVASS PSSA Student Academic Growth Index. The research creates a foundation for the continued examination of the constructs.

Stronge et al. (2011) suggested teachers are an extremely important part of the learning process. Danielson's Domain Two (Classroom Environment) and Domain Three (Instructions) address key parts of the learning process. This research revealed teachers' Technology Knowledge (TK) explained a large portion of the Danielson Domain Two Scores (Classroom Environment). Schools have technology available in classrooms, labs, and other areas throughout the building. It is not surprising that a teachers' self-efficacy with regard to their technology knowledge would influence the classroom. The research also revealed that a teacher's Danielson Domain Three (Instruction) score had an influence on the 2017 PVAAS PSSA Student Academic Growth Index. Embracing the assumption that teachers are integral to the student's success (Stronge et al., 2011), it is not surprising that there is a relationship between classroom instruction and student academic growth.

The research did involve limitations that could directly influence the research findings. Foremost, the small sample size could eliminate some potential relationships and may diminish others. Future research will need to address the concerns expressed by superintendents and collective bargaining units. The results of this research indicate there is a level of maintained security of district and teacher identifiers. Superintendent concerns over principal workload is also addressed, as the researcher did not receive any negative feedback from participating principals regarding excessive time requirement to complete the data collection.

SAMR presented limitations with regard to potential evaluation misunderstanding and reporting. Principals consistently rated classroom SAMR levels in the substitution and augmentation ranges. The researcher is not implying the SAMR scores are incorrect. Rather, the suggestion is for greater information gathering to understand principal SAMR familiarity and understanding. The additional SAMR data can be used to minimize the possible SAMR limitations of this study. Based on the information gathered, additional principal training on SAMR may be warranted to ensure all principals are identifying the differing SAMR levels consistently.

Schools are going to continue technology deployments. Taxpayers and legislators will continue to ask questions about the benefit of spending tax dollars on educational technology. Teachers will continue to be evaluated for effectiveness in the classroom. Research should continue to examine frameworks for their effectiveness on student academic growth. Technology is not a fad. It is here for the long haul in education. The challenge is to help teachers leverage the technology to benefit student learning.

References

American Institutes for Research, (2014). Technology Implementation Practice Guide. Retrieved from http://ctdinstitute.org/sites/default/files/file_attachments/PowerUp%20Technology%20Implementation%20Practice%20Guide%20FINAL.pdf

Agyei, D. D., & Keengwe, J. (2014). Using technology pedagogical content knowledge development to enhance learning outcomes. *Education and Information Technologies 19*(1), 155-171.

Alford, R. R. (1998). *The craft of inquiry: Theories, methods, evidence*. New York, NY: Oxford University Press.

Amer, A. (2006). Reflections on Bloom's revised taxonomy. *Electronic Journal of Research in Educational Psychology, 4*(1), 213-230.

Brady, M. (2015). The important things standardized tests don't measure. *The Washington Post.* Retrieved from https://www.washingtonpost.com/news/answer-sheet/wp/2015/03/01/the-important-things-standardized-tests-dont-measure/?utm_term=.baa2d7f57974

Brantley-Dias, L., & Ertmer, P. A. (2013). Goldilocks and TPACK: Is the construct 'just right?' *Journal of Research on Technology in Education, 46*(2), 103-128.

Brusic, S. A., & Shearer, K. L. (2014). the ABCs of 21st century skills. (cover story). *Children's Technology & Engineering, 18*(4), 6.

CFF. (2010). Pennsylvania's Classrooms for the Future program meeting with success. Retrieved from http://news.psu.edu/story/169827/2010/03/02/pennsylvanias-classrooms-future-program-meeting-success

Common Sense Media. (2015). Introduction to the SAMR model. Retrieved from https://www.commonsensemedia.org/videos/introduction-to-the-samr-model#&t*,14*

Danielson, C. (2011). *Teacher effectiveness.* Retrieved from https://www.pdesas.org/Frameworks/TeacherFrameworks/TeacherEffectiveness

Danielson, C. (2015). *The framework.* Retrieved from https://danielsongroup.org/framework/

Danielson Group. (2013). The Framework. Retrieved from https://www.danielsongroup.org/framework/

Danielson's Four Domains [Online image]. (2016). Retrieved November 12, 2016 from http://www.mathguide.com/services/Evaluation/Danielson500x488.gif

Delgado, A. J., Wardlow, L., McKnight, K., & O'Malley, K. (2015). Educational technology: A review of the integration, resources, and effectiveness of technology in k-12 classrooms. *Journal of Information Technology Education: Research,* 14.

Education 2020. What do 21st century learners need? Retrieved from https://education-2020.wikispaces.com/21st+Century+Learning

Federal Communications Commission. (2014). Summary of the E-Rate modernization order. Retrieved from https://www.fcc.gov/general/summary-e-rate-modernization-order

Federal Communications Commission. (2015). *Universal service program for schools and libraries.* Retrieved from https://www.fcc.gov/consumers/guides/universal-service-program-schools-and-libraries-e-rate

Federal Communications Commission. (2016). E-Rate - Schools & libraries USF program. Retrieved from https://www.fcc.gov/es/general/e-rate-schools-libraries-usf-program

Field, A. (2013). *Discovering statistics using IBM SPSS Statistics.* Los Angeles, CA: Sage.

Gill, B., English, B., Furgeson, J., & McCullough, M. (2014). *Alternative student growth measures for teacher evaluation: Profiles of early-adopting districts.* Regional Educational Laboratory Mid-Atlantic, & National Center for Education Evaluation and Regional Assistance. (REL 2014–016)

Harold, B. (2016). Technology in education: An overview. *Education Week*. Retrieved from http://www.edweek.org/ew/issues/technology-in-education/index.html?r=154224369#resources

Hammer, P. C., & West Virginia Department of E. (2013). Creating the context and employing best practices for teacher professional development: A brief review of recent research. West Virginia Department of Education.

Harris, J., Mishra, P., & Koehler, M. (2009). Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed. *Journal of Research on Technology in Education, 41*(4), 393–416.

Hartman, D. (2012). The Charlotte Danielson model. Retrieved from http://danielle6849.weebly.com/lessons/the-charlotte-danielson-method

Koba, M. (2015). Education tech funding soars — but is it working in the classroom? Retrieved from http://fortune.com/2015/04/28/education-tech-funding-soars-but-is-it-working-in-the-classroom/

Koehler, M. (2012). The seven components of TPACK. Retrieved from http://matt-koehler.com/tpack2/tpack-explained/

Koehler, M. J. (2015). *What is TPACK?* Retrieved from http://tpack.org/

Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education, 9*, 60-70.

Koehler, M. J., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge (TPACK)? *Journal of Education*, *193*(3), 13–19.

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

Kwolek, K. (2014). *Impact of teacher evaluation protocols on classroom instructional practices.* (Doctoral dissertation). Retrieved from https://etd.ohiolink.edu/

Kurzweil Blog Team. (2015, February 12). 5 positive effects technology has on teaching & learning [Web blog post]. Retrieved from https://blog.kurzweiledu.com/2015/02/12/5-positive-effects-technology-has-on-teaching-learning/

Landry, G. A (2010). *Creating and validating an instrument to measure middle school mathematics teachers' technological pedagogical content knowledge (TPACK).* (Doctoral dissertation). Retrieved from http://trace.tennessee.edu/utk_graddiss/720/

Lynch, M. (2015). 4 ways digital tech has changed k-12 learning. *The Journal*. Retrieved from https://thejournal.com/articles/2015/05/20/4-ways-digital-tech-has-changed-k12-learning.aspx

Malinowski, A. T. (2011, April). *Validity research on teacher evaluation systems based on the framework for teaching*. Paper presented at the American Education Research Association annual meeting, New Orleans, LA.

Mishra, P., & Koehler, M. J. (2008). Introducing technological pedagogical content knowledge. *Proceedings of annual meeting of the American Educational Research Association* (pp. 1–16).

Macvibrant. (n.d.). HOTS. Higher order thinking skills. Retrieve from http://www.maxvibrant.com/bloom-s-taxonomy/bloom-s-taxonomy

Nagle, D. (2014). Spending on instructional tech to reach $19 billion within 5 years. *The Journal.* Retrieved from http://thejournal.com/articles/2014/06/11/spending-on-instructional-tech-to-reach-19-billion-within-5-years.aspx

New Jersey State Advisory Committee to the U.S. Commission on Civil Rights (2010). Teacher quality: A vital determinant of student achievement. Retrieved from https://www.law.umaryland.edu/marshall/usccr/documents/cr12nj12010.pdf

News Media Consortium. (2014). *Horizon report: 2014 K-12 edition.* Retrieved from http://cdn.nmc.org/media/2014-nmc-horizon-report-k12-EN.pdf

Niess, M. L. (2011). Investigating TPACK: Knowledge growth in teaching with technology. *Journal of Educational Computing Research, 44*(3), 299–317.

Niess, M. L. (2013). Central component descriptors for levels of technological pedagogical content knowledge. *Journal of Educational Computing Research, 48*(2), 173-198.

O'Hara, S. (2014). What is the impact of technology on learning? Retrieved from http://www.education.com/reference/article/what-impact-technology-learning/

PA Bulletin. (2013). Educator effectiveness rating tool: Classroom teachers. Retrieved from http://www.pabulletin.com/secure/data/vol43/43-25/1115.html

Pearson. (2015). Pearson student mobile device survey 2015 national report: Students in grades 4-12. Retrieved from http://www.pearsoned.com/wp-content/uploads/2015-Pearson-Student-Mobile-Device-Survey-Grades-4-12.pdf

Pennsylvania Department of Education. (2013). Educator effectiveness system - Differentiated supervision. Retrieved from http://www.education.pa.gov/Documents/Teachers-Administrators/Educator%20Effectiveness/Classroom%20Teaching%20Professionals/Educator%20Effectiveness%20System%20-%20Differentiated%20Supervision.pdf

Pennsylvania Department of Education. (2014a). Student performance measures for classroom teachers frequently asked questions. Retrieved from http://www.education.pa.gov/Documents/Teachers-Administrators/Educator%20Effectiveness/Student%20Performance%20Measures%20for%20Classroom%20Teachers%20FAQs.pdf

Pennsylvania Department of Education. (2014b). *Educator effectiveness administrative manual.* Retrieved from http://www.nctq.org/docs/Educator_Effectiveness_Administrative_Manual.pdf

Pennsylvania Department of Educations. (2015). *PA inspired leadership (PIL) programs*. Retrieved from http://www.education.pa.gov/Teachers%20-%20Administrators/PA%20Inspired%20Leaders/Pages/default.aspx#.VoRl2rYrJoV

Pennsylvania Department of Education-PVAAS. (2015). *Pennsylvania value-added assessment system (PVAAS).* Retrieved from http://www.education.pa.gov/K-12/Assessment%20and%20Accountability/Pennsylvania%20Value%20Added%20Assessment%20System/Pages/default.aspx#.VoRnr7YrJoU

PSSA. (2017). Pennsylvania system of school assessment (PSSA). Retrieved from http://www.education.pa.gov/K-12/Assessment%20and%20Accountability/PSSA/Pages/default.aspx#tab-1

Poole, B. (2011). Ten pillars of successful technology implementation. Retrieved from http://www.educationworld.com/a_tech/columnists/poole/poole011.shtml

Puentedura, R. R. (2014). SAMR and Bloom's taxonomy: Assembling the puzzle. Retrieved from https://www.graphite.org/blog/samr-and-blooms-taxonomy-assembling-the-puzzle#

Purdue University Online. (2017). How has technology changed education? Retrieved from http://online.purdue.edu/ldt/learning-design-technology/resources/how-has-technology-changed-education

Rich, E., Allington, R., Berry, B., Wessling, S. B., Cator, K., Chen, M., … Singer, S. R. (2010). How do you define 21st century learning? Retrieved from *http://www.edweek.org/tsb/articles/2010/10/12/01panel.h04.html*

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences, 4* (1973), 155-169.

Rotherham, A. J., & Willinham, D. (2009). 21st century skills: The challenge ahead. *Teaching for the 21st Century, 67*(1).

Russell, M., Bebell, D., & Higgins, J. (2004). Laptop learning: A comparison of teaching and learning in upper elementary classrooms equipped with shared carts of laptops and permanent 1:1 laptops. *Journal of Educational Computing Research, 30*(4), 313-330.

Schaffhauser, D. (2014). 9 lessons from 1-to-1 pioneers. *The Journal, 41*(3), 10-17.

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koeler, M.J., & Shin, T.S. (2009). Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education*, *42*(2), 123–149.

Schroek, K. (2013). SAMR and Bloom's. Retrieved from http://www.schrockguide.net/samr.html

Stanberry, M. (2011). Five characteristics of an effective 21st century Educator. Retrieved from http://www.eschoolnews.com/2011/09/09/five-characteristics-of-an-effective-21st-century-educator/

Stronge, J. H., Ward, T. J., & Grant, L. W. (2011). What makes good teachers good? A cross-case analysis of the connection between teacher effectiveness and student achievement. *Journal of Teacher Education*, *62*(4), 339–355.

Swanson, P. A. (2014). Rethinking SAMR. Retrieved from http://www.teacherpaul.org/2889

Takahashi, P. (2011). Las Vegas schools bet iPad effort will improve learning. *Education Week, 31*(8), 10.

Teacher Quality. (2010). *Teacher quality: A vital determinant of student achievement* [PDF File]. Retrieved from http://www.law.umaryland.edu/marshall/usccr/documents/cr12nj12010.pdf

Upadhyaya, P. (2013, December 1). *How Apple, Google, Cisco are competing for the $5 billion K-12 ed-tech market.* Retrieved from http://www.bizjournals.com/sanjose/news/2013/11/25/heres-how-silicon-valley-will-make.html?page=all

USAC. (2016). USAC 2016 discount matrix. Retrieved from http://www.usac.org/_res/documents/sl/pdf/samples/Discount-Matrix.pdf

United States Department of Education. (2014a). *Programs: Improving teacher quality state grants*. Retrieved from http://www2.ed.gov/programs/teacherqual/index.html

United States Department of Education. (2014b). Title II, part a sea awards, FY 2005-2014 [PowerPoint slides]. Retrieved from http://www2.ed.gov/programs/teacherqual/seastateawds05-14.pdf

United States Department of Education. (2016). Reimagining the role of technology in education: 2016 national education technology plan. Retrieved from https://tech.ed.gov/netp/

Williams, N. L, & Larwin, K. H. (2016). One-to-one computing and student achievement in Ohio high schools. *Journal of Research on Technology in Education, vv*, xx-xx. Retrieved from http://dx.doi.org/10.1080/15391523.2016.1175857

Wilson, L. O. (2013). Understanding the new version of Bloom's taxonomy. Retrieved from http://thesecondprinciple.com/teaching-essentials/beyond-bloom-cognitive-taxonomy-revised/

Zelkowski, J., Gleason, J., Cox, D. C., & Bismark, S. (2013). Developing and validating a reliable TPACK instrument for secondary mathematics preservice teachers. *Journal of Research on Technology in Education 42(*2), 173-206.

Zucker, A. (2004, June). Developing a research agenda for ubiquitous computing in schools. *Journal of Educational Computing Research*, 371-386.

Appendix A – TPACK Survey

Teacher TPACK

Welcome to my survey.

Thank you for agreeing to participate in my study. The study examines teacher TPACK self-efficacy, SAMR/Bloom's Taxonomy level, and educator effectiveness scores impact on student academic growth. This survey ONLY gathers information to determine your self-efficacy regarding TPACK (Technology, Pedagogy, and Content Knowledge). Your participation is greatly appreciated.

Teacher TPACK

Please answer each question to the best of your knowledge. Your thoughtfulness and candid responses will be greatly appreciated.

* 1. Please enter your email address.

Teacher TPACK

Demographic Information

* 2. Please select your gender.

Female

Male

* 3. Indicate the range your age falls within.

- 21-28
- 29-35
- 36-42
- 43-51
- 52-61
- 62 and older

* 4. Select the number of years you have been in teaching.

- 0-4
- 5-10
- 11-20
- 21 and over

* 5. In the last three (3) years, how many hours of professional development have your received directly related to technology integration in your curricular area?

- 0-9
- 10-20
- 21 and over

Teacher TPACK

Classroom Technology

* 6. Do you have a one-to-one program at your grade level?

- Yes
- No

Teacher TPACK

Classroom Technology

7. Since you do not have one-to-one in your classroom, which of the following describes the type of access to technology in your classroom?

- I take my students to a computer lab
- I request mobile carts to use in my classroom
- I have some computers assigned to my classroom
- I do not have access to any computers
- Other (please specify)

Teacher TPACK

8. Do you allow students to take their one-to-one technology home?

- Yes
- No

Other (please specify)

Teacher TPACK

* 9. Technology is a broad concept that can mean a lot of different things. For the purpose of this questionnaire, technology is referring to digital technology/technologies. That is, the digital tools we use such as computers, laptops, iPods, handhelds, interactive whiteboards, software programs, etc. Please answer all of the questions and if you are uncertain of, or neutral about, your response, you may always select "Neither Agree or Disagree"

	Strongly Disagree	Disagree	Neither Agree or Disagre	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 know about a lot of different technologies.	○	○	○	○	○
I have the technical skills I need to use technology.	○	○	○	○	○
I have sufficient opportunities to work with different technologies.	○	○	○	○	○

Teacher TPACK

* 10. PK

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
I know how to assess student performance in a 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 allow students to use technology for assessment as it parallels instruction.	○	○	○	○	○
I can use a wide range of teaching approaches in a classroom setting.	○	○	○	○	○
I am familiar with common student understandings and misconceptions.	○	○	○	○	○
I know how to organize and maintain classroom management.	○	○	○	○	○

Teacher TPACK

* 11. PCK

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
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.).	○	○	○	○	○
An effective teacher explicitly teaches the correct way to use a technology.	○	○	○	○	○

Teacher TPACK

* 12. TPK

	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.	◯	◯	◯	◯	◯
I can adapt the use of the technologies that I am learning about to different teaching activities.	◯	◯	◯	◯	◯
I can select technologies to use in my classroom that enhance what I teach, how I teach, and what students learn.	◯	◯	◯	◯	◯
I am thinking critically about how to use technology in my classroom.	◯	◯	◯	◯	◯
I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my schooland/or district.	◯	◯	◯	◯	◯
I can choose technologies that enhance the content for a lesson.	◯	◯	◯	◯	◯
I can use technology to create effective representations of content that depart from textbook knowledge	◯	◯	◯	◯	◯

Teacher TPACK

* 13. Please indicate which curricular area you teach in.

◯ Language Arts

◯ Mathematics

Teacher TPACK

* 14. Mathmatics

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
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.	○	○	○	○	○
I am able to focus on the mathematics while taking advantage of instructional opportunities offered by technology.	○	○	○	○	○
When I approach mathematics instruction with technology, I know where students are conceptually, what they need to achieve, and how to proceed.	○	○	○	○	○
I can select effective teaching approaches to guide student thinking and learning in mathematics.	○	○	○	○	○
Teachers should teach exact procedures for students as they use calculators.	○	○	○	○	○
I know about technologies that I can use for understanding and doing mathematics.	○	○	○	○	○
I make connections with students as to why technology is useful for certain mathematics problems.	○	○	○	○	○
I can teach lessons that appropriately combine mathematics, technologies, and teaching approaches.	○	○	○	○	○
I can help students use digital technologies that allow them to create and/or manipulate mathematical models.	○	○	○	○	○

Teacher TPACK

* 15. Language Arts

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
I have sufficient knowledge about language arts.	○	○	○	○	○
I can use a language arts way of thinking.	○	○	○	○	○
I have various ways and strategies of developing my understanding of language arts.	○	○	○	○	○
I am able to focus on language arts while taking advantage of instructional opportunities offered by technology.	○	○	○	○	○
When I approach language arts instruction with technology, I know where students are conceptually, what they need to achieve, and how to proceed.	○	○	○	○	○
I can select effective teaching approaches to guide student thinking and learning in language arts.	○	○	○	○	○
Teachers should teach exact procedures for students as they use word prcessing.	○	○	○	○	○
I know about technologies that I can use for understanding and doing language arts.	○	○	○	○	○
I make connections with students as to why technology is useful for certain language arts problems.	○	○	○	○	○
I can teach lessons that appropriately combine language arts, technology, and teaching approaches.	○	○	○	○	○
I can help students use digital technologies that allow them to create and/or manipulate language arts.	○	○	○	○	○

Teacher TPACK

16. You have completed all the questions for this survey. Your responses are greatly appreciated. If you have anys comment regarding the survey, please use the comment space below.

Appendix B – SAMR Evaluation Matrix

<table>
<tr><th>Bloom's Revised Taxonomy Level</th><th>SAMR Level
Place an X in the box</th></tr>
<tr><td>Creating

Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.</td><td rowspan="6">Redefinition

Technology allows for the creation of new tasks previously inconceivable.

Modification

Technology allows for significant task redesign.

Augmentation

Technology acts as a direct tool substitute with functional improvement.

Substitution

Technology acts as a direct tool substitute with no functional change.</td></tr>
<tr><td>Evaluating

Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.</td></tr>
<tr><td>Analyzing

Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.</td></tr>
<tr><td>Applying

Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.</td></tr>
<tr><td>Understanding

Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.</td></tr>
<tr><td>Remembering

Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.</td></tr>
</table>

School Name

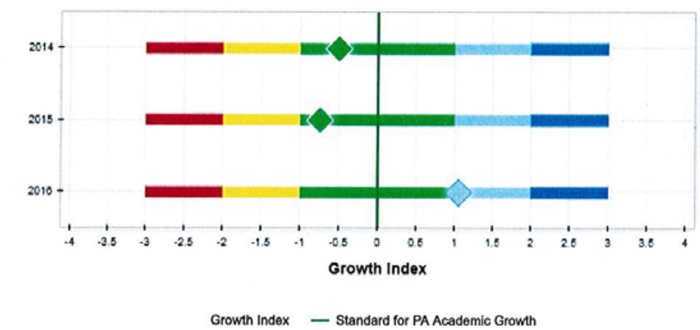
Teacher Name

Principal Name Date

Appendix C – Teacher Value Example Report

9/17/2017 PVAAS 2016: Teacher Value Added

Report: [redacted] **Test:** PSSA
School: [redacted] **Subject:** Math
District: [redacted] **Grade:** 8th Grade
Teacher: [redacted]



2016: Light Blue

Light Blue: Moderate evidence that the teacher's group of students exceeded the standard for PA Academic Growth.

2016 ▾ Distribution of Teachers

Color	Nr of Teachers
Dark Blue	391
Light Blue	241
Green	856
Yellow	338
Red	391

Teacher Growth Measures and Standard Errors

Year	Growth Measure	Standard Error	Growth Index
2014	-0.6	1.2	-0.51
2015	-0.9	1.3	-0.75
2016	1.3	1.2	1.05

PVAAS teacher specific reports are from SAS ® EVAAS ® multivariate, longitudinal analyses using all available state assessment data for each student.

Dark Blue: Significant evidence that the teacher's group of students exceeded the standard for PA Academic Growth.
Light Blue: Moderate evidence that the teacher's group of students exceeded the standard for PA Academic Growth.
Green: Evidence that the teacher's group of students met the standard for PA Academic Growth.
Yellow: Moderate evidence that the teacher's group of students did not meet the standard for PA Academic Growth.
Red: Significant evidence that the teacher's group of students did not meet the standard for PA Academic Growth.

Note: When an index falls exactly on the boundary between two colors, the higher growth color is assigned.

https://pvaas.sas.com/teacherValueAddedBeta.html?ad=rjn46jgfH6bdBKaP&as=O&aj=5&w4=124&ww=25633&x9=12&af=1&yb=61&wD=8&xu=554&x... 1/1

Appendix D – Superintendent Packet

August 10, 2016

Dear Superintendent,

I am currently participating in the Educational Leadership Doctoral program at Youngstown State University. I am writing you regarding an upcoming research project that I will be conducting as part of my dissertation work. I'd like to take a few minutes of your time to explain the research and encourage you to explore participation from your district.

I have been involved with educational technology for the past 30 years. I have been fascinated by the potential that technology can provide[K1] as a support in the educational process. However, as I'm sure you are aware, the research clearly notes that technology itself has very little impact on learning. This is not to say technology is not a worthy investment, rather it is a realization that other variables may be required to leverage technology at a greater level. My research will focus on several variables that have been individually identified as having some impact on student achievement and growth but have not been examined together. These variables are the following:

A. Technology, Pedagogy, and Content Knowledge – TPACK

   Examining a teacher self-efficacy towards TPACK using a survey tool

B. SAMR (Level of technology integration in lessons – Substitution, Augmentation, Modification and Redefinition)

   Examining the level of technology integration a teacher achieves in the classroom by examining the recollection of four specific lessons throughout the previous school year and how they relate to the Bloom's

Revised Taxonomy. The recollections will be scored by reviewers and translated to the appropriate SAMR level.

C. Educator Effectiveness

Teacher effectiveness scores for the 15-16 school year will be Utilized for the proposed investigation. The four domains of the Danielson's framework, making up 50% of Pennsylvania's score, will be used.

These variables will be analyzed in an effort to understand how they may relate to PVAAS student academic growth scores. The null hypothesis is that TPACK, SAMR, and Educator Effectiveness ratings have no impact on student academic growth.

I am interested in gathering data from eighth grade math and language arts teachers. It is important to note individual teacher effectiveness scores and teacher specific PVAAS data will need to be gathered. As the process unfolds, administrators and teachers will be informed about the procedures to keep this data completely confidential.

I hope this brief summary of the proposed research has been helpful and that it has sparked your curiosity. I will be happy to share with you the results of this investigation. I hope that the results will provide information for your schools that can further the success of every student.

Sincerely

Vince Humes

March 21, 2017

Dear Superintendent:

I am a doctoral student from Youngstown State University working on my dissertation. My committee chair, Dr. Karen Larwin, and I are conducting a study to investigate the influence teacher technology self-efficacy, the level of technology integration reached in the classroom, and Educator Effectiveness have on student academic growth in eighth grade language arts and mathematics. Teacher technology self-efficacy, level of technology integration in the classroom, and Educator Effectiveness have all been studied individually in the literature; However, there is a paucity of research on these variables in multi-variant studies. These three variables occur in all schools and this study will provide insight for school officials pursuing instructional technology infusion into their classrooms.

This study will involve principals and teachers in schools containing eighth grade language arts and mathematics served by the Northwest Tri-County Intermediate Unit. Teachers will be asked to complete and/or agree to several things. First, they will be asked to complete a short survey to determine their technology self-efficacy (about 15 minutes are needed to complete the survey). This survey is referred to as the TPACK survey. The survey is designed to identify how teachers view their level of technology understanding, their level of pedagogical understanding, and their level of content knowledge. The survey will also gather information such as age, gender, years in education, and the level of technology professional development received. Second, they will be asked to permit the researcher to obtain their 16-17 Educator Effectiveness evaluation (only the parts referencing the Danielson domains) from their principal. Their principal will be adding an evaluation of the level of technology integration in the teacher's classroom based on the SAMR (Substitution, Augmentation, Modification and Redefinition) model as well. The principal's SAMR rating is one score representing the level of SAMR most often achieved in the classroom. Finally, they will be asked to allow their principal to provide their teacher specific PVAAS scores.

Principals will need to complete the SAMR rating form for each eighth grade language arts and mathematics teacher. The form is one page requiring the principal to make one entry that reflects the level of technology use most often achieved in the teacher's classroom. This form will be attached to the teacher's final Educator Effective evaluation for the year. Principals will provide a copy of the teacher's Educator Effectiveness form, the SAMR rating, and the teacher specific PVASS scores to the researchers.

The benefit to your district from being in this study is the results of the survey will provide valuable information on the relationship between teacher technology self-efficacy, technology integration, and educator effectiveness on student academic growth. The results will potentially provide insight in to areas your district may want to focus on in your pursuit of student success.

Your staff's privacy is important and we will handle all information collected about them in a confidential manner. All data collected will be maintained in a digitally encrypted storage area to ensure only myself and my research chairperson have access to the data. I will report the results of the project in a way that will not identify teachers. I do plan to present the results of the study to my dissertation committee, Northwest Tri-County Superintendent meeting, and at the Pennsylvania Technology Conference (Pete & C).

Your staff does not have to be in this study. If they do not want to, they can say no without losing any benefits that they are entitled to. If they do agree, they can stop participating at any time. If they wish to withdraw, they can inform me or the contact person listed below.

If you have questions about this research project, please contact Dr. Karen Larwin, Department of Educational Foundations, Research, Technology and Leadership, Beeghly College of Education, Youngstown State University. Dr. Larwin can be reached at 330-941-2231 or khlarwin@ysu.edu. If you have questions about your rights as a participant in a research project, you may contact the Office of Research at YSU (330-941-2377) or at YSUIRB@ysu.edu

I hope your district will see the value of this study and agree to participate. If you are interested in participating, the following pages need to be signed and copied to your district letterhead.

Thank you for considering participation in this study.

Sincerely,

Vince Humes

Vince Humes

Letter of Cooperation

The ________________________________ School District will participate in the study "***The Impact of TPACK, SAMR, and Teacher Effectiveness on Student Academic Growth in Eighth Grade Language Art and Mathematics"*** being conducted by Vince Humes and Dr. Karen Larwin. We understand the following regarding the study:

- Only eighth grade language arts and mathematic teachers are eligible to participate
- The researchers will obtain written consent from eligible teachers
- Consenting teachers will do the following:
  - Complete the TPACK survey
  - Grant permission to the principal to share their 16-17 Educator Effectiveness score (Danielson domain components only) with the researchers
  - Grant permission to their principal to share their teacher specific PVAAS data with the researchers
- Principals will do the following:
  - Provide contact information of eligible teachers
  - Complete the SAMR evaluation form for consenting teachers
  - Include the SAMR evaluation with the teacher's Educator Effectiveness form and submit it to the researchers
  - Provide teacher specific PVAAS scores of consenting teacher to the researchers
- The researchers will:
  - Keep all information confidential
  - Provide the school district, principals and participating teachers with results of the study

We also understand that teachers are not required to participate in the study and teachers can stop participating at any time.

________________________________ ________________________

Signature of Superintendent Date

The following contact information for our schools with eighth grade language arts and mathematics is being provided to assist in the research project:

Building Name	Principal Name	Principal Email	Principal Phone

Dear teaching professional:

I am a doctoral student from Youngstown State University working on my dissertation. My committee chair, Dr. Karen Larwin, and I are conducting a study to investigate the influence teacher technology self-efficacy, the level of technology integration reached in the classroom, and Educator Effectiveness have on student academic growth in eighth grade language arts and mathematics. Teacher technology self-efficacy, level of technology integration in the classroom, and Educator Effectiveness have all been studied individually in the literature; However, there is a paucity of research on these variables in multi-variant studies. These three variables occur in all schools and this study will provide insight for school officials and teachers pursuing instructional technology infusion into their classrooms.

This study will involve principals and teachers in schools containing eighth grade language arts and mathematics served by the Northwest Tri-County Intermediate Unit. As a teacher, you will be asked to complete and/or agree to several things. First, you will be asked to complete a short survey to determine your technology self-efficacy (about 15 minutes are needed to complete the survey). This survey is referred to as the TPACK (**T**echnology, **P**edagogy, and **C**ontent **K**nowledge) survey. The survey is designed to identify how you view your level of technology understanding, your level of pedagogical understanding, and your level of content knowledge. The survey will also gather information such as age, gender, years in education, and the level of technology professional development received. Second, you will be asked to permit the researcher to obtain your 16-17 Educator Effectiveness evaluation (only the parts referencing the Danielson domains) from your principal. Your principal will be adding an evaluation of the level of technology integration in your classroom based on the SAMR (Substitution, Augmentation, Modification and Redefinition) model as well. The principal's SAMR rating is one score representing the level of SAMR most often achieved in the classroom. Finally, you will be asked to allow your principal to provide your teacher specific PVAAS scores.

The benefit to you for being in this study is the results of the survey will provide valuable information on the relationship between teacher technology self-efficacy, technology integration, and educator effectiveness on student academic growth in your classroom. The results will potentially provide insight in to areas your district may want to focus on in your pursuit of student success.

Your privacy is important and I will handle all information collected about you in a confidential manner. All data collect will be maintained in a digitally encrypted storage area to ensure only myself and my research chairperson have access to the data. I will report the results of the project in a way that will not identify you. I do plan to present the results of the study to my dissertation committee, Northwest Tri-County Superintendent meeting, and at the Pennsylvania Technology Conference (Pete & C).

You do not have to be in this study. If you don't want to, you can say no without losing any benefits that you are entitled to. If you do agree, you can stop participating at any time. If you wish to withdraw just tell me or the contact person listed below.

If you have questions about this research project, please contact Dr. Karen Larwin, Department of Educational Foundations, Research, Technology and Leadership, Beeghly College of Education, Youngstown State University. Dr. Larwin can be reached at 330-941-2231 or khlarwin@ysu.edu. If you have questions about your rights as a participant in a research project, you may contact the Office of Research at YSU (330-941-2377) or at YSUIRB@ysu.edu.

I hope you will consider participation in my study. Should you decide to participate, please complete the attached Letter of Participation and return it in the provided envelop.

Thank you for your time and consideration.

Sincerely,

Vince Humes
Doctoral Student
Youngstown State University

Sincerely,

Dr. Karen H. Larwin
Associate Professor
Youngstown State University

I understand what is required of me to participate in the study "*The Impact of TPACK, SAMR, and Teacher Effectiveness on Student Academic Growth in Eighth Grade Language Art and Mathematics"* being conducted by Vince Humes and Dr. Karen Larwin. I understand the following regarding the study:

- Only eighth grade language arts and mathematic teachers are eligible to participate
- The researchers will obtain written consent from eligible teachers
- Consenting teachers will do the following:
    - Complete the TPACK survey
    - Grant permission to the principal to share their 16-17 Educator Effectiveness score (Danielson domain components only) with the researchers
    - Grant permission to their principal to share their teacher specific PVAAS date with the researchers
    - Teachers are not required to participate in the study
    - Teachers can stop participating at any time by notifying the researchers
- Principals will do the following:
    - Provide contact information of eligible teachers
    - Complete the SAMR evaluation form for consenting teachers
    - Include the SAMR evaluation with the teacher's Educator Effectiveness form and submit it to the researchers
    - Provide teacher specific PVAAS scores of consenting teacher to the researchers
- The researchers will:
    - Keep all data collected with the upmost confidentiality and the researchers will not report any findings that can personally identify teachers
    - Provide the school district, principals and participating teachers with results of the study

- Next Page -

I agree to the three requirements of the study as listed below and signify my agreement with my signature.

Requirement	Signature
I agree to complete the online survey regarding Technology, Pedagogy, and Content Knowledge (TPACK).	
I grant my principal permission to share my 16-17 school year Educator Effectiveness score (The Danielson framework components only) with the researcher.	
I grant my principal permission to share my teacher specific PVAAS scores with the researcher.	

Signature of Participant ______________________ Date ______________________

Printed Name ______________________ e-mail address ______________________

School District ______________________ School Building Name ______________________

Participation Identifier

Confidentiality of your information is paramount for this study. All surveys and data collected will identify you by a participation code and not by any of your personally identifiable information. Please keep this Participation Identifier form and use the provided code when completing the TPACK survey. Your principal will use this code as well when submitting your Educator Effectiveness scores and your teacher specific PVAAS data.

T1001

Appendix E - Results

Statistics

		Please select your gender.	Indicate the range your age falls within.	Select the number of years you have been in teaching.	In the last three (3) years, how many hours of professional development have your received directly related to technology integration in your curricular area?	Do you have a one-to-one program at your grade level?
N	Valid	6	6	6	6	6
	Missing	0	0	0	0	0

Statistics

		Since you do not have one-to-one in your classroom, which of the following describes the type of access to technology in your classroom?	Other (please specify)	Please indicate which curricular area you teach in.
N	Valid	5	6	6
	Missing	1	0	0

Frequency Table

Please select your gender.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	4	66.7	66.7	66.7
	Male	2	33.3	33.3	100.0
	Total	6	100.0	100.0	

Indicate the range your age falls within.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	21-28	1	16.7	16.7	16.7
	29-35	1	16.7	16.7	33.3
	36-42	2	33.3	33.3	66.7
	52-61	2	33.3	33.3	100.0
	Total	6	100.0	100.0	

Select the number of years you have been in teaching.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5-10	4	66.7	66.7	66.7
	21 and over	2	33.3	33.3	100.0
	Total	6	100.0	100.0	

In the last three (3) years, how many hours of professional development have your received directly related to technology integration in your curricular area?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-9	3	50.0	50.0	50.0
	10-20	3	50.0	50.0	100.0
	Total	6	100.0	100.0	

Do you have a one-to-one program at your grade level?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	1	16.7	16.7	16.7

	No	5	83.3	83.3	100.0
	Total	6	100.0	100.0	

Since you do not have one-to-one in your classroom, which of the following describes the type of access to technology in your classroom?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Other (please specify)	1	16.7	20.0	20.0
	I request mobile carts to use in my classroom	3	50.0	60.0	80.0
	I have some computers assigned to my classroom	1	16.7	20.0	100.0
	Total	5	83.3	100.0	
Missing	System	1	16.7		
Total		6	100.0		

Other (please specify)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		5	83.3	83.3	83.3
	I may use a mobile cart in my classroom or take my students to one of two computer labs.	1	16.7	16.7	100.0

Total	6	100.0	100.0	

Please indicate which curricular area you teach in.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Language Arts	3	50.0	50.0	50.0
	Mathematics	3	50.0	50.0	100.0
	Total	6	100.0	100.0	

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Please indicate which curricular area you teach in. * Please select your gender.	6	100.0%	0	0.0%	6	100.0%
Please indicate which curricular area you teach in. * Indicate the range your age falls within.	6	100.0%	0	0.0%	6	100.0%

Please indicate which curricular area you teach in. * Select the number of years you have been in teaching.	6	100.0%	0	0.0%	6	100.0%
Please indicate which curricular area you teach in. * In the last three (3) years, how many hours of professional development have your received directly related to technology integration in your curricular area?	6	100.0%	0	0.0%	6	100.0%
Please indicate which curricular area you teach in. * Do you have a one-to-one program at your grade level?	6	100.0%	0	0.0%	6	100.0%
Please indicate which curricular area you teach in. * Since you do not have one-to-one in your classroom, which of the following describes the type of access to technology in your classroom?	5	83.3%	1	16.7%	6	100.0%
Please indicate which curricular area you teach in. * Other (please specify)	6	100.0%	0	0.0%	6	100.0%

Please indicate which curricular area you teach in. * Please select your gender. Crosstabulation

Count

		Please select your gender.		
		Female	Male	Total
Please indicate which curricular area you teach in.	Language Arts	3	0	3
	Mathematics	1	2	3
Total		4	2	6

Please indicate which curricular area you teach in. * Indicate the range your age falls within. Crosstabulation

Count

		Indicate the range your age falls within.				
		21-28	29-35	36-42	52-61	Total
Please indicate which curricular area you teach in.	Language Arts	0	0	1	2	3
	Mathematics	1	1	1	0	3
Total		1	1	2	2	6

Please indicate which curricular area you teach in. * Select the number of years you have been in teaching. Crosstabulation

Count

		Select the number of years you have been in teaching.		
		5-10	21 and over	Total
Please indicate which	Language Arts	1	2	3

curricular area you teach in.	Mathematics	3	0	3
Total		4	2	6

Please indicate which curricular area you teach in. * In the last three (3) years, how many hours of professional development have your received directly related to technology integration in your curricular area? Crosstabulation

Count

		In the last three (3) years, how many hours of professional development have your received directly related to technology integration in your curricular area?		
		0-9	10-20	Total
Please indicate which curricular area you teach in.	Language Arts	1	2	3
	Mathematics	2	1	3
Total		3	3	6

Please indicate which curricular area you teach in. * Do you have a one-to-one program at your grade level? Crosstabulation

Count

		Do you have a one-to-one program at your grade level?		
		Yes	No	Total

Please indicate which curricular area you teach in.	Language Arts	1	2	3
	Mathematics	0	3	3
Total		1	5	6

Please indicate which curricular area you teach in. * Since you do not have one-to-one in your classroom, which of the following describes the type of access to technology in your classroom? Crosstabulation

Count

		Since you do not have one-to-one in your classroom, which of the following describes the type of access to technology in your classroom?			
		Other (please specify)	I request mobile carts to use in my classroom	I have some computers assigned to my classroom	Total
Please indicate which curricular area you teach in.	Language Arts	1	1	0	2
	Mathematics	0	2	1	3
Total		1	3	1	5

Please indicate which curricular area you teach in. * Other (please specify) Crosstabulation

Count

		Other (please specify)	Total

			I may use a mobile cart in my classroom or take my students to one of two computer labs.	
Please indicate which curricular area you teach in.	Language Arts	2	1	3
	Mathematics	3	0	3
Total		5	1	6

RELIABILITY

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/MODEL=ALPHA.

Reliability

Case Processing Summary

		N	%
Cases	Valid	6	100.0
	Excluded[a]	0	.0
	Total	6	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.769	7

Case Processing Summary

		N	%
Cases	Valid	6	100.0
	Excluded[a]	0	.0
	Total	6	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items

.914	8

Case Processing Summary

		N	%
Cases	Valid	6	100.0
	Excluded[a]	0	.0
	Total	6	100.0

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Reliability Statistics

Cronbach's Alpha	N of Items
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RELIABILITY

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Case Processing Summary

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Cases	Valid	6	100.0
	Excluded[a]	0	.0
	Total	6	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.970	8

RELIABILITY

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q0014_0008 q0014_0009 q0014_0010 q0014_0011

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Case Processing Summary

		N	%
Cases	Valid	3	50.0
	Excluded[a]	3	50.0
	Total	6	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.738	11

RELIABILITY

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q0015_0008 q0015_0009 q0015_0010 q0015_0011

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/MODEL=ALPHA.

Case Processing Summary

		N	%
Cases	Valid	3	50.0
	Excluded[a]	3	50.0
	Total	6	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.904	11

COMPUTE

/ORDER=ANALYSIS.

Frequencies

Statistics

		TKFactor	PKFactor	PCKFactor	TPKFactor	CK
N	Valid	6	6	6	6	6
	Missing	0	0	0	0	0
Mean		3.5238	4.3542	4.2222	3.5208	4.0455
Std. Deviation		.53959	.66340	.65546	.86029	.45545
Skewness		.755	-.944	-.254	-1.152	.000
Std. Error of Skewness		.845	.845	.845	.845	.845
Kurtosis		1.100	.163	-1.828	1.856	-2.972
Std. Error of Kurtosis		1.741	1.741	1.741	1.741	1.741

```
NPAR TESTS
  /K-S(NORMAL)=TKFactor PKFactor PCKFactor TPKFactor CK
  /MISSING ANALYSIS.
```

NPar Tests

One-Sample Kolmogorov-Smirnov Test

		TKFactor	PKFactor	PCKFactor	TPKFactor	CK
N		6	6	6	6	6
Normal Parameters[a,b]	Mean	3.5238	4.3542	4.2222	3.5208	4.0455
	Std. Deviation	.53959	.66340	.65546	.86029	.45545
Most Extreme Differences	Absolute	.195	.225	.251	.210	.258
	Positive	.195	.165	.135	.128	.258
	Negative	-.120	-.225	-.251	-.210	-.258
Test Statistic		.195	.225	.251	.210	.258
Asymp. Sig. (2-tailed)		.200[c,d]	.200[c,d]	.200[c,d]	.200[c,d]	.200[c,d]

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. This is a lower bound of the true significance.

```
CORRELATIONS
  /VARIABLES=SAMR TKFactor PKFactor PCKFactor TPKFactor CK
  /PRINT=TWOTAIL NOSIG
  /MISSING=PAIRWISE.
```

Correlations

Correlations

		SAMR	TKFactor	PKFactor	PCKFactor	TPKFactor
SAMR	Pearson Correlation	1	.328	-.409	-.585	-.457
	Sig. (2-tailed)		.525	.421	.222	.362
	N	6	6	6	6	6
TKFactor	Pearson Correlation	.328	1	.456	.386	.518
	Sig. (2-tailed)	.525		.364	.450	.292
	N	6	6	6	6	6
PKFactor	Pearson Correlation	-.409	.456	1	.952**	.948**
	Sig. (2-tailed)	.421	.364		.003	.004
	N	6	6	6	6	6
PCKFactor	Pearson Correlation	-.585	.386	.952**	1	.936**
	Sig. (2-tailed)	.222	.450	.003		.006
	N	6	6	6	6	6
TPKFactor	Pearson Correlation	-.457	.518	.948**	.936**	1
	Sig. (2-tailed)	.362	.292	.004	.006	
	N	6	6	6	6	6
CK	Pearson Correlation	-.716	-.011	.839*	.873*	.716
	Sig. (2-tailed)	.110	.984	.037	.023	.109
	N	6	6	6	6	6

Correlations

		CK
SAMR	Pearson Correlation	-.716
	Sig. (2-tailed)	.110
	N	6
TKFactor	Pearson Correlation	-.011
	Sig. (2-tailed)	.984
	N	6
PKFactor	Pearson Correlation	.839*
	Sig. (2-tailed)	.037
	N	6
PCKFactor	Pearson Correlation	.873*
	Sig. (2-tailed)	.023
	N	6
TPKFactor	Pearson Correlation	.716
	Sig. (2-tailed)	.109
	N	6
CK	Pearson Correlation	1
	Sig. (2-tailed)	
	N	6

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

CORRELATIONS

/VARIABLES=@1Ave @2Ave @3Ave @4Ave TKFactor PKFactor PCKFactor TPKFactor CK

/PRINT=TWOTAIL NOSIG

/MISSING=PAIRWISE.

Correlations

Correlations

		1Ave	2Ave	3Ave	4Ave	TKFactor	PKFactor
1Ave	Pearson Correlation	1	.472	.455	-.471	.659	.414
	Sig. (2-tailed)		.344	.365	.346	.154	.415
	N	6	6	6	6	6	6
2Ave	Pearson Correlation	.472	1	-.445	-.013	.906*	.071
	Sig. (2-tailed)	.344		.376	.981	.013	.894
	N	6	6	6	6	6	6
3Ave	Pearson Correlation	.455	-.445	1	-.293	-.225	.372
	Sig. (2-tailed)	.365	.376		.573	.668	.467
	N	6	6	6	6	6	6
4Ave	Pearson Correlation	-.471	-.013	-.293	1	-.013	.320
	Sig. (2-tailed)	.346	.981	.573		.981	.537
	N	6	6	6	6	6	6

TKFactor	Pearson Correlation	.659	.906*	-.225	-.013	1	.456
	Sig. (2-tailed)	.154	.013	.668	.981		.364
	N	6	6	6	6	6	6
PKFactor	Pearson Correlation	.414	.071	.372	.320	.456	1
	Sig. (2-tailed)	.415	.894	.467	.537	.364	
	N	6	6	6	6	6	6
PCKFactor	Pearson Correlation	.230	.000	.166	.365	.386	.952**
	Sig. (2-tailed)	.661	1.000	.753	.477	.450	.003
	N	6	6	6	6	6	6
TPKFactor	Pearson Correlation	.234	.194	.140	.448	.518	.948**
	Sig. (2-tailed)	.656	.712	.791	.373	.292	.004
	N	6	6	6	6	6	6
CK	Pearson Correlation	.122	-.395	.401	.396	-.011	.839*
	Sig. (2-tailed)	.818	.439	.431	.437	.984	.037
	N	6	6	6	6	6	6

Correlations

		PCKFactor	TPKFactor	CK
1Ave	Pearson Correlation	.230	.234	.122
	Sig. (2-tailed)	.661	.656	.818
	N	6	6	6
2Ave	Pearson Correlation	.000	.194	-.395
	Sig. (2-tailed)	1.000	.712	.439
	N	6	6	6

3Ave	Pearson Correlation	.166	.140	.401
	Sig. (2-tailed)	.753	.791	.431
	N	6	6	6
4Ave	Pearson Correlation	.365	.448	.396
	Sig. (2-tailed)	.477	.373	.437
	N	6	6	6
TKFactor	Pearson Correlation	.386	.518	-.011
	Sig. (2-tailed)	.450	.292	.984
	N	6	6	6
PKFactor	Pearson Correlation	.952**	.948**	.839*
	Sig. (2-tailed)	.003	.004	.037
	N	6	6	6
PCKFactor	Pearson Correlation	1	.936**	.873*
	Sig. (2-tailed)		.006	.023
	N	6	6	6
TPKFactor	Pearson Correlation	.936**	1	.716
	Sig. (2-tailed)	.006		.109
	N	6	6	6
CK	Pearson Correlation	.873*	.716	1
	Sig. (2-tailed)	.023	.109	
	N	6	6	6

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Regression

Descriptive Statistics

	Mean	Std. Deviation	N
2Ave	2.3000	.37417	6
TKFactor	3.5238	.53959	6

Correlations

		2Ave	TKFactor
Pearson Correlation	2Ave	1.000	.906
	TKFactor	.906	1.000
Sig. (1-tailed)	2Ave	.	.006
	TKFactor	.006	.
N	2Ave	6	6
	TKFactor	6	6

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	TKFactor[b]	.	Enter

a. Dependent Variable: 2Ave

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
					R Square Change	F Change	df1
1	.906[a]	.820	.775	.17734	.820	18.259	1

Model Summary[b]

Model	Change Statistics	
	df2	Sig. F Change
1	4	.013

a. Predictors: (Constant), TKFactor

b. Dependent Variable: 2Ave

ANOVA[a]

Model	Sum of Squares	df	Mean Square	F	Sig.

1	Regression	.574	1	.574	18.259	.013[b]
	Residual	.126	4	.031		
	Total	.700	5			

a. Dependent Variable: 2Ave

b. Predictors: (Constant), TKFactor

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance
1	(Constant)	.087	.523		.166	.876	
	TKFactor	.628	.147	.906	4.273	.013	1.000

Coefficients[a]

Model		Collinearity Statistics VIF
1	(Constant)	
	TKFactor	1.000

a. Dependent Variable: 2Ave

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions (Constant)	TKFactor
1	1	1.990	1.000	.00	.00
	2	.010	14.377	1.00	1.00

a. Dependent Variable: 2Ave

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.8813	2.8682	2.3000	.33888	6
Std. Predicted Value	-1.236	1.677	.000	1.000	6
Standard Error of Predicted Value	.073	.151	.098	.032	6
Adjusted Predicted Value	1.7752	2.5138	2.2283	.28035	6
Residual	-.24019	.13925	.00000	.15862	6
Std. Residual	-1.354	.785	.000	.894	6
Stud. Residual	-1.489	1.427	.142	1.139	6
Deleted Residual	-.29040	.48621	.07166	.28336	6
Stud. Deleted Residual	-1.932	1.765	.126	1.338	6
Mahal. Distance	.008	2.812	.833	1.125	6
Cook's Distance	.002	2.740	.595	1.059	6
Centered Leverage Value	.002	.562	.167	.225	6

a. Dependent Variable: 2Ave

Appendix F – IRB Approval

Youngstown
STATE UNIVERSITY

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Office of Research
330.941.2377
www.ysu.edu

March 7, 2017

Dr. Karen Larwin, Principal Investigator
Mr. Vince Humes, Co-investigator
Department of Educational Foundations, Research, Technology and Leadership
UNIVERSITY

RE: HSRC PROTOCOL NUMBER: 089-2017
TITLE: The Impact of TPACK, SAMR, and Teacher Effectiveness on Student Academic Growth in Eighth Grade Language Art and Mathematics

Dear Dr. Larwin and Mr. Humes:

The Institutional Review Board has reviewed the abovementioned protocol and determined that it is exempt from full committee review based on a DHHS Category 3 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.

Sinc

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

MAH:cc

c: Dr. Charles Vergon, Chair
Department of Educational Foundations, Research, Technology & Leadership