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THE INFLUENCE OF TEACHERS' TECHNOLOGY ATTITUDE AND APTITUDE ON STUDENTS' PERFORMANCE ON COMPUTERIZED ASSESSMENTS

by

Charlotte Ashford

A Dissertation

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ABSTRACT

The purpose of this grounded theory study is to identify teacher factors that affect student performance on computerized exams such as teacher beliefs, professional development, and school resources. Additionally, the researcher seeks to identify student factors that can have an impact on student performance such as student demographics and the socioeconomic status of students.

To analyze and describe any differences in teacher beliefs between two schools, the researcher compared teacher training, administrative support, and teacher comfort with technology as it related to the technology acceptance model (TAM). The question that the researcher hopes to answer, which is a guiding question for this research is:

What factors influence student preparedness for computerized assessments?

The researcher attempts to answer this question by conducting surveys and interviewing teachers. The researcher codes and then analyzes the quantitative data using IBM's Statistical Package for Research Software Program (SPSS) and codes the qualitative data using NVivo, a data analysis tool, to determine common themes about beliefs about technology. Major sections covered in this document include an introduction, review of the literature, methodology, results, and discussion.

Keywords: Technology attitude, student performance, computerized tests

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ACKNOWLEDGMENTS

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I have been told that life does not start until one's dissertation is finished. I'm so thankful I get to start living now.

CHAPTER 1: INTRODUCTION

The Every Student Succeeds Act (ESSA), signed into law by President Obama on December 10, 2015, included several provisions to help ensure that schools and students were successful in terms of academic achievement (U.S. Department of Education, n.d.). One of the provisions of ESSA is accountability for the lowest-performing schools that are not making progress. The ESSA was preceded by the No Child Left Behind Act of 2001 (NCLB), which increased the value placed on standards-based student test outcomes to measure student achievement (Embse & Hasson, 2012). ESSA contains another essential provision that "ensures that vital information is provided to educators, families, students, and communities through annual statewide assessments that measure students' progress toward those high standards" (U.S. Department of Education, 2017). It is therefore essential that we identify variables that affect the authentic measurement of student achievement because student achievement on accountability assessments is the primary indicator of school performance and student success.

As more districts and schools are administering tests such as the Smarter Balanced Assessment Consortium (SBAC) exam, it would appear computer access for students should be plentiful for preparation for the tests because it is a computerized exam. However, the researcher has proctored schools and observed that students were frustrated due to the unfamiliarity with the computerized testing platform. Additionally, there seemed to be resistance to using technology and a preference for traditional methods of instruction which may affect how students train and prepare for computerized exams (Newhouse, 1998).

Background of the Study

Business owners, policymakers, parents, and others have worked to ensure that schools have better access to new technologies since the beginning of the 1980s (Cuban, 2001). Even now in the new millennia, there are still some schools that have not been equipped with computers, Smartboards, or any form of digital technology. In fact, some experts agree that because of the ubiquitous nature of the Internet for educational purposes, it has pushed the World Wide Web into schools whether teachers are ready or not to use technology for instruction (Wilson, 2014).

Proponents of computer-implemented instruction hold the belief that using computers will increase student learning and positively change instruction (Hannafin & Foshay, 2006). Some researchers have written that technology implementation would better prepare and solve academic deficiencies, while other researchers believe technology implementation alone is not enough to close the achievement gap (Wagner, 2014). The National Center for Education Statistics (NCES) states, "that an achievement gap is a difference in scores between two groups of students, for instance, male and female, Black and White, or Hispanic and White" (National Center for Education Statistics, 2015). They further note that this difference is only considered an achievement gap when it is statistically significant, meaning larger than the margin of error.

Although the NCES does not explain the reason for an achievement gap in terms of computers, Clark stated that the measured differences in student achievement from computer instruction could be attributed to either a difference in (a) the instructional method or content of the lesson, or to (b) the novelty effect caused by a new medium that disappears as students become familiar with the new medium (as cited in Hannafin & Foshay, 2006). Also in an article highlighted in the British Broadcasting Corporation (BBC), it was noted that the Program for International Student Assessment (PISA) test scores for science and math have not improved even with the use of technology (Coughlan, 2015).

Some researchers believe that students need more than simply being exposed to computers (Twinning, 2002). Although research has revealed that students do not automatically increase their academic skill by having access to computers, a certain level of training via computer may be necessary if students are required to be tested using computers. Research has shown that when students have access to ubiquitous laptop use, their performance increases in core content areas such as Math and English (Kposowa & Valdez, 2013). Additionally, students do not have a chance to develop computer literacy when they have limited access to technology such as computers, iPads, or the Internet (Merrill, Hammons, & Tolman, 1996). Computer literacy can lead to higher wages further strengthening the rationale for the use of computers in school, as believed by some researchers (Cuban, 2001). It is the researchers' belief that teachers everywhere should find ways to incorporate technology into their curriculum to better prepare students for computerized assessments and to prepare them with 21st century skills.

Schools that have implemented one-to-one initiatives, where each student is assigned a laptop computer, have been successful in improving student achievement as well as providing an increase in student motivation (Holcomb, 2009). Holcomb also noted that exposing students to technology is only part of the equation that seems to echo the findings from other researchers. Holcomb further discussed that teachers and students should always have time to practice before the implementation of technology takes place at their school.

The researcher therefore, seeks to discover if teachers at one-to-one schools have different beliefs about technology integration than teachers where they use computer labs and what effect this belief has on preparing students for computerized assessments. Additionally, the researcher would like to explore other factors that may affect student test performance such as teacher training, school resources, student demographics, and student socioeconomic status.

Many have found that teachers and staff require ongoing technical support to ensure the successful implementation of one-to-one initiatives (Penuel, 2006), which are one computer to one student. Teachers also need to know how to facilitate student engagement in the learning process in a one-to-one classroom if they adopt a one-to-one format (Wilson, 2014). Additionally, whether a school is a one-to-one school or a school that only has computer labs, identifying teachers' perceptions about technology integration can lead to an effective implementation strategy in schools (Claro et al., 2017).

The researcher seeks to understand how teacher beliefs about technology affect a students' performance on computerized assessments. The researcher will also identify any correlation between professional development, school resources, student demographics, and student socioeconomic status. Additionally, is there a difference in test scores of students who have unlimited access to technology such as iPads, laptops, or Smartboards and test scores from students who have limited access to technology such as an occasional trip to the computer lab or access to computer carts several times a month?

History of Smarter Balanced Assessment Consortium

The SBAC is a state-led consortium working to develop next-generation assessments that accurately measure student progress toward college- and career-readiness (Council of Chief State School Officers, n.d.). The assessment developed by the consortium has several factors such as multiple-choice items with multiple correct answers, multipart items, and multiple texts where students are required to compare sections of the text with other sections (Shanahan, 2014). Questions on the SBAC exam get harder when students answer correctly and easier when they answer incorrectly, allowing students to better demonstrate what they know (Smarter Balanced Assessment Consortium, 2017).

Students receive a scaled score on the SBAC assessment that falls on a continuum between 2,189 and 2,862 as shown in Table 1. Based on their scale scores, students are then placed into one of the four achievement levels as determined by SBAC (Smarter Balanced Assessment Consortium, 2017). Achievement level one refers to a student who has not met the standard and is considered novice with scores from 2,280 to 2,542, achievement level two refers to a student who has nearly met the standard and is considered developing with scores ranging between 2,543 - 2,627. Achievement level three refers to a student who has met the standard and is considered proficient with scores ranging between 2,628 - 2,717, and achievement level four refers to a student who has exceeded the standard and considered advanced when scores exceed 2,717. High school students in the 11th grade take the SBAC test every year in the spring.

States began using the Common Core State Standards (CCSS) in 2010 as a basis of reading instruction (Shanahan, 2014). Those states that adopted the CCSS use the tests developed by the Partnership for Assessment of Readiness for College and Career (PARCC) and the Smarter Balanced Assessment Consortium (SBAC) to evaluate the effects of those tests. PARCC is a consortium of 23 states plus the U.S. Virgin Islands working together to develop a common set of K-12 assessments in English and Math anchored in what it takes to be ready for college and career (Partnership for Assessment Readiness for College and Careers, n.d.).

The PARCC and SBAC were authorized by the U.S. Department of Education as a part of The Race to the Top Assessment Program (The White House, n.d.). The purpose of The Race to The Top initiative was to encourage states to strive for higher standards, use data effectively in the classroom, adopt new strategies to help failing schools, and to improve teacher effectiveness (The White House, n. d.). The four critical areas of reform as reported on the website were:

- Development of rigorous standards and better assessments

- Adoption of better data systems to provide schools, teachers, and parents with information about student progress
- Support for teachers and school leaders to become more effective
- Increased emphasis and resources for the rigorous interventions needed to turn around the lowest-performing schools

However, the PARCC and the SBAC do not measure computer knowledge but instead measure student progress in preparation for college and career readiness as stated above.

Table 1

Mathematics Scale Score Ranges

Grade	Min Scale Score	Max Scale Score	Level 1 Standard Not Met	Level 2 Nearly Met	Level 3 Standard Met	Level 4 Standard Exceeded
3	2189	2621	2189–2380	2381–2435	2436–2500	2501–2621
4	2204	2659	2204–2410	2411–2484	2485–2548	2549–2659
5	2219	2700	2219–2454	2455–2527	2528–2578	2579–2700
6	2235	2748	2235–2472	2473–2551	2552–2609	2610–2748
7	2250	2778	2250–2483	2484–2566	2567–2634	2635–2778
8	2265	2802	2265–2503	2504–2585	2586–2652	2653–2802
11	2280	2862	2280–2542	2543–2627	2628–2717	2718–2862

Note. Adapted from "Reporting Scores: Smarter Balanced Assessment Consortium", by the Smarter Balanced Assessment Consortium, 2017, retrieved from http://www.smarterbalanced.org/assessments/scores/

Statement of the Problem

Students at one school have anytime access to technology while students at another school have limited access to technology, yet students at both schools are required to take the same computerized assessment. There is evidence that suggests there is a connection between a teacher's student-centered beliefs about instruction and the nature of the teacher's technology-integrated lessons (Judson, 2006). Judson (2006) noted that teachers who have fears about technology might teach in a more traditional style while teachers who believe students should explore learning may be more apt to use technology. Judson (2006) further noted that it might be hard to distinguish between whether a teacher was using technology because it aligned with their belief and whether their belief about quality instruction caused them not to use technology. The researcher is conducting this research study between a school where students have iPads on a limited basis and a school where students have anytime access to computers in the form of an assigned laptop. The researcher will identify the correlation between limited access to technology and anytime access to technology and students' performance on computerized assessments.

School Environment

Carter is a high school in Scholarly District providing instruction to students in Grades 9 to 12. Carter High School had roughly 800 students with 68% African Americans and 30% Latino students. The school has three magnet schools on the campus, which allowed students to focus on business, performing arts or science/medicine. The school has several computer labs where teachers could schedule class time during the week. The students at Carter High School were not assigned personal laptops or iPads.

The second high school, Grades 9 to 12, is Knightly High and is also in the Scholarly District. Knightly High School has a student population of about 1,600 with 45% African Americans and 54% Latino students. This school is a one-to-one school with each student assigned a take-home laptop computer. The researcher compared data at both schools to determine if there was a difference in test scores between students who had ubiquitous access to computers and students who had occasional use of iPads in a computer lab. The researcher also compared teacher perspectives and training with student demographics at each school to identify if there was a connection between teacher perceptions and student demographics for computerized exams.

The researcher utilized questionnaires as a way to gather teacher data in several key areas. The purpose of questionnaires was to identify the perception and feelings that teachers had about the use of administering computerized tests and the amount of training teachers received in preparation for technology integration as well as identify their level of computer with technology integration. The researcher also used the technological pedagogy content knowledge (TPACK) survey that was designed to assess the seven components of TPACK in four different content areas: Math, Science, Social Studies, and Literacy. The researcher distributed the surveys to participants over a four-week period and conducted face-to-face interviews after the surveys were completed.

The researcher obtained the Smarter Balanced Assessment Consortium (SBAC) scores from both schools to conduct a comparison of students who take the test at a one-to-one school and students who take the test in a computer lab. Three teachers were interviewed from each school as a representation of all teachers at those schools. The researcher utilized English teachers because English is one of the two main content areas of the SBAC exam. In the event that three English teachers were not available or chose to not participate, the researcher randomly chose an equivalent number of alternate teachers.

Purpose of the Study

The purpose of this grounded theory study is to identify factors that affect student performance on computerized exams. The researcher sought to understand and identify any apprehension teachers had towards technology that might influence whether students were exposed to technology in the classroom that would improve their performance. Additionally, the researcher sought to identify other factors that might have an impact on student performance such as student demographics and the socioeconomic status of students.

Although most would consider today's youth as being technologically well informed, many only use the computer for playing games, searching the Internet, or being heavily involved in social media such as Snapchat, Facebook, or Twitter (Statista, 2017). In the article titled "Discrepancy Raises Questions About Fairness," Herold, a writer for Education Week, examined the discrepancy between computerized tests scores and those given via pencil and paper and found students who took computerized exams via computer had lower scores. The acting commissioner of National Center for Education Statistics, Peggy Carr, told Education Week that students' prior exposure to and experience with computers were key factors for students who took computerized exams (Herold, 2016). The article noted that if students had familiarity with technology, then they would do better on computerized exams than students who were unfamiliar with technology. The researcher also holds the belief that students who are more comfortable with technology and familiar with technology and the computerized testing platform will do better on computerized assessments.

Research Questions

This research study addressed the following three questions:

1. Is there a relationship between students who have one-to-one access to school computers compared to those who have scheduled access to school computers and student performance on computerized exams?
2. How does access to school computers affect the student's performance on computerized assessments when controlling for differences in socioeconomic status and demographics?

3. What is the relationship between the number of technology training classes educators take and the number of minutes they spend preparing their students for computerized assessments?

Theoretical Framework

The use of technology for computerized test taking is the most current trend in the nation for the Common Core State Standards (CCSS). The issues surrounding technology integration often involve such barriers as (a) resources, (b) institution, (c) subject culture, (d) attitudes and beliefs, (e) knowledge and skills, and (f) assessment (Hew & Brush, 2007). Some teachers may not have experience with technology or may be inadequately prepared to incorporate technology into their classrooms (Koehler, Mishra, & Cain, 2013). Koehler et al. (2013) discuss the need for educators to integrate technology into their teaching by developing ways to comprehend the difficulty of technology implementation. They address three core components of good teaching: content, pedagogy, and technology.

The framework for technology integration defined as "Technological Pedagogical Knowledge (TPK) is an understanding of how teaching and learning can change when particular technologies are used in certain ways" (Koehler et al., 2013, p. 16). However, the knowledge that goes beyond all three-core components is Technological Pedagogical Content Knowledge (TPACK).

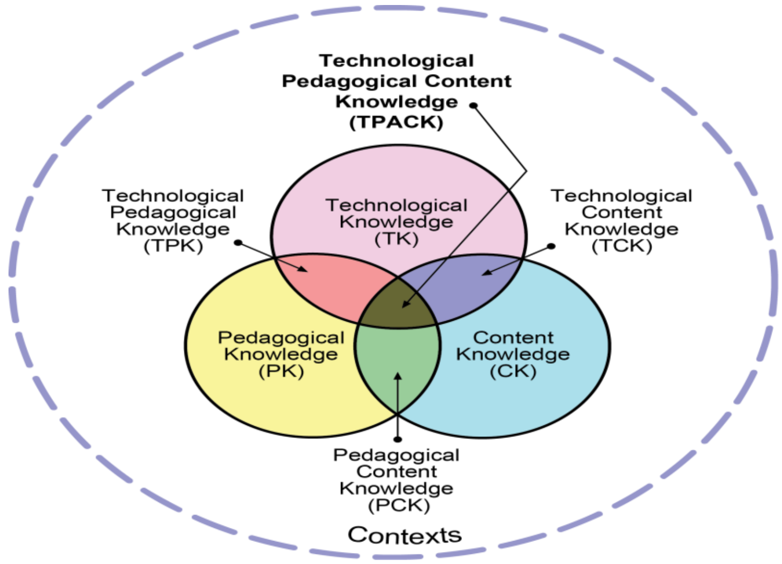

Figure 1. The TPACK framework and its knowledge components, reprinted from "What Is Technological Pedagogical Content Knowledge?" by M. J. Koehler, 2009 (http://www.citejournal.org/volume-9/issue-1-09/general/what-is-technological-pedagogicalcontent-knowledge). Copyright by TPACK. Reprinted with permission.

TPACK is the basis of effective teaching with technology, requiring an understanding of the representation of concepts using technologies and pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face (Koehler et al., 2013, p. 16). Koehler suggests that TPACK allows researchers and teachers to move from viewing technology as an add-on and to focus on connecting technology, pedagogy, and content in a more natural way.

Significance of the Study

The findings of this study will be significant because the results from computerized tests in some schools and districts may be factored into graduation rates the following year in content areas such as English and math (Graham, 2017). Graham also noted that local, state and federal levels use test scores for accountability purposes. The researcher seeks to understand the teacher factors of teacher beliefs, professional development, and attitude about technology to identify the effect these factors have on student performance on computerized assessments. Additionally, the researcher will identify student factors that may be barriers to student preparation and performance on computerized exams to improve student success on computerized exams.

Definition of Terms

The following terms are defined as used in this study:

Common Core State Standards (CCSS): The Common Core State Standards (CCSS) are educational standards for English Language Arts (ELA)/Literacy and Mathematics in grades K-12 (National Governor's Association, & Council of Chief State School Officers, n.d.).

Constructivist Learning Theory: Constructivism is a theory based on observation and scientific study about how people learn. The theory says that people construct their understanding and knowledge of the world through experiencing things and reflecting on those experiences rather than having the teacher disseminate information to them. In the classroom, the constructivist view of learning can point towards many different teaching practices. In the most general sense, it usually means encouraging students to use active techniques (experiments, real-world problem-solving) to create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing (Thirteen Ed Online, 2017).

English Language Learners (ELL's): Students who are unable to communicate fluently or learn effectively in English, who often come from non-English-speaking homes and backgrounds, and who typically require specialized or modified instruction in both the English language and in their academic courses (Great School Partnerships, 2013).

Halo Effect: Generalization from the perception of one outstanding personality trait to an overly favorable evaluation of the whole personality (Merriam Webster Dictionary, n.d.).

Limited English Proficient (LEP): Individuals who do not speak English as their primary language and who have a limited ability to read, speak, write, or understand English can be limited English proficient, or "LEP" (Limited English Proficiency, n.d.).

Linguistic: The scientific study of language and its structure, including the study of grammar, syntax, and phonetics. Specific branches of linguistics include sociolinguistics, dialectology, psycholinguistics, computational linguistics, comparative linguistics, and structural linguistics (Oxford English Dictionaries, 2017).

Member Check: This is when data, analytic categories, interpretations, and conclusions test with members of those groups from whom the data was originally obtained. As opportunities for member checks may arise during the normal course of observation and conversation, testing can be both formal and informal. Typically, member checking is a technique for establishing the validity of an account (Cohen & Crabtree, 2006).

New Technologies: Software applications, computers, digital cameras, iPads, and tablets will identify as new technologies.

Partnership for the Assessment of Readiness for College and Careers (PARCC): The Partnership for Assessment of Readiness for College and Careers (PARCC) is a group of states working together to develop a modern assessment that replaces previous state standardized tests. The PARCC states provide an annual year-end test in English language arts/literacy, and mathematics in Grades 3 to 8 and high school (Partnership for Assessment Readiness for College and Careers, n.d.).

Pedagogy: Pedagogy is the discipline that deals with the theory and practice of teaching. Pedagogy informs teaching strategies, teacher actions, and teacher judgments and decisions by taking into consideration theories of learning, understandings of students and their needs, and the backgrounds and interests of individual students (TheFreeDictionary, n.d.).

Race-To-The Top Initiative (RTTT): Authorized under the American Recovery and Reinvestment Act of 2009 (ARRA), the Race to the Top Assessment Program provides funding to consortia of States to develop assessments that are valid, support and inform instruction, provide accurate information about what students know and can do, and measure student achievement against standards designed to ensure that all students gain the knowledge and skills needed to succeed in college and the workplace (U.S. Department of Education, 2014).

Self-efficacy: In social cognitive theory, a person's belief in his/her ability to execute the behaviors necessary to achieve desired outcomes. In contrast to self-confidence, self-efficacy refers to beliefs about specific behaviors in specific situations (TheFreeDictionary, n.d.).

Smarter Balanced Assessment Consortium (SBAC): This is a public agency currently supported by members. They created an online customized test, by the same name, using a computer-adaptive format aligned to the Common Core State Standards (CCSS), as well as tools for educators to improve teaching and learning (Smarter Balanced Assessment Consortium, 2017b).

Socioeconomic status: Defined by the American Psychological Association (APA) as the "social standing or class of an individual or group," which is "often measured as a combination of education, income, and occupation" (American Psychological Association, n.d.).

Statistical Package for Research Software Program (SPSS): SPSS is a predictive analytics software program that is used to analyze data. The program uses a simple drag and drop interface to access a wide range of capabilities and work across multiple data sources (IBM, n.d.).

Technological Pedagogical Content Knowledge (TPACK): 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. The TPACK frameworks combine three primary forms of knowledge: Content (CK), Pedagogy (PK), and Technology (TK) (TPACK ORG, 2017).

Technological Pedagogical Knowledge (TPK): It is an understanding of how teaching and learning can change when we use technologies in particular ways. TPK is one of the seven components of the Technological Pedagogical Content Knowledge (TPACK ORG, 2017).

Technology Acceptance Model (TAM): The technology acceptance model (TAM) is an information systems theory that models how users come to accept and use technology. Davis (1986) initially proposed the TAM in 1989. The model suggests that when users are presented with new technology, many factors influence their decision about how and when they will use it, which is perceived usefulness (PU) and perceived ease-of-use (PEOU). Davis defined PU as the degree a person believes that using a system would enhance his or her job performance and PEOU as the degree to which a person believes that using a particular system would be free from effort (Revolvy, n.d.).

Title I: Title I, Part A (Title I) of the Elementary and Secondary Education Act (ESEA), as amended ESEA provides financial assistance to local educational agencies (LEAs) and schools with high numbers or high percentages of children from low-income families to help ensure that all children meet challenging state academic standards (U.S. Department of Education, n.d.).

Ubiquitous: Being or seeming to be everywhere at the same time; omnipresent (TheFreeDictionary, n.d.).

Limitations

The limitations that the researcher anticipated were the number of participants in the study, as data was only collected from two schools within the same district. The number of teachers at each school was three, and this small number may not be enough to determine if the results yielded would apply to a larger school population. The three teachers at each school represented English teachers as English is one of the core content areas tested on the Smarter Balanced Assessment Consortium Exam (SBAC). The research study did not include data from private or charter schools.

Another limitation of the study was that the researcher relied on teachers to provide information about how students reacted during times when technology was used in the classroom rather than the researcher collecting data from the students. Because interaction with students requires the consent of the school district, teachers, students, and parents, the researcher only chose to use teachers' perceptions and demographics obtained from the district. Teacher observation data could be the result of teacher bias if teachers provide only positive data.

Delimitations

To gain the perceptions of students from the teachers' account, who will be taking a computerized exam, the researcher did not use participants who had already graduated from either school. Although recent graduates' attitudes might provide another layer to discovering how students are trained, the researcher only chose to include observation data from teachers who observed their current 9 - 12th grade students. Additionally, data used in the study was from SBAC scores, of 11^{th} grade students, from the previous year.

A second delimitation by the researcher was the use of only educators from public schools. In using only public-school educators within the Scholarly District, the researcher did not use the views of teachers in other school districts or private/charter schools.

Assumptions

This study included the following assumptions (a) each teacher completed the survey in its entirety, (b) each teacher answered all questions accurately and truthfully, and (c) the confidentiality the researcher offered all participants created an atmosphere where they could be open about their beliefs.

The researcher anticipated that teachers who had positive attitudes about technology use and had received training would have students who perform higher on computerized exams than students whose teachers held negative views about technology integration. The researcher also projected those teachers who held a positive belief about technology put more effort into preparing their students for computerized exams as opposed to teachers who held a negative belief about technology.

About the Researcher

The researcher resides in California and was in her third year of teaching high school Algebra 1 and Geometry in the Scholarly District at the time of this research study. She transferred to this position from a middle school where she taught Geometry in the gifted magnet program for two years. Before embarking on a career in the public-school system, the researcher spent 10 years working as a substitute teacher in the Scholarly District and for a private Christian school located on the campus of a well-known Christian church. Although the researcher was concurrently building a career in sales for a major cosmetics company, it was her love for teaching Math that led her to choose to become a full-time Math teacher.

Originally, from St. Louis, Missouri, the researcher has been in California since 1984. She holds a Master's degree in Computer Information Systems (CIS) and a Master's degree in Education as well as a single-subject credential to teach foundational-level Math.

Organization of the Study

The researcher presents this study in five chapters:

- Chapter 1: Background of the study, significance of the study, statement of the problem, purpose of the study, definition of terms, theoretical framework, research questions, limitations, delimitations, and the assumptions of the study.
- Chapter 2: Review of the literature, teacher perspectives, student perspectives, professional development and school resources, student demographics and socioeconomic status.
- Chapter 3: Methodology used for this research study and how the data was analyzed and evaluated. It includes the selection of participants, instrumentation, data collection, and how the data was validated.
- Chapter 4: Study's findings, including demographic information, testing the research questions, confirmatory factor analysis and results of the data analyses for the research questions.
- Chapter 5: Summary of the entire study, discussion of the findings, implications of the findings for theory and practice, recommendations for further research, and conclusions.

Summary

The researcher discussed the purpose of the study and highlighted research questions on which the researcher based the study. The researcher described the research and the importance of answering the research questions. Additionally, the researcher provided detailed information of the theoretical framework that will be used in this study, as well as defined terms that will be used throughout the document.

CHAPTER 2: REVIEW OF LITERATURE

The purpose of this chapter is to highlight issues surrounding teacher beliefs and attitudes about technology integration and computer practice for students who are required to take computerized assessments. Additionally, the researcher reviewed literature that dealt with professional development and school resources, as well as issues surrounding the effect student demographics and socioeconomic status have on student performance. The researcher discusses the disadvantages and advantages of using technology in the classroom as well as using technology to take computerized assessments. Teacher perceptions about professional development as it relates to preparing students for computerized exams are identified as a positive or negative factor in reference to preparing students for computerized assessments.

This educational study will draw attention to the attitudes educators have about technology to see if there is a correlation between teacher attitudes about technology and student performance. The researcher reviewed literature about the debate on whether technology will assist in closing the achievement gap on computerized assessments. Additionally, the researcher reviewed literature on whether using technology efficiently would increase scores on computerized assessments.

The research problem is relevant since students are required to take computerized assessments often without much preparation for the test or familiarity with the computer platform. Research has shown that when students lack experience with technology they are at a disadvantage when it is time to take a computer-based exam (Salend, 2009). While some researchers believe the integration of computers will augment and increase student test scores, current research has not examined the variable of how the technology belief of teachers affects student performance. Additionally, student perceptions were addressed in this study as well as professional development and school resources as it related to technology integration. The researcher addressed the following questions:

1. Is there a relationship between students who have one-to-one access to a school computer compared to those who have scheduled access to school computers and student performance on computerized exams?
2. How does access to school computers affect the student's performance on computerized assessments when controlling for differences in socioeconomic status and demographics?
3. What is the relationship between the number of technology training classes educators take and the number of minutes they spend preparing their students for computerized assessments?

The researcher organized Chapter 2 into the following sections (a) teacher beliefs, (b) professional development, (c) school resources, (d) student demographics, (e) student socioeconomic status (f) technology, and (g) computers and computerized tests.

Teacher Factors

Teacher Beliefs

People's belief about their self-efficacy can influence their action and how much effort they put into pursing any course of endeavor, including embracing technology or avoiding it at all cost (Bandura, 1997). Bandura (1997) states that perceived self-efficacy is more about a person's belief about what they can do rather than a measure of their skills. It is obvious that teacher attitudes and behaviors affect technology implementation and in turn, future teacher behaviors and student learning and performance regardless of the job requirement (Lumpe & Chambers, 2001; Subhi, 1999). Although certain methods such as experiences and persuasion can increase self-efficacy, the best strategy is to help teachers increase their personal mastery of using technology (Ertmer & Ottenbreit-Leftwich, 2010).

Subhi (1999) conducted a study and noted that before computers are implemented in an educational system, students and teachers must have a positive attitude about computer use. The authors used a survey to determine teacher and gifted students' attitudes toward computers. They used The Jordanian Version of the Advanced Raven's Progressive Matrices (ARPM) as the instrument to measure intelligence and The Mathematical Skills Assessment (MSA) to measure achievement of the students. Additionally, they used a Likert-type questionnaire with 22 items to measure the attitudes of the gifted students and their teachers.

Subhi (1999) used a standard multiple regression procedure to evaluate the relationship between teachers' attitudes as the dependent variable, and teachers' age, qualifications, and years of teaching as the independent variable. The author found that the dependent variable was not related directly to the independent variable. When the author compared the attitudes of teachers to the attitude of gifted students they found no significant difference but noted the attitude toward computers for students was related to their IQ and math scores. Lastly, the authors found that a lack of teacher training was a major obstacle to the implementation of computers in their classes.

Teachers bring their experiences and fixed ideas about testing to their profession (Hogan, 2015). Teachers who avoid technology or choose not to implement technology in their classroom may inadvertently create a disadvantage for some students who may not have access to technology at home. Students need the technological skills necessary to compete in today's global society (International Society for Technology in Education, 2017).

The International Society for Technology website reads, “It’s not about using digital tools to support outdated education strategies and models; it’s about tapping into technology’s potential to amplify human capacity for collaboration, creativity, and communication” (International Society for Technology in Education, n.d.). Additionally, the Office of Educational Technology, a part of the Department of Education, developed a National Education Technology Plan to promote equity by using technology. The website reads “While acknowledging the continuing need to provide greater equity of access to technology itself, the plan goes further to call upon all involved in American education to ensure equity of access to transformational learning experiences enabled by technology” (U.S. Department of Education, 2017). The National Education Technology plan was updated in 2017 and has seen an increase in the number of schools that have integrated technology as well as an increase in the number of teachers who are trained on technology in preservice programs.

Zepp (2005) conducted a study to determine teachers’ perceptions of educational technology. The author asked students if they thought technology would eradicate the need for teachers. All participants in the study believed that educators would always be better than machines because people interact better with people. However, the author discovered the participants thinking lined up with two different views: modernist and postmodernist.

Zepp (2005) found that the modernist views education as a way to transmit information and skills and that the efficiency of that transmission would determine the success. In juxtaposition, the postmodernist views education as more than the transmission of information but believes personal growth should be an end in itself rather than a means to acquire information. Zepp conducted a study and asked 38 students applying for admission at Eastern Mediterranean University to answer the following question:

> "In the near future, it will be possible for technology (including books, videos, computers, etc.) to transmit any information or skill more effectively than teachers. Therefore, there will be no need for teachers." Do you agree or disagree with this statement? Discuss.

After eliminating three questions because of ambiguity, Zepp (2005) recorded that of the 26 students who held master's degrees, 13 students had a modernist view about technology and ten had a postmodernist view about technology. After eliminating one question because of ambiguity Zepp recorded that of the 12 students who held doctorate degrees, five had a modernist view about technology and six had a postmodernist view about technology. After completing a chi-square analysis on the responses, the author found no statistically significant difference between the two groups. Zepp (2005) concluded that educators should be made aware of the role of technology and which goals could be best achieved by implementing technology.

Teachers should understand how computers fit into the learning process before they implement technology. Teachers embrace new tools when they are more open (Onen, 2012). Onen further concluded there was a positive and significant relationship between a teacher's attitude and their belief about education thereby noting that the teacher's beliefs influence the teaching in the classroom.

In his study, Onen (2012) determined that if teachers are to be successful in using technology effectively, his or her pre-service philosophical approach must be a prior consideration. In using computers and the Internet for educational purposes, pre-service teachers and teachers need to interact within the boundaries they have set based on their educational beliefs. Onen (2012) further notes that teachers need to have perceptions for using computers and the Internet in their classes in such a way that technology is a tool and notes that perception is a teacher's belief.

Another research study was conducted to examine teacher and student views about technology integration. The results of the study found that while student perceptions about technology were enthusiastic, teacher perceptions about technology integration was negative (Li, 2007). Li highlighted the fact that because students and teachers were the most critical stakeholders that their beliefs should be a consideration before technology integration takes place. Li (2007) further discussed that teachers' and students' beliefs about technology might affect their adoption of the tools, which directly affect a technology-enhanced environment. While this current research study will focus on the perceptions of teachers in an urban school, Li (2007) focused on secondary science and math teachers in urban and rural school districts.

Additionally, Li (2007) addressed teacher and student beliefs from a "systems design" approach listing educators and students as systems themselves that are part of the system of education. The teachers in Li's study held the belief that we utilize technology only when necessary and that weak students would benefit more from studying to pass tests rather than worrying about technology integration.

In an article published in Education World (2012) writer Bernie Poole identifies six skills that all educators should possess:

1. Every teacher should be proficient in the use of productivity tools.
2. Every teacher should be able to troubleshoot technology-related problems that commonly crop up in the classroom.
3. Every teacher should know where to go for technical assistance.

4. Every teacher should be familiar with what's available on the Web in his or her subject area.
5. Every teacher should have well-honed Web searching skills.
6. Every teacher should be open to new ways of doing things.

President Obama's ConnectEd initiative, which was introduced in 2013, has four technology goals:

1. Within five years, connect 99 percent of America's students through next-generation broadband and high-speed wireless in their schools and libraries
2. Empower teachers with the best technology and training to help them keep pace with changing technological and professional demands
3. Provide students with feature-rich educational devices that are price competitive with basic textbooks
4. Empower students with digital learning content and experiences aligned with college- and career-ready standards being adopted and implemented by states across America (U.S. Department of Education, 2017).

The above initiative should provide assurance to educators and schools who are integrating technology into their classrooms and schools. The Every Student Succeeds Act (ESSA), which was authorized by Congress in 2015, contains an Effective Use of Technology portion that allocates funds for technology use in schools (U.S. Department of Education, 2017). The goal of the plan is to create an infrastructure that combines resources and connectivity for constant learning.

Karatas (2014) conducted a study about mathematics teachers' beliefs and found that just as Math teacher beliefs about teaching math can shape the learning environment for students, so too can their belief about computers shape the use of computers in their classrooms. The research conducted the study with 104 pre-service math teachers who were in their second, fourth and fifth year of their education. Participants were then required to take a computer-assisted mathematics instruction (CAMI) survey that allowed the author to collect data about their beliefs about using computers to teach and learn math. The participants then took three classes.

The first class was Computer Oriented Model (COM), which included word processing, basic and advanced spreadsheet applications, basic information technology, presentation software, and Internet applications. The second class was Integrated Model (IM), which was mathematics software that focused on the technological pedagogical content knowledge about Geometry. The third class was Exploring Mathematical Relationships with Mathematical Software (EMReMaS) in which the participants were taught the principles of using computers in mathematics education and to some common mathematical softwares, such as Dynamic Geometry Software, Computer Algebra Systems, and Win Logo Programming Language.

Karatas (2014) noted that before participants took the three described courses that the primary analysis showed no statistical difference in their beliefs about using computers for teaching and learning mathematics. After participants completed their coursework, they were required to complete the CAMI survey again which revealed that the EMReMaS and IM classes had a positive impact on pre-service math teacher's belief but no impact on students who took the COM classes.

Therefore, it may be concluded that the EMReMaS and IM groups had a positive impact on pre-service mathematics teachers' beliefs and no impact on COM students. Karatas was careful to note that the study did not take into account a participant's prior knowledge about computer literacy as a condition for participating in their study and further suggested that prior computer literacy of educators be considered.

Karatas concluded in the study that teacher experiences and beliefs are critical in teaching math with the use of instructional technology. It is probably safe to say that teachers' belief about a plethora of events may shape how they teach or what activities become a part of their respective classrooms. In fact, the decisions, behaviors, and actions of individuals base their lives on their beliefs (Hofer & Pintrich, 1997; Pajares, 1992). While some studies have dealt with external factors surrounding the implementation of technology, Karatas (2014) dealt with the effects that external variables had on educators' attitude toward using technology.

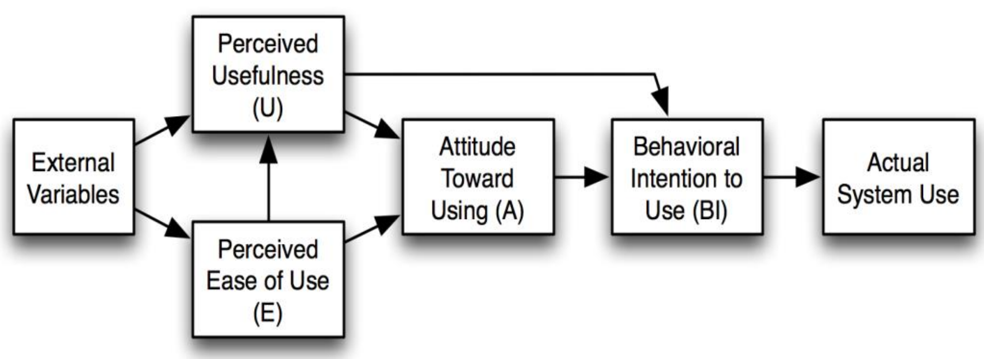

Figure 2. Technology acceptance model (TAM), Adapted from the "*Technology Acceptance Model for empirically testing new end user information systems theory and results*, doctoral dissertation, retrieved from https://dspace.mit.edu/handle/1721.1/15192?show=full

The Technology Acceptance Model (TAM), depicted in Figure 2, was developed as a way of evaluating or predicting a person's belief about the use of technology (Davis, 1986). Davis developed this theoretical model noting that two major objectives would help identify if a person would use computers based on two major objectives. The first objective was to improve how people understood the user acceptance process and second, TAM would allow system designers an opportunity to evaluate how effective a system would be before the actual implementation (Davis, 1986). The TAM model provides a foundation that allows researchers to understand how external factors influence attitude, belief, and intention of use regarding technology (Sung, 2009). Sung noted that a person's perceived usefulness of a system and their behavioral intentions determine how they will use technology.

Motshegwe and Batane (2015) conducted a study that utilized the TAM and the results showed that perceived ease of use and perceived usefulness positively influenced instructors' attitude toward technology adoption. The authors defined technology integration to include "computers, data projectors, video conferencing, VCRs and television sets, the Internet, Learning Management Systems, PowerPoint, and Social Media." The authors then used a questionnaire to collect data from a sample population of 54 educators and developed the following hypotheses statements:

- Self-efficacy will have a significant influence on perceived usefulness.
- Self-efficacy will have a significant influence on perceived ease of use.
- Self-efficacy will have a significant influence on attitudes.
- Perceived usefulness will have a significant effect on attitudes.
- Perceived ease of use will have a significant influence on attitudes.

After running a correlation, the authors tested the null hypotheses of each hypothesis and found the following results for each null hypotheses:

- Self-efficacy will have no significant influence on perceived usefulness – results showed no statistically significant relationship between self-efficacy and perceived usefulness. The authors concluded the relationship between the two variables was due to chance and the null hypothesis was retained.

- Self-efficacy will have no significant influence on perceived ease of use – results showed no statistically significant relationship between self-efficacy and perceived ease of use. The authors concluded the relationship between the two variables was due to chance and the hypothesis was retained.
- Self-efficacy will have no significant influence on attitudes – results showed a statistically significant relationship between attitude towards technology and self-efficacy. The authors concluded that the relationship between the two variables was due to chance and the hypothesis was retained.
- Perceived usefulness will have no significant effect on attitudes – results showed a statistically significant relationship between attitude towards technology and perceived usefulness. The authors concluded that perceived usefulness had a positive effect on attitudes and the null hypothesis was rejected.
- Perceived ease of use will have no significant influence on attitudes – results showed a statistically significant relationship between attitude towards technology and perceived ease of use. The authors concluded that perceived ease of use had a positive effect on attitudes.

Motshegwe and Batane (2015) considered self-efficacy to be an external factor and found it had no influence on educator's perceived ease of use or perceived usefulness and therefore noted self-efficacy is not a reliable tool to predict people's attitude toward technology integration. The authors, therefore, noted in the study that although participants believed they had confidence in using technology it did not mean they found the technology useful. The authors further noted that the decision to use technology was influenced not only by the availability of training and resources but also by an individual's philosophical and inner feelings about technology.

Bai and Ertmer (2008) noted that in using the Technology Acceptance Model in their study, that attitude was a crucial driver of technology adoption. The authors conducted a study about the pedagogical beliefs of preservice teachers' attitudes toward technology about their pedagogical beliefs and technology use. The participants in the study were instructors and preservice teachers at a large university. At the beginning of the semester, each preservice teacher completed a pre-survey that was given online to identify their current beliefs and attitudes toward technology while teacher educators took a similar survey but at the end of the semester. The only difference between the two groups was that preservice teachers took an introductory technology class during the semester and teacher educators did not.

Bai and Ertmer (2008) also noted that there was a significant relationship between preservice teachers' technology attitudes related to educational benefits and teacher educators' technology uses. The authors further noted that there was no significant relationship between preservice teacher's technology attitude and their technology use until after they took an introductory technology class. They concluded in their study that using self-efficacy, as a determining factor, should be ruled out because participants' self-beliefs did not impact their attitude towards integration.

In another study, ChanLin (2007) used a 28-item questionnaire to assess teachers' perceived manageability and perceived importance of technology integration into their classrooms. The authors conducted the study with volunteer teachers from secondary and elementary schools in Taiwan who taught various subjects in Grade 1 to Grade 9. The participants in the study were asked 28 questions from the following four categories: curricular, environment, social, and personal. In each of the four categories, the author ranked the answers to the questions from the most important to the least important.

In the curricular factors, teacher's concerns were how technology would align with their teaching strategies, literacy skills and how to enhance them; personal beliefs about teaching, and their personal technology experience (ChanLin, 2007). In the environmental factor, ChanLin found teachers were concerned with items such as budget support, allocation of time for using computer labs, training, incentives and management of manpower and resources. In the social factors, teacher's concerns were with social changes and technology trends, attitudes of administrators, the social value of using technology, and expected support from their peers. Finally, in personal factors, teachers were concerned with family support and personal growth.

ChanLin (2007) concluded from the study that integrating computer technology into teaching would involve some level of implementation from all four categories contained in the questionnaire. ChanLin (2007) further found that teachers would require training to change their attitude on how to meaningful implement technology into their classrooms because of the difficulty in managing the social factors of technology trends, attitudes towards authorities, the social value of computer technology, and support from peers. Kiridis, Drossos, and Tsakiridou (2006) conducted another study and found that if teachers did not take the time to apply a new teaching philosophy, they were less likely to hold a positive belief that technology integration would be useful in their classrooms.

As teachers implement technology into the curriculum to prepare students for computerized exams, other concerns may develop that are unique to online testing situations, and facilitators should be aware of these concerns (Donovan, Hartley & Strudler, 2007). Using computers during class or on a test can create a tempting situation for students because of the ability to search for answers using Internet search engines. Schools and educators may have to address high-tech cheating, the digital divide, and training programs for both teachers and students (Salend, 2009).

Professional Development

Although states are requiring computerized testing such as the Smarter Balanced Assessment Consortium (SBAC), not all teachers have embraced the idea and therefore, have not implemented any technology into their curriculum. As previously stated, Subhi (1999) conducted a study and found that one of the major obstacles for computer implementation was the lack of teacher training. The author further noted that it is the teacher who decides on student computer usage. Judson (2006) echoed the same line of thinking when he discussed “the constructivist teaching style” in the article “How Teachers Integrate Technology and Their Beliefs About Learning: Is There a Connection?” The constructivist teaching style refers to a teacher who guides students through activities such as experiments and helps them understand and talk about what they are doing as opposed to a teacher who uses a more direct approach to disseminating information to students (WNET Education, 2017). Teachers that use technology as a learning tool teach with a more constructivist teaching style (Judson, 2006).

Researchers have found that some teachers often do not have the experience needed to integrate digital technologies into their curriculum (Koehler et al., 2013; Pelgrum, & Plomp, 1991). Li (2007) found that teachers were more willing to integrate technology into their curriculum when their confidence level about their core class was high. Often the obstacles teachers face in technology preparation can hinder their ability to administer tests or prepare students for computerized tests (Salend, 2009). There is an imbalance between computer acquisition and teachers who know how to integrate technology into their classrooms. Teachers express their inability to effectively integrate technology because of a lack of technology integration training (Zhao, 2007). One critical way to help teachers manage the integration of technology is to participate in ongoing professional development that could boost their confidence. Teachers' confidence in using computers increases as they become more open to learning how to use and implement computers into their curriculum (ChanLin, 2007). Additionally, Christensen (2002) determined technology training had a strong influence on teachers' attitudes about incorporating technology use in the classroom.

Preservice teacher training programs before the 1990s often did not provide technology training for teachers and is a fundamental reason for the imbalance (Picciano, 2011). Picciano (2011) noted that recent graduates or new teachers, for the most part, might have received technology training as a part of the certification program although they may still need ongoing training to refine their skills.

Because technology is continually changing, professional development for educators should be an ongoing process (Picciano, 2011). Training avenues that are available to schools after the acquisition of technology can vary from one-to-one coaching, workshops, seminars, conferences, college classes, online classes and even training from co-workers (Amadeo, 2017). A blog or electronic bulletin board can be an inexpensive avenue to keep one apprised of technology changes in the industry. Additionally, educators can find valuable information from resources such as the International Society for Technology in Education (ISTE) or the Office of Educational Technology.

School Resources

While some students attend schools where their classroom has state-of-the-art technology, many other students attend schools where technology is lacking, and it may all have to do with a family's wealth or color of their skin (Ushomirsky & Williams, 2017). In the article "Funding Gaps 2015," Ushomirsky and Williams (2017) report that although districts with similar demographics and funding levels can produce different results, those districts with more resources can pay teachers more, thereby attracting the highest qualified educators. The authors used the poverty rate, as opposed to the percentage of students qualifying for free/reduced lunch, to compare the revenues of the highest and lowest poverty districts across the country.

Ushomirsky and Williams (2017) found that districts with the highest poverty levels received on average $1,200, or 10 percent, less per student than the lowest poverty districts. The difference in funding would mean a shortage of resources of $600,000 per year for a school with 500 students and $1.2 million for a school with 1,000 students. The authors note that because students of color often start school academically behind their peers, schools with higher poverty should be provided with more support to ensure that all students leave high school ready for meaningful careers or college. In their conclusion, Ushomirsky and Williams (2017) report that too many states spend less on educating low-income students and students of color which contradicts a national commitment to equality of opportunity and denies students of the support they need to flourish.

Regardless of the amount of money that districts receive, if the resources are not producing the intended goal of increasing student performance the expenditure of resources may be considered inefficient (Lavigne, Ryan, Zweig, & Buffington, 2017). Lavigne et al. (2017) ranked 98 sample districts using the following six expenditure-to-performance ratios to determine their level of efficiency:

1. Total per pupil expenditures (dollars)

   Median student growth percentile in Math

2. Total per pupil expenditures (dollars)

   Percentage of district students scoring proficient or above in Math

3. Instructional per pupil expenditures (dollars)

   Median student growth percentile in Math

4. Instructional per pupil expenditures (dollars)

   Percentage of district students scoring proficient or above in Math

5. Constructed per pupil expenditures (dollars)

   Median student growth percentile in Math

6. Constructed per pupil expenditures (dollars)

   Percentage of district students scoring proficient or above in Math

The authors found that each ratio resulted in a different ranking that was influenced more from the measures of performance rather than the measures of expenditures. The authors concluded that for districts to determine the efficiency of resources they receive, the best indicator is to select the measures of expenditure and performance that are most relevant to the current interest of the district.

Baird (2012) conducted a study to determine the relationship between school resources and math performance among students who had low socioeconomic status. Baird (2012) investigated achievement gaps in 19 wealthy countries to explain why low SES students underperform other students. The author found that in some countries, the school-resource difference existed while in other countries the resource difference did not explain the reason for the achievement gap.

To determine the extent to which differences in average school and classroom-level resources between the two groups Baird (2012) conducted an analysis of the 2003 Third

International Mathematics and Science Study (TIMSS) math scores among eighth graders. As reported in the study, the results appear to imply that a large portion of the achievement gap can be contributed to the characteristics of low SES students rather than the difference in resources received by high versus low SES students.

Technology

As other professionals use technology to increase effectiveness on the job, teachers should be expected to use technology to meet the needs of the 21st-century learner (Ertmer & Ottenbreit-Leftwich, 2010). It was reported that teachers not only need to know how to use technology hardware, but also should be required to expand their knowledge of pedagogical practices across multiple aspects of the planning, implementation, and evaluation processes. The authors believe that technology is a necessary tool for successful performance, rather than a supplemental teaching tool. As teachers incorporate technology into their curriculum, they should also improve their pedagogical methods to enable student learning.

The implementation of technology has and always will be governed by certain procedures and policies. Often administrators only realize the importance of having policies when problems arise in the absence of a policy (Picciano, 2011). Schools and teachers should become familiar with the advantages and disadvantages of implementing technology into their schools and classrooms. Moreover, students today spend so much time on the Internet and using computers in general, that teaching with technology is a natural way to reach these students (Tileston, 2004). There is an old saying that bears repeating: "I hear, and I forget. I see, and I remember. I do, and I understand" (Crockett, Jukes & Churches, 2011, p. 90).

McDaniel and Fraser (2016) conducted a study based on The No Significant Difference Phenomenon, which was discussed by Russell (1999). The authors noted that Russell found few studies where there were measurable positive effects about technology-based learning environments. However, McDaniel and Fraser (2016) noted several studies that provided comprehensive support for the effectiveness of technology use including:

- A meta-analysis of 26 studies between 1992 and 2002 by Goldberg, Russell and Cook (2003) who concluded students using computers for writing produced higher quality work,
- A meta-analysis of 36,793 learners who showed improved mathematics achievement when they used computer technology (Li & Ma, 2010), and
- A research study conducted by Hunsu, Adesope and Bayly (2016) that revealed small but statistically significant effects on cognitive outcomes when students used clicker-based technology.

McDaniel and Fraser (2016) wanted to determine the effectiveness of using technology regarding the perception students have about their learning environments. Their eight-month study involved using a pretest with 966 students in Grades 6, 7, and 8 and a posttest of 860 students. The instrument they used was The Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI) developed by Aldridge, Dorman and Fraser (2004). The TROFLEI contains 80 items with eight items in each of the following ten scales:

1. Student Cohesiveness – knowing and helping one another
2. Teacher Support – teacher, being interested in the student
3. Involvement – students encouraged to participate
4. Investigation – problem solving and inquiry
5. Task Orientation – students, staying on task
6. Cooperation – cooperating rather than competing

7. Equity – inclusive environment
8. Differentiation – differences in students' abilities
9. Computer Use – student use of computers, and
10. Young Adult Ethos – students responsible for their learning

The authors identified a small difference between students' scores for their pretest and posttest for eight of the ten learning scales. They found the standard deviation ranged from 0.02 to 0.22 for technology integration. McDaniel and Fraser (2016) concluded that although technology integration into the curriculum was not advantageous, it was also not disadvantageous which was consistent with the 'no significant difference phenomenon' as discussed by (Russell, 1999).

In another research study, in juxtaposition to McDaniel and Fraser (2016), Chandra and Lloyd (2008) conducted a study regarding information and communication (ICT) and the effects of student achievement and found an improvement in student test scores. The authors conducted the study with two cohorts where one group of Year 10 students, identified as the Traditional group, took the same classes as another group of students, identified as the Blended group, in a blended e-learning environment. Students took a test at the end of each term, and the authors compared the results using a paired sample t-test. After dividing each term into quartiles, the authors conducted further analysis between boys and girls from Term 1 unit and Term 2 unit.

The authors revealed that the results showed the boys in the Traditional group had a lower mean in the test after their physics class (Pre-M > Post-M) but results were reversed for boys in the Blended group (Pre-M < Post-M). They noted the results suggested that the computer-based intervention impacted the results although there was a narrow spread. The researchers revealed the results for the girls were reversed, as the difference was negative.

Chandra and Lloyd (2008) cited Snyder (2000), who noted that isolating the e-learning environment from other variables is difficult. The authors also indicated that Gunawardena and McIsaac (2004) believed that it is not the technology that affects student performance but the facilitation of altered pedagogy. Chandra and Lloyd (2008) reported that the results of their research study might have had a positive impact on learning because of the 'halo' effect. Lastly, they suggest that although the improvement is not global, their research showed that information and communication (ICT) could improve student performance through an e-learning environment.

Computers and Computerized Tests

Recent reviews outline the need for more scientifically based research to determine how one-to-one computing affects student achievement (Dunleavy & Heinecke, 2007). Research has shown that some students do worse on computerized assessments because of their unfamiliarity with technology rather than their skill or academic knowledge (Herold, 2016). Access to information has become easier because of the intranet networks and the Internet (Retnawati, 2015). The question then, as it relates to this research study, is not whether computers are efficient or if they can be used to raise achievement scores but how student achievement on computerized exams is affected by teacher beliefs about technology, professional development, school resources, student socioeconomic status and student demographics.

Several studies have provided evidence that academic performance is improved with computer use although further studies are needed to determine the cause (Lee, Brescia, & Kissinger, 2009). The researchers controlled the variables of home computer access and socioeconomic status and found that students who used the computer for at least one hour per day, either at home or school had higher math and reading test scores on computerized exams than students who used the computer for less than one hour per day. It was also noted that because one hour of computer use is a predictor for students to be successful in English and math that parents and students should monitor their computer use to ensure they use their computer time efficiently (Lee et al., 2009).

Jackson et al. (2006) conducted a study that dealt with home computer use and found that students who use computers at home have higher test scores. The authors provided research evidence that the connection between high student performance and computer use was inconclusive. They also note that further research is needed to determine how cultural characteristics and technology design influence student performance. Because the researcher anticipates that dealing with the variable of home computer use would produce a longitudinal study, this factor will not be covered in this research study. The researcher will only deal with the advantages and disadvantages of using computers.

Retnawati (2015) lists the following disadvantages to using computers for taking a computerized assessment:

1. Teachers might find it difficult to control the testing environment because student's responses could differ at various times and settings, and perhaps not even by the designated test taker, as well as the possibility of double submissions.
2. Wasted time due to computer crashes and restarts.
3. The computer screen, for longer tests, may be more tiring.
4. The serial presentation is difficult to attain equivalence with computer and paper presentation.
5. Confidentiality.

In juxtaposition, Retnawati (2015) also lists the following advantages to using computers for taking computerized exams:

1. The richness of the interface, for example, the use of graphics allows a dynamic presentation of the test content,
2. The user population, computer-based testing via the Internet allows the researcher to locate a more diverse sample,
3. Standardization of test environment, that is, presenting the test in the same way and the same format for a specified time,
4. Online scoring, this results in faster feedback and
5. Greater accuracy that results in a reduction in human error.

Although schools are working diligently to implement computer use in the classroom, educators debate whether assessment scores are improving after technology implementation. However, a research study noted that student achievement increases, under certain conditions, with the use of one-to-one computer use (Dunleavy & Heinecke, 2007; Ringstaff, Kelley, & WestEd, 2002). Merrill (1996) believes that if we consider computer use in the same way that we think of reading and writing, we will create a population that is more computer literate. He further notes that by asking our students to use technological tools we give our students electronic tools that may also be valuable to their future employers.

Still, other researchers believe students are using computers more for surfing the Internet or engaging in social media rather than using the computer as a tool to increase their ability to excel on tests or in school (Duran & Aytac, 2016). The authors reported that students preferred the interaction between their teachers and felt that tablet computers “weaken communication” between students and educators. There were other students who found the use of tablet computers more entertaining and enjoyable as opposed to regular blackboards.

In an article that dealt with the Common Core Assessments, Timothy Shanahan addressed reading to help students obtain higher scores on tests such as the PARCC and the SBAC. He discussed the requirement that students should be tested to ensure they are meeting the educational standards that were set by No Child Left Behind. Teaching students to read test passages will help them receive higher test scores than having them practice sample questions from tests (Shanahan, 2015). However, some experts have suggested that the cognitive demands brought on by students taking computerized exams be assessed before administering the computerized exams (Fritts & Marszalek, 2010). Shanahan indicates that for students to excel on a test such as the SBAC, those teachers need to ensure students are taught to read long passages of text, dissect sentences and words, and engage in periods of sustained silent reading (Shanahan, 2015).

Ringstaff and Kelley (2002) listed the following issues, as crucial to the success of computer implementation:

1. Technology utilized as one component in a broad-based reform effort.
2. Teachers must be adequately trained to use technology.
3. Teachers may need to change their beliefs about teaching and learning.
4. Technological resources must be sufficient and accessible.
5. Effective technology use requires long-term planning and support.
6. Technology should be integrated into the curricular and instructional framework.

The authors discovered that computers were beneficial in helping to differentiate instruction for students whether the students were English learners or students with disabilities.

Finally, the authors noted that educational change could be supported by technology, but the impact is minimal without reform at the district, school, and classroom level.

Researchers have wondered if the expenditure of computers is worth the investment because of the lower than expected use of computers (Shi & Bichelmeyer, 2007). One factor they noted was the increased number of computers that have been placed in public schools in the United States and related it to support from the U.S. Government and the No Child Left Behind Act of 2001. The authors identified six themes in their study that had an impact on teachers' experiences with computers. They include (a) accessibility of computers, (b) availability of technical support, (c) perceptions regarding usefulness of computers, (d) appropriate programs for teachers' use, (e) factors facilitating teachers' use of computers, and (f) factors which are inhibiting teachers' use of computers.

Shi and Bichelmeyer (2007) compared the six-themes in 1991 and 2004 from two different case studies that were conducted by two different researchers. Similarities and variations within each theme were identified as the natural progress of more computers into schools for teachers to use. A comparative data analysis was conducted and the results indicated that teachers in 2004 were more certain that computers could be used a tool compared to the uncertainty of computer use in 1991. The authors conclude that the best strategy for technology integration would be a collaborative effort between teachers and instructional technologists to identify ways to help teachers' foster learning and achievement.

Many programs that allow educators to create quizzes and tests also allow students to master the content of the subject as well as their test taking-skills (Salend, 2009). In considering practice programs for students, educators should consider how to assess students throughout the programs. Practice programs should not only adjust when students are struggling but also when their skill level improves. If students answer a practice question correctly, a screen can appear (a) explaining why the answer is correct, (b) providing additional information about the test content, (c) pointing out why the other answers are incorrect (in the case of multiple-choice items), and (d) presenting effective test-taking skills and strategies that can be used to answer the question (Salend, 2009).

The SBAC exam is a customized exam that is available and appropriate for all students including English learners and students with disabilities (Smarter Balanced Assessment Consortium, 2017). The online format of the exam allows teachers to assess their students several times a year based on their content level. The test is adaptive in nature, and questions become harder as students provide correct answers and become easier as students struggle during the exam (Smarter Balanced Assessment Consortium, 2017).

Student Factors

Student Demographics

The No Child Left Behind Act (NCLB) requires that all states make adequate yearly progress (AYP), by year 2014, and have grade-level proficiency in Math and English language arts (ELA) by having a statewide system of accountability (Mei-Jiun, 2013). Each state is allowed to design its own accountability system, assessment criteria, and AYP targets. Schools are required to work toward the NCLB's 100% proficiency goals in mathematics, by taking steps to monitor their school using two models--status and growth model. In their study, Mei-Jiun sought to study how academic performance index (APIs) change with school resources and student demographics and in individual schools. They used a status index in one model that measured schools against a common target while another school was measured by a change index in the growth model.

Mei-Jiun (2013) compared the changes in nine student demographic variables, which included free and reduced meals, seven racial/ethnic factors and seven school resource variables. They concluded that as schools spent more resources on highly educated and fully credentialed teachers that there was a positive effect on API gains. They suggest that the correlation between spending more resource and performance goals was significant and could be used by officials and policymakers before offering reward or sanction to schools for progress or decline in API.

Although not exhaustive, a few student demographic factors that can influence student performance are free reduced lunch status, ethnicity, language, and culture.

Free reduced lunch status. Students from low-income families receive free and reduced lunch (Marchetti, Wilson, & Dunham, 2014). Their research has shown that students who receive reduced lunch are from families with incomes between 130% and 185% of the poverty level. The U.S. government sets the federal poverty level and uses it as an indicator to provide aid to low-income families (Amadeo, 2017).

Ethnicity. Research has shown that racial/ethnic and socioeconomic segregation strongly links to school behaviors as well as academic performance (Palardy, Rumberger, & Butler, 2015). Racial/ethnic and socioeconomic segregation affects blacks, Hispanic, and low socioeconomic students more than other students because they are more likely to attend segregated schools.

Language. There has been an increase in the number of immigrants arriving in the United States, which has increased the educational needs of their children (Sung, 2014). Immigrant students often experience difficulties in adapting to social expectations and norms because they speak a different language and are from different cultures. The National Council of Teachers of English (2008) reported that in the past 30 years, the foreign-born population of the

U.S. had tripled, as more than 14 million immigrants moved to the U.S. during the 1990s alone. In the United States, the Department of Education, refer to immigrants as English Language Learners (ELL's) or Limited English Proficiency (LEP) students. English Language Learners (ELLs) is a broader term used to refer to students at different levels of immersion into the English culture. For consistency throughout this paper the term ELLs will be used to reference students who have a language barrier except in Table 19 where the term Limited English Proficiency will be used.

The ELL population is comprised of approximately 10% of the total K-12 student population (Spees, Potochnick & Perreira, 2016). The authors cite Cosentino del Cohen and Clewell (2007) who report that over 70% of ELL children have traditionally resided in California, Illinois, Texas, New York, and Florida, which are the top-five immigrant-receiving states because of the strong co-ethnic presence.

ELL students face additional educational barriers beyond just English language challenges according to research. Speeset al. (2016) report that some of the linguistic gaps in academic performance are due to the lack of ELL educational support systems. Poverty also creates a significant impact on children's mental health in elementary school, which informs researchers and educators of the need for early intervention to diminish the lifelong damage of poverty. Additionally, students who speak another language often are unable to respond to requests from educators because they misunderstand information that is provided (LaRocque, 2013).

Khong and Saito (2014) conducted a study of English Language Learners and noted challenges to educating this population could be broken into three broad categories:

- Social challenges - which include the growth and diversity of ELLs, societal attitudes, federal, state, and district educational policies.
- Institutional challenges - which include teacher education, tools and resources, time, communication, school culture, and academic achievement and retention of ELL students.
- Personal challenges - which include the beliefs, attitudes, and assumptions of ELLs, and emotions.

The authors note that, “The complexity of the problems involved in educating ELLs demands a concerted effort by all stakeholders, since the obstacles faced by ELL teachers are not merely technical aspects of how to educate this special population of students, but are rather social, economic, political, and cultural issues of a much wider scope” (Khong & Saito, 2014, p. 220).

Culture. Research has shown that culture is a critical factor in how students learn and become socially responsible in the host society (Li, 2013). Gorman (2010) noted that culture defines the beliefs, behaviors, sanctions, values and goals that mark the way of life of a group of people. Gorman uses Maslow’s Hierarchy of Needs to discuss the social and emotional needs of Aboriginal and Torres Strait Islander Australians who have been disconnected from their culture. Gorman believed that people’s higher-level needs are linked to culture and any disconnection will make it almost impossible to meet those needs. Maslow’s Hierarchy of Needs then becomes important in educational environments as students from different cultures attend schools in cultures that are different from theirs.

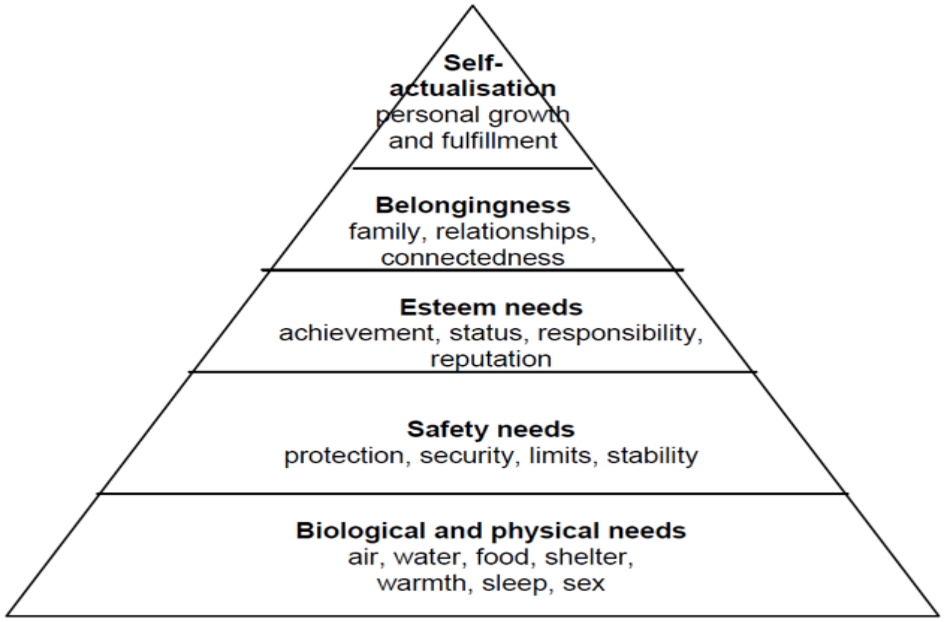

Figure 3. Maslow's Hierarchy of Needs.

Developed over 50 years ago Maslow's Hierarchy of Needs can still be used to explain how people respond when their most basic needs are unmet. The needs at the bottom of the pyramid are deemed most important, and if not met, then it becomes the most motivating factor for an individual (Burleson & Thoron, 2014). The authors noted that although teachers cannot meet the basic needs of all learners, teachers can provide learners with access to programs at the school to help address these needs such as the free lunch program or counseling services.

Student Socioeconomic Status

The U.S. Supreme Court decision in Brown v. Board of Education was a landmark case that was designed to end segregation in schools in 1954. The case validated research that presented evidence that segregating black students had negative social-emotional and behavioral consequences (Palardy, Rumberger, & Butler, 2015). The authors conducted a study to determine the effects that three types of segregation had on school behaviors and academic behaviors: socioeconomic, ethnic/racial, and linguistic. They determined that low socioeconomic students along with Hispanics and blacks were more likely to suffer poor academic performance and school behaviors because they attended segregated schools.

Socioeconomic status is one of the most critical factors in school disparities (Howard, 2015). Howard (2015) states in his book, *Why Race and Culture Matter in Schools* that the school children attend is often dictated by the impoverished backgrounds of their parents and therefore affects the quality of education they receive. It was found in a nationwide survey of teachers that, as of 1998, more than 75% of students had access to computers at school (Becker, 2000). Becker noted that lower-income students used the computer for repetitive practice and used the computer less because of a lack of the Internet at home, while higher-income students used the computer for more complex applications. In 2012, The United States Census Bureau reported that households with computers at home were 79% while households with an Internet connection at home was 75% which means that schools are a vital link for disadvantaged students in helping to ensure they know the proper uses of computer technology (Becker, 2000).

Student Perceptions

Just like teacher perceptions, students vary in their opinions and perceptions of both computer use in the classroom and using a computer to take a computerized test. In one article Duran and Aytac (2016) chronicled student responses about the use of computers. Most of the students stated that, during the teaching process with the use of tablet computers, they did not learn more quickly and easily, they had some difficulty understanding topics, learning was not permanent, and it did not contribute to increasing their level of success (Duran & Aytac, 2016).

In a study conducted by Pino-Silva (2008), students questioned about the advantages and disadvantages of taking a computerized test, reported, “Overall, self-reported advantages outnumbered disadvantages to a significant degree. The Pino-Silva study was a strong indication that test-takers' perceptions of the computerized test appear to be positive (Pino-Silva, 2008). The authors report the frequently reported advantage was being able to have access to grades from the test immediately. Depending on the type of test given, the process of accurately grading and reporting the results may take several days if conducted by hand.

Mango (2015) conducted a study to gain students' perceptions of their learning from the use of iPads in the classroom. The participants were arabic students who were enrolled in a university in the Southwest of the U.S. Students used the iPads once a week for ten weeks with each session lasting between 30 - 45 minutes in duration. Students in the study were given extra time during the first two weeks to become familiar with the iPad and received written and verbal instructions for each assignment.

The results of the study indicated that students felt the iPads enhanced their learning and allowed them an opportunity to collaborate with their classmates. Mango (2015) noted in the journal article "there is an indirect effect on students' perceptions of their actual learning" (p. 56). The author was careful to mention the limitation of the study because it only included 35 students in their first year of a foreign language as well as included activities that were designed to enhance engagement.

Gherardi (2017) conducted a mixed-methods study in Chicago to analyze teacher results concerning a one-to-one laptop program in a low-income Latino school district. The author utilized a 5-point Likert scale survey and interviews to gather data from participants. The author noted that the purpose of the study was to measure teachers' potential technology-informed paradigm shifts.

The survey was provided to 252 teachers with 106 completing the survey, which equated to 42% of the teacher population. The author asked the participants to answer questions from the following categories:

1. General perceptions of technology,
2. Technology and assessment,
3. Technology and differentiated instruction,
4. Technology and parent engagement, and
5. Technology, and access to technology.

The survey results indicated that 60% of teachers had a positive perception about technology and 59% agreed that the one-to-one program had improved the use of formative assessments. Sixty-eight percent of participants either strongly agreed or agreed that technology had changed the way they differentiated instruction. Thirty-two percent of the participants reported that the one-to-one program had a positive impact on the way parents communicated with the school while twenty-eight percent felt there was a negative impact. The answers to the last category indicated that over 80% of teachers strongly agreed or agreed that students were accessing material about their class outside of the classroom and 85% strongly agreed or agreed that students were representing knowledge in new ways.

The author noted three conclusions from the study:

1. Changes to teacher practices around technology are not necessarily evidence of paradigm shift (some evidence of decoupling);

2. Cohesion in stated values, policy messaging, and policy implementation influences teacher sensemaking around those policies, and

3. The adoption of flexible notions of what and how students should learn mediates a positive response to a technology-informed paradigm (Gherardi, 2017).

The author noted that although the findings were a step in the right direction to understanding how technology programs shift educational paradigms that similar studies could dispute or confirm the relevance of this study. Gherardi (2017) further noted that a closer look at the issues of administrator mindset and matters of policy should be explored for future research to bring about change in technology programs.

Summary

Research has shown that when students have sufficient access to computers, it increases their learning opportunities (Penuel, 2006). To adequately prepare students for computerized assessments several factors need to be considered. The integration of technology into a teacher's curriculum often involves factors that include environmental and personal issues (ChanLin, 2007). As stated earlier, teachers need time to practice with technology before introducing it to their students (Holcomb, 2009) and their belief about their self-efficacy can influence whether they incorporate technology into their classroom (Bandura, 1997).

The inclusion of technology into the curriculum should be viewed as a tool rather than an instrument that will fix instruction goals for educators (Ringstaff & Kelley, 2002). As school districts seek to incorporate technology, they must ensure that educators and students have the proper training to ensure success. Merrill (1996) writes that, "Efficient use of technology requires that teachers understand the goals of the curriculum and know the capabilities of technology in meeting those goals" (p. 273). Additionally, the most important factor, other than knowledge of technology, is that teachers need to feel confident that using technology will facilitate student learning (Ertmer & Ottenbreit-Leftwich, 2010).

CHAPTER 3: METHODOLOGY

This chapter describes the procedures that will be used to conduct this research study. The sections of this chapter include a description of the participants, the data, data collection procedure, and data analysis used in this research study. Also outlined in this chapter is the methodology that the researcher chose for this research study.

The primary goal of this research study is to identify factors that affect student performance on computerized exams. The researcher seeks to understand and identify any apprehension teachers have towards technology that might influence whether students are exposed to technology in the classroom that would improve student performance. Additionally, the researcher seeks to identify other factors that have an impact on student performance such as student demographics and the socioeconomic status of students.

This chapter is organized into the following sections: (a) selection of participants, (b) sampling procedures, (c) instrumentation, (d) narrative structure, (e) data collection, (f) data analysis, (g) ethical issues, (h) expected outcomes, and (i) summary.

The research will answer the following questions:

1. Is there a relationship between students who have one-to-one access to school computers compared to those who have scheduled access to school computers and student performance on computerized exams?
2. How does access to school computers affect the students' performance on computerized assessments when controlling for differences in socioeconomic status and demographics?

3. What is the relationship between the number of technology training classes educators take and the number of minutes they spend preparing their students for computerized assessments?

The study is conducted at two public high schools in the Scholarly District. The researcher conducted the study on the west coast of the United States in a large metropolitan city in California. The research study highlights factors that influence student performance such as teacher perspectives about technology, student demographics, and student socioeconomic status (SES).

The researcher will use a mixed-methods grounded theory explanatory sequential design structure in this research study interpreting the data in a non-statistical procedure rather than an analytical procedure. A grounded theory is a qualitative research design in which the inquirer generates a general explanation (a theory) of a process, an action, or an interaction shaped by the views of a large number of participants (Creswell, 2013). The researcher will gather data from surveys and face-to-face interviews to develop a theory to identify a correlation between teacher preparedness and student performance on computerized assessments. The researcher specifically analyzed data from the Likert-scale survey in the following areas: technology use, professional development, and teacher attitudes toward technology to develop a theory about teacher preparedness.

The technology use section contained four questions, the professional develop section contained nine questions and the teacher attitude section contained eight questions. Each participant will be asked to rate all questions on a 5-point Likert-type scale (see Appendix H). The Likert scale moves from five points signifying complete or 100% agreement, four-points signifying 75% agreement, three-points signifying neutral or 50% agreement/disagreement, two-points signifying 25% disagreement and one-point signifying complete disagreement or 0%. Additionally, the researcher used open-ended questions that allowed each participant an opportunity to identify the types of technology training they have received, the type of equipment that is contained within their classroom, and the numbers of minutes they spend preparing students to take computerized assessments.

Setting and Participants

Phase 1: Surveys

The sample size of teachers for this research study consisted of 47 teachers from Carter High School and 65 teachers from Knightly High School. Each teacher had an equal opportunity to complete the initial survey. The researcher administered the survey to all teachers to decrease common method bias of only giving the survey to participants who the researcher believed had a favorable view of technology.

The researcher utilized student data in the form of SBAC test scores, and the sample size of students for this research was all 11^{th} grade students at both schools. The researcher utilized data obtained by the school district to identify student demographics and identify the student socioeconomic status of the student population at both schools. The researcher also used student test data from the Smarter Balanced Assessment Consortium (SBAC) website and data from the school district. The researcher did not have direct contact with students.

Phase 2: Interviews

Three teachers were selected from each school (*n* = 6) for face-to-face interviews. The researcher purposefully selected English teachers because English is a main content area that is tested on the Smarter Balance exam. In the event, three English teachers were not available the researcher randomly chose an equivalent number of alternate teachers. The researcher interviewed each participant, during non-instructional time at his or her school, to provide a familiar atmosphere for comfort. Additionally, to utilize the process of member checking, each teacher was provided a copy of their respective interview to ensure the accuracy of their words. The time the researcher allotted for each face-to-face meeting was between 30 to 45 minutes.

Selection of the Participants

All participants of the study were public high school teachers. Three teachers from Carter High School and three teachers from Knightly High School participated in the research study. Each teacher was given an alias to protect their identity and the identity of the school. The three teachers from Carter High School were Ms. Simpson, Mr. Summit, and Ms. Waters. The three teachers from Knightly High School were Ms. Walker, Mr. Oscar, and Ms. Ware.

1. Ms. Simpson has worked at Carter High School for five years. She serves as the Department Chair for the English department. Ms. Simpson taught upper-level AP classes that included Contemporary Composition, Expository Composition, and Modern Literature. She spends several hours after school on a daily basis to tutor her students.
2. Mr. Summit has been an educator for 20 years and taught English for 15 of the 20 years. Mr. Summit indicated that he taught music for five years before becoming an English Teacher. He has taught in the English department at Carter High for five years. Mr. Summit serves Carter High in several capacities as he is a member of the Shared Decision-Making Committee and helps facilitate meetings for the local UTLA union. Mr. Summit is very supportive of all sports teams at the school and attends weekly games for every team represented at the school.

3. Ms. Waters is new to Carter High. She started at the beginning of the 2017/2018 school years and teaches in the English department. She has been an educator for 17 years having taught other subjects like social studies, science, and math.
4. Ms. Walker has worked for Knightly school for three years. She currently teaches English and has stated she has taught English her entire tenure as an educator. Ms. Walker currently serves as the Department Chair of the English Department.
5. Mr. Oscar has taught math and science for 38 years. He has been a teacher at Knightly for 19 years and has previously taught physics and chemistry.
6. Ms. Ware has been an educator for 35 years and has taught math at Knightly High for 19 years. Ms. Ware also teaches music. She holds a credential in math, music, and computers.

Table 2

Description of Participants

Teacher	School	Gender	Age	Ethnicity
Ms. Simpson	Carter	Female	37	African American
Mr. Summit	Carter	Male	48	caucasian
Ms. Waters	Carter	Female	45+	African American
Ms. Walker	Knightly	Female	40	African American
Mr. Oscar	Knightly	Male	59	African American
Ms. Ware	Knightly	Female	59	African American

Note. Carter = Fictitious name for School 1; Knightly = Fictitious name for School 2

Table 2 highlights each participant's gender, age, and ethnicity. The purpose of gathering participants' gender may help the researcher determine if males or females have differing beliefs about technology integration. Gathering the age and ethnicity of participants may enable the researcher to identify if younger teachers hold different beliefs about technology compared to educators who were more mature in age or if educators of different ethnicities hold differing beliefs about technology over other ethnic groups.

Table 3 highlights the total years each participant has taught at their current school, total years of teaching, subject taught, and the highest educational degree they hold. Gathering this demographic information will allow the researcher to identify the relationship between these items and the educator's belief about technology and computerized assessments.

Table 3

Participants of the Study

Teacher	School	Total Years Taught at the School	Total Years of Teaching	Subject Taught	Degree Held
Ms. Simpson	Carter	5	13	AP English, American Literature	Doctorate
Mr. Summit	Carter	5	20	English	Masters
Ms. Waters	Carter	1	17	English	Masters
Ms. Walker	Knightly	3	14	English	Masters
Mr. Oscar	Knightly	19	38	Social Studies	Masters
Ms. Ware	Knightly	19	35	Math/Music	Masters

School Environment

This research study was conducted with two schools in California, within a large metropolitan city in the United States. Both schools were public high schools, with similar demographics, ethnicity, magnet status, and were both located in the Scholarly District. Table 4 highlights school demographics obtained from the Scholarly School District from the 2016-2017 school year.

Table 4

School Demographics (2016-2017)

	Carter High	Knightly High
# Of Students	833	1,555
Limited English Proficiency	250	24
Ethnicity	589 African American 244 Hispanic	679 African American 876 Hispanic
Students who qualify for free/reduced lunch	545	590

Carter High School. Carter High School, located in the Scholarly District, was founded in 1968. Carter is a public high school and currently serves about 800 students in Grades 9 to 12 with 71% African Americans and 29% Latino students. The school has had a decrease in enrollment over the last several years due to students transitioning to charter schools in the area. The school is a combination of three smaller magnets schools where students choose a career pathway based on their interest. Carter provides computer labs where teachers can schedule time for student use.

Whether a student desires to excel in business, performing arts, or professional sports, the school is working to attract the best. Carter is a Title I school where most of the students who live in the community and attend Carter are from low-income families, and 65% of students qualify for free or reduced lunch.

Title I is a part of the Elementary and Secondary Education Act (ESEA) and assists schools in helping ensure all children achieve high academic standards (US Department of Education, 2017). Carter has approximately 47 full-time teachers that equate to a teacher ratio of about 17 students per class, per teacher.

Knightly High School. Knightly High School opened in 1982 to meet the needs of under-represented students who have had an interest in science and medicine. Unlike Carter, which includes three magnets, the entire student population at Knightly is one magnet. Knightly is a one-to-one school where students are assigned personal tablets for school and home use.

Knightly is a public high school that has roughly 1,555 students in Grades 9 to 12. Although Knightly is in the Scholarly District, the students there perform higher than other students in the state despite having a poverty level higher than other schools in the surrounding area. Knightly is also a Title I school with 40% of students eligible for free lunch.

Knightly High School has approximately 65 full-time teachers that equate to a teacher ratio of 24 students per teacher. The school has 44% African Americans and 56% Latino students and is also located in the Scholarly School District.

Interview Process

The researcher used NVivo, a qualitative data analysis software, to analyze the data gathered from participants and categorized them into similar categories. Each similar theme or category was assigned a name to simplify the analysis process and ensure ease with locating the data digitally. Participants were interviewed during non-instructional time and were provided a copy of their transcript to review for accuracy.

Sampling Procedures

The researcher purposefully selected the participants of this study from two public high schools. The population size is 47 teachers at Carter High School and 65 teachers at Knightly. For the interviews, the sample size is three teachers from each school. Since English is a core content subject for the SBAC tests, the researcher purposefully utilized English teachers for this study. In the event, three English teachers were not available the researcher randomly chose an equivalent number of alternate teachers.

Instrumentation and Measures

The researcher utilized instruments that were designed to identify teacher perceptions on professional development, technology integration, and their attitudes about technology as well as measuring how participants answered questions using the TPACK survey. The survey allowed the researcher to gather additional information about teacher beliefs and attitudes about student preparation for computerized assessments.

The researcher provided participants with an initial survey (Appendix G) to identify their demographics and to determine their interest in participating in the research study. Participation in the study was optional, and the identity of the school and each participant remained confidential. A member other than the researcher issued the surveys to all participants to decrease the potential pressure that participants may have felt due to the presence of the researcher.

The researcher used a five-point Likert-type scale (see Appendix H). The Likert scale moves from five-points signifying complete or 100% agreement, four-points signifying 75% agreement, three-points signifying neutral or 50% agreement/disagreement, two-points signifying 25% disagreement and one-point signifying complete disagreement or 0%.

Participants would circle one signifying 0% if they completely disagreed with the criterion and would circle five if they completely agreed with the criterion signifying 100%.

There are nine questions that relate to professional development in the survey. Each question in this section asks the participant to identify some aspect of how professional development training has prepared them to adequately prepare students for computerized assessments. For example, one question asks the educators if their school provides in-house technology training. Teachers could choose one of five different choices on a continuum between completely disagree and completely agree. The interval between each choice is 25%.

There are four questions that relate to technology use in the survey. Questions in this section help to identify the participants comfort level with using technology. Participants are required to rate how familiar they are with their district's technology plan. Questions are on a continuum with five different choices ranging from one of *Completely disagree* to five of *Completely agree*. The interval between each choice is 25%.

There are eight questions in the attitude about technology section of the survey. Each question in this section asks the participant to identify a belief or attitude they have about technology. For example, question three asks participants if computers make them nervous. Participants could choose between five different choices ranging from one of completely disagree to five of completely agree. The interval between each choice is 25%. The researcher then coded the responses from each section on the survey.

During the interview, the researcher utilizes open-ended questions, which allow each participant the opportunity to be creative as they respond. The researcher will ask follow-up questions to gain a better understanding of each participant's perspective about their belief as it relates to technology integration and computerized assessments.

Reliability

Reliability refers to the consistency of measurement or the degree to which measurement is replicable across multiple administrations (Lester & Lochmiller, 2016). To this end, the researcher ensures that the findings of this research study are reliable by using the TPACK survey, which has been validated in previous studies. Specific questions that relate to technology use, the researcher has modified professional development, and attitude about technology, and doctoral candidates in a doctoral program have validated these questions. The questions that relate to technology use, professional development, and attitude have been scored according to the scoring procedure of the TPACK survey. The researcher is aware that teacher perceptions change with time and therefore a teacher's answer may change based on professional development or other training they receive.

The researcher will be able to apply similar results to employees of public colleges or school settings through triangulation of the results of three or more data collection methods: such as surveys, questionnaires, and interviews. Reliability in this study was validated by using the TPACK survey that has shown internal consistency as documented by researchers at Iowa and Michigan State University (TPACK ORG, 2017).

Validity

The validity of the study can be determined by ensuring the researcher asks participants questions that are relevant to the research questions. The researcher should ensure that the study is free from bias and that they have correctly identified teacher perceptions during the coding of the data and that the researcher has correctly identified teacher perceptions. The researcher should also ensure that each participant answers all questions on the survey. The research study is only as valid as the honesty of the participants to answer each question truthfully.

Another way to address internal validity is to deal with the issue of mortality during the initial interview. Mortality refers to research participants who drop out of the research study for any reason (Lester & Lochmiller, 2016).

Narrative Structure

This research study was conducted using a grounded theory explanatory sequential design structure utilizing a Likert-scale survey to gather quantitative data that was analyzed using SPSS and interviews to gather qualitative data that was analyzed using NVivo. The use of a mixed method study provided the researcher an opportunity to identify outliers in the research results (Simpson, 2011).

The researcher interpreted the quantitative results before proceeding to collect the qualitative data through interviews. The data from explanatory sequential designs were collected and analyzed in two phases (Lester & Lochmiller, 2016). The researcher utilized broad research questions to gain a better understanding of the phenomenon of teachers' perceptions of technology as it related to preparing students for computerized exams. By analyzing participant responses, a central theme became apparent as the researcher used axial coding to link the categories around the central theme to show correlations between the factors of this study and student performance.

Data Collection

For this research study, the researcher collected data through a survey using a 5-point Likert-type scale (see Appendix C). Participants were asked to answer questions from the TPACK Survey and other questions in the following areas: professional development, technology use, and attitude towards computers. Participants were also asked additional questions during face-to-face interviews that will help to answer the researchers questions. The researcher gathered initial demographic information about each participant such as age, race, gender, education, and experience at the beginning of the survey and created a data sheet for the initial contact session with each participant.

The first question addressed in this survey is “Is there a relationship between students who have one-to-one access to school computers compared to those who have scheduled access to school computers and student performance on computerized exams?” The Null Hypothesis is: There is no significant difference between students who have one-to-one access to school computers compared to those who have to schedule access to school computers and student performance on computerized exams. The Alternate Hypothesis is: There is a significant difference between students who have one-to-one access to school computes compared to those who have to schedule access to school computers and student performance on computerized exams.

Another factor the researcher addresses in this study is the effect that a students’ socioeconomic status has on student performance. The researcher used data supplied by Scholarly District to identify the poverty level of students as evidenced by their free/reduced lunch status.

The second question addressed in this research study is: “How does access to school computers affect the student’s performance on computerized assessments when controlling for differences in socioeconomic status and demographics?” The Null Hypothesis is: There is no significant difference on computerized assessments when controlling for socioeconomic and student demographics. The Alternate Hypothesis is: There is a significant difference on computerized assessments when controlling for socioeconomic and student demographics. Researchers have noted that both student motivation and a student’s socioeconomic status predict academic attainment (Berger & Archer, 2016). They also highlight the fact that students with low socioeconomic status were less likely to embrace mastery of performance goals as opposed to students with high socioeconomic status.

The third question addressed is "What is the relationship between the number of technology training classes educators take and the number of minutes they spend preparing their students for computerized assessments?" The Null Hypothesis is: There is no significant difference between the number of technology training classes educators take and the number of minutes they spend preparing their students for computerized assessments. The Alternate Hypothesis is: There is a significant difference between the number of technology training classes educators take and the number of minutes they spend preparing their students for computerized assessments.

Data Analysis

The researcher used a survey developed to measure the seven components of a teacher's Technological Pedagogical Content Knowledge (TPACK) in the area of Science, Math, Literacy, and Social Studies. TPACK was used as the theoretical framework for this research study as the researcher attempted to identify knowledge teachers needed to integrate technology into their curriculum to prepare students for computerized assessments. The survey demonstrates internal consistency reliability (Coefficient alpha) ranging from .75 to .92 for the seven TPACK subscales (TPACK ORG, 2017). It was developed through collaboration between Iowa State University and Michigan State University and is being used with permission from Dr. Denise Schmidt (dschmidt@iastate.edu).

To identify each participant's agreement or disagreement with professional development and technology use, and attitude toward technology, the researcher used a 5-point Likert-type scale. Each participant could get a minimum of nine-points or a maximum of 45 points in the professional development section and a minimum of four-points or a maximum of 20 points in the technology use section and a minimum eight-points or a maximum of 40 points in the attitude section. Each participant's score was divided by nine in the professional development, divided by four in the technology use section, and divided by a total of eight in the attitude section to calculate the ratio in each category. All sections for the survey were calculated in this fashion and the totals were calculated for each section. Additionally, the researcher added the total of all questions in each section to obtain an overall score in each section.

The researcher will utilize the interim assessments and student test scores from the Smarter Balanced Consortium exam (SBAC) to identify differences between students who have one-to-one computers and students who only have access to computers via iPads or computer labs. Interim assessments are given in the fall and the SBAC exam is given in the spring. The researcher will also obtain demographic data and the socioeconomic status of students to identify poverty levels in an attempt to predict the effect they have on student performance.

Anticipated Ethical Issues

An ethical issue that could arise during the participant interviews is whether the participants divulge their preference for students of a specific ethnicity. Other issues that could be of an ethical nature is if participants who failed to provide access to technology for certain population groups such as students with special needs, students with disabilities or English learners. Educators are obligated to teach all students regardless of their nationality, race, creed, ethnicity, or learning disability (U.S. Department of Education, 2017).

At the initial interview with participants, the researcher made clear the purpose of the interview and that although there would be a certain level of confidentiality for what would be reported, any information that the participant did not want to be reported, should not be shared. Additionally, the researcher informed the participants that they were under no obligation to answer questions and they were always free to end the interview at any time without penalty or consequences.

Expected Outcome

The researcher anticipates that some teachers would identify a negative perception about technology integration as the reason they did not implement technology in their classrooms. The researcher also anticipates that some teachers will identify a lack of professional development as their reason for not implementing technology integration or a lack of administrative support as to why they had not implemented technology. The researcher seeks to identify the relationship between teachers' perceptions of technology and how they prepare their students for computerized exams. Additionally, the researcher seeks to identify the relationship between student factors and student performance on computerized exams. The researcher hopes to use the information from this research program to develop a plan that would facilitate teacher training on the use of technology as well as how to train and prepare students for computerized exams.

Depending on data from the research, the researcher will initially recommend that the school develop a team to analyze the technology needs of the school which may include hardware and software needs. The Scholarly District should review the technology plan. Is the approved plan being followed? The next step would require teachers in the content area of English to participate in professional development training to prepare them for technology integration into their curriculum. The professional development training should be ongoing in anticipation of the changing needs of technology. The plan should minimally include the addition of iPad carts into the core content classes of English, Math, History, and Science. Additionally, schools may want to ensure that all teachers have technology for their use before classroom implementation takes place, such as district laptops or iPads. Teachers should also be provided ample time to practice with technology before integration into their curriculum (Holcomb, 2009).

The results of this research study may help Scholarly District identify the need to implement one-to-one computers at lower-performing schools to increase student performance on computerized assessments.

Summary

Although all teachers, at both high schools were given the initial survey, the participants for this research study were primarily English teachers as English is one of the main topics on the Smarter Balanced exam. Both schools had a Technology Plan that governed technology implementation and integration.

The researcher utilized open-ended questions to gather information from participants and then coded and analyzed the quantitative data using SPSS, a statistical analysis tool, and analyzed the qualitative data using NVivo, a data analysis tool. The researcher identified similarities and differences of the different themes to better understand the theory about teachers' perceptions concerning technology integration.

As technology continues to become a viable part of the global society, there will continue to be researchers who debate over whether the impact is negative or positive (Wilson, 2014). The researcher anticipates the need for further research to include a more detailed look at student performance in specific departments such as Math, Science, and History and to compare student scores over time after educators have received professional development on technology implementation and students have been adequately prepared to use computers to take assessments.

CHAPTER 4: FINDINGS

The purpose of this mixed-method study was to identify factors that affect student performance on computerized exams. The researcher used an analytical process of interpreting the data rather than a statistical process. Quantitative data was gathered from a TPACK Survey, and qualitative data was gathered from face-to-face interviews of three participants from each of the two schools used in the study. Descriptive statistics are covered first followed by a correlational analysis of each section of the survey. Additionally, the researcher provided the results of a cross tabulation that was completed on the test scores and language level of the eleventh-grade students at the two schools. The last section that will be covered is the qualitative analysis of the face-to-face interviews. The researcher used NVivo to identify common themes from the interviews.

The participants of the study were a purposive selection of English teachers. If English teachers were unavailable, then the researcher randomly chose an alternate number of teachers for the face-to-face interviews. This chapter highlights an analysis of results of participants' responses from surveys and interviews to answer the three research questions:

1. Is there a relationship between students who have one-to-one access to school computers compared to those who have scheduled access to school computers and student performance on computerized exams?
2. How does access to school computers affect the students' performance on computerized assessments when controlling for differences in socioeconomic status and demographics?

3. What is the relationship between the number of technology training classes educators take and the number of minutes they spend preparing their students for computerized assessments?

Descriptive Statistics

Table 5 shows the descriptive statistics of the age of the participants. The average number of participants was around 45 years of age.

Table 5

Age of Participants

Cases	*N*	*M*	*Mdn*	Mode	*SD*	*S*	Range	Minimum	Maximum	Sum
Valid	34	45.62	44	37[a]	10.293	105.94	40	25	65	1551
Missing	2									

[a]Multiple modes exist. The smallest value is shown.

Figure 4 shows the age distribution of the sample population. However, for this research study, participants provided their exact age (see Appendix L).

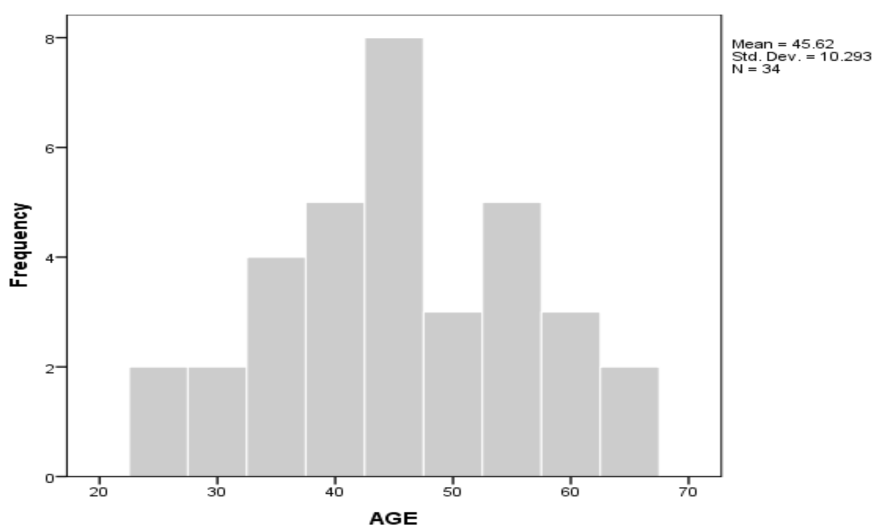

Figure 4. Histogram is showing the age distribution of the sample population ($N = 34$).

Table 6 shows the gender of the participants who completed the survey. Twenty-two of the participants who chose to complete the survey were women which equates to approximately 61%, and 14 were men who equate to 39% of the total sample size of 36 participants.

Table 6

Gender of Participants

Gender	Frequency	%
Female	22	61.1
Male	14	38.9
Total	36	100

Table 7 shows the ethnicity of the participants who completed the survey. Over 50% of the participants were African American (*N* = 19).

Table 7

Ethnicity of Participants

Ethnicity	Frequency	%
African American	19	52.8
Persian	1	2.8
Caucasian	8	22.2
Southeast Asian	1	2.8
Hispanic	6	16.7
Mestiza	1	2.8
Total	36	100

Table 8 shows the breakdown of the education level of the participants of the study. Twenty-two percent of participants hold bachelor’s degrees, 22% hold master’s degrees, and 5% hold a doctoral degree. The survey revealed that the two teachers who hold a Doctorate teach at Carter High School.

Table 8

Education Level of Participants

Degree	Frequency	%
Bachelor's	8	22.2
Master's	26	72.2
Doctorate	2	5.6
Total	36	100

Frequency of Survey Items

Frequency percentages are provided for each response (ranging from *strongly disagree* to *strongly agree*) for each category on the survey. The categories of the survey are Technology Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Technology Use (TU), Technological Content Knowledge (TCK), Professional Development (PD), Technology Pedagogy and Content Knowledge (TPACK), and Attitude toward Technology (ATT). The frequency tables for each category is located in Appendix P numbered P1-P8, respectively.

Technology Knowledge (TK)

Survey items (see Appendix G) 1- 6 measured a participant's technology knowledge (TK) and the researcher referred to them as TK1- TK6. Frequency data (see Appendix P, Table P1) indicated that more teachers were neutral or agreed with the questions in this section except Question 2 where the majority of teachers agreed that they could learn technology easily.

Content Knowledge (CK)

Content knowledge (CK) refers to a teachers' knowledge about the subject they teach and how it will be taught or learned (Koehler, Mishra, & Cain, 2013). Survey items (see Appendix G) 7 - 9 measured a participant's content knowledge in mathematics and the researcher refers to them as CK1-CK3. Survey items 10 - 12 measured a participant's content knowledge in social studies and the researcher referred to them as CK4 - CK6. Survey items 13 - 15 measured a participant's content knowledge in science, and the researcher referred to them to as CK7 - CK9. Survey items 16 -18 measured a participant's content knowledge in literacy and are referred to as CK10 - CK12.

Pedagogical Knowledge (PK)

Survey items (see Appendix G) 19 - 25 measured a participant's pedagogical knowledge (PK) and the researcher referred to them as PK1 - PK7. Koehler et al. (2013) report that a teacher with an increased pedagogical knowledge understands how students construct knowledge and acquire skills, which are vital for the integration of technology into the classroom.

Technology Use (TU)

Survey items (see Appendix G) 26 - 29 measured a participant's technology use (TU) and the researcher referred to them as TU1 - TU4. In this section, participants were required to identify their level of comfort in using technology and report how well they felt students were prepared to take computerized assessments. The majority of participants were neutral regarding being able to solve their technical problems while 60% of the participants believed that they could learn technology easily (see Appendix P, Table P4).

Technological Content Knowledge (TCK)

Survey items (see Appendix G) 30 - 33 measured a participant's technological content knowledge and the researcher referred to them as TCK1 - TCK4. An interviewee from the face-to-face interviews reported that she has watched technology evolve from nothing into the digital form it is today. Teachers should understand the impact of technology on the practices and knowledge of their subject matter to develop suitable technological tools for educational purposes (Koehler et al., 2013).

Professional Development (PD)

Survey items (see Appendix G) 34 - 42 measured a participant's professional development level and the researcher referred to them as PD1 - PD9. Although the TPACK survey was not originally designed to measure educators' professional development level, it has been used by researchers and educators to help determine the impact of professional development programs (Koehler et al., 2013). Over 30% of participants who took the survey reported that they had not taken a technology class in the past five years (see Appendix P, Table P6).

Technology Pedagogy and Content Knowledge (TPACK)

Survey items (see Appendix G) 43 - 46 measured a participant's technology pedagogy and content knowledge and the researcher referred to them as TPACK1 - TPACK4. The questions in this area are designed to measure how well educators interact when content, pedagogy, and technology are combined, and technology is used to help students learn across disciplines (Koehler et al., 2013).

Attitude Towards Technology (ATT)

Survey items (see Appendix G) 47 - 54 measured a participant's attitude towards technology (ATT), and the researcher referred to them as ATT1 - ATT8. Multiple correlations were run (see Appendix I) using SPSS and found a significant negative correlation at -.387 between an educator's length of time they have been teaching and their attitude about technology. The negative relationship of this correlation might indicate that the longer a teacher has been teaching, the less likely they are inclined to embrace the use of technology in their classes. This may be due to a lack of interest, the lack of technology training programs when they entered the teaching field or an unknown factor.

Findings of Quantitative Research

Teacher Surveys

The researcher gave the survey to 47 teachers at Carter High School and 65 teachers at Knightly High School. Twenty-one teachers from Carter High completed the survey, which equated to 45% of the teacher population and fifteen teachers from Knightly High School completed the survey, which equated to 23% of the teacher population. The survey included 54 Likert-scaled items and eight open-ended questions to identify the types of technology training classes participants have attended, types of technology equipment in their rooms, and the amount of time they spend preparing students for computerized assessments. IBM's Statistical Package for the Social Sciences (SPSS) was used to analyze the quantitative statistics.

Correlations

The researcher ran several multiple correlations between the demographics of the survey (length of time as an educator, age, length of time participants has taught) to identify any relationships that existed between the survey total items using Pearson r. The relationship between the totals of each section of the survey was analyzed against all other totals of the survey. Appendix I displays the results of multiple correlations between length of education and the totals of each section on the survey. Appendix J displays the results of multiple correlations between age of the participant and the totals of each section on the survey. Appendix K displays the results of multiple correlations between length of time participants has taught and the totals of each section on the survey.

Length of education (LENEDU). There is a negative significant relationship between the participants length of time they have been teaching and their attitude toward technology (ATT) (see Appendix I).

Exact age of participants (AGE). There were no significant relationships between age and any of the section totals on the survey (see Appendix J).

Length of time an educator has taught (LENOFSUB). There were no significant relationships between length of time an educator has taught, their current subject, and any of the section totals on the survey (see Appendix K).

School Correlations

The researcher ran a correlation (see Appendix M) between the schools and the overall totals of each section of the survey. The researcher specifically took a critical look at the correlation between the two schools in three areas that the researcher identified as potential factors that could affect students' performance on computerized assessments: Technology Use (TU), Professional Development (PD), and Attitude Towards Technology (ATT). Table 17 displays the correlation between the totals of all variables from the survey.

Participants' answers revealed a strong relationship between attitude towards technology (ATT) and technology knowledge (TK) at Carter High School while participants' answers at Knightly High revealed a medium correlation. Participants with a high degree of technology knowledge can be said to have 'open-ended interaction with technology' (Koehler et al., 2013). Knightly High School participants also had a strong relationship between Content Knowledge (CK) to Technological Content Knowledge (TCK) and between Technological Content Knowledge (TCK) to Technology Pedagogy and Content Knowledge (TPACK).

Koehler et al. stated that Technological Content Knowledge (TCK) is an understanding of the manner in which technology and content influence and constrain one another. They also note that teachers should be able to recognize which technologies can assist in helping students learn the content matter. Knightly High school is a one-to-one school, where technology is embedded into the daily curriculum of teachers, which may account for the strong correlation in content area and technology.

Table 9

Correlations Between the Totals of Variables

School	Variable	*R*
1	TU-TCK	0.582
1	TU-PD	0.572
1	TU-TPACK	0.468
1	PD-TK	0.477
1	PD-PK	0.518
1	PD-TCK	0.493
1	PD-TPACK	0.488
1	PD-ATT	0.495
1	CK-PK	0.523
1	CK-TCK	0.475
1	CK-TPACK	0.489
1	TCK-PK	0.454
1	TCK-TPACK	0.465
1	TPACK-PK	0.455
1	ATT-TK	0.73
2	TU-ATT	0.674
2	TU-TK	0.603
2	TU-PK	0.608
2	PD-CK	0.544
2	PK-TK	0.661
2	CK-TCK	0.767
2	CK-TPACK	0.691
2	TCK-TPACK	0.827
2	ATT-TK	0.567

Note. TK = technology knowledge; CK = content knowledge; PK = pedagogical knowledge; TU = technology use; TCK = technological content knowledge; PK = professional development; TPACK = Technology Pedagogy and Content Knowledge; ATT = attitude towards technology. School 1 is Carter High School and School 2 is Knightly High School.

Figure 5 displays the bar graph for all variables between both schools. While most of the correlations between the variables revealed a medium relationship, there were several that revealed strong relationships.

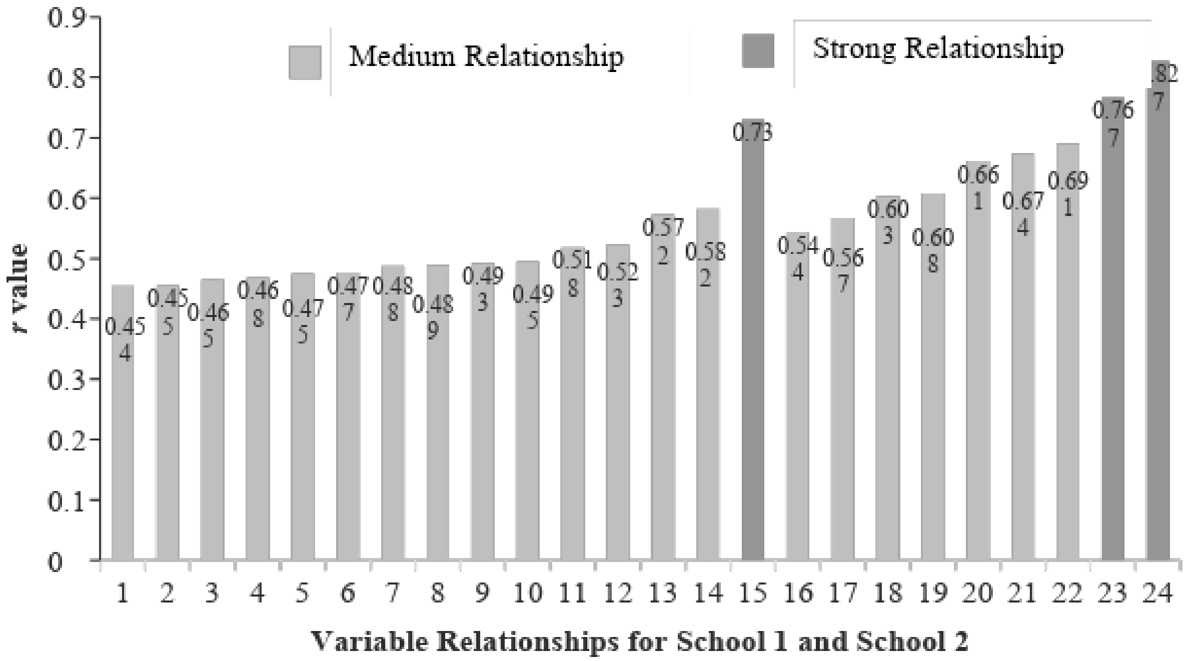

Figure 5. Bar chart showing the strength of the relationship between variables. TK = Technology Knowledge; CK = Content Knowledge; PK = Pedagogical Knowledge; TU = Technology Use; TCK = Technological Content Knowledge; PK = Professional Development; TPACK = Technology Pedagogy and Content Knowledge; ATT = Attitude Towards Technology. School 1 is Carter High School and School 2 is Knightly High School.

Multiple Linear Regressions.

The researcher ran a multiple linear regression between the two schools (see Appendix O) with Technology Use Total (TU) as the dependent variable and totals of Technology Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Content Knowledge (TCK), Professional Development (PD), Technology Pedagogy and Content Knowledge (TPACK), and Attitude Toward Technology (ATT) as the independent variables. The multiple regressions were used to assess the ability of the control variables to predict the effect they had on Technology Use (TU). The researcher ran a preliminary analysis to ensure there was no violation of the assumptions of normality, multicollinearity, or linearity. There was no homoscedasticity, at either school, as evidenced by the following residual plots.

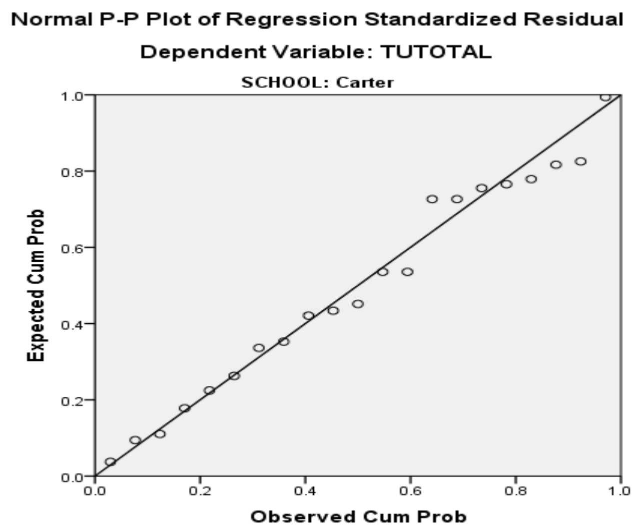

Figure 6. Regression Plot for Carter High School

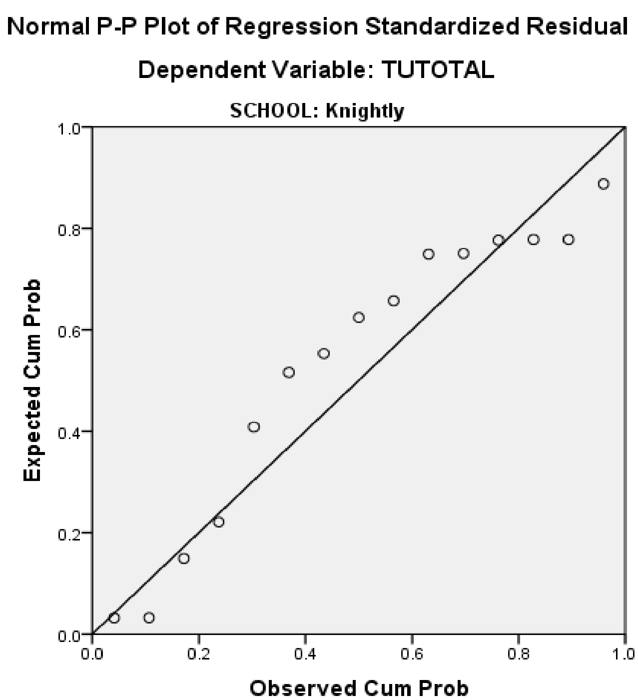

Figure 7. Regression Plot for Knightly High School

The model summary (see Appendix O) shows that for Carter High School, Technological Content Knowledge (TCK) is a low predictor (33.9%) for Technology Use (TU). For Knightly High School, the model summary shows that 45.4% of the variance for Technology Use (TU) was attributed to Attitude Toward Knowledge (ATT). The standardized Beta coefficient for Carter High School was .582 (see Appendix O) showing that it was a strong contributor to predicting Technology Use (TU). The standardized Beta coefficient for Knightly High School was .674 indicating it was a strong contributor to predicting Technology Use (TU) for teachers at this high school.

The following variables were removed from the linear regression (see Appendix O) for Carter High School indicating they were closely related:

- Technology Knowledge (TK),
- Content Knowledge (CK),
- Pedagogical Knowledge (PK),
- Professional Development (PD),
- Technology Pedagogy and Content Knowledge (TPACK), and
- Attitude Toward Technology (ATT).

The following variables were removed from the linear regression (see Appendix O) for Knightly High school, indicating they were closely related:

- Technology Knowledge (TK),
- Content Knowledge (CK),
- Pedagogical Knowledge (PK),
- Professional Development (PD),
- Technology Pedagogy and Content Knowledge (TPACK), and
- Technological Content Knowledge (TCK).

Figure 8 shows a visual model of the relationship of the above factors of the variables at Carter High School according to the correlation coefficients identified from the multiple linear regressions. Technological Content Knowledge (TCK), Professional Development, and Technology Pedagogy and Content Knowledge (TPACK) shows a medium relationship with Technology Use (TU) indicating that an increase in these factors could increase teachers' Technology Use (TU). All other factors were closely related with one another as evidenced by coefficient correlations that are close in number.

The two factors with the strongest positive relationship were between Technology Knowledge (TK) and Attitude Towards Technology (ATT) showing correlation coefficient of 73%. The relationship could indicate that as teachers increase their Technology Knowledge (TU) they also have a more positive attitude about technology integration or vice versa.

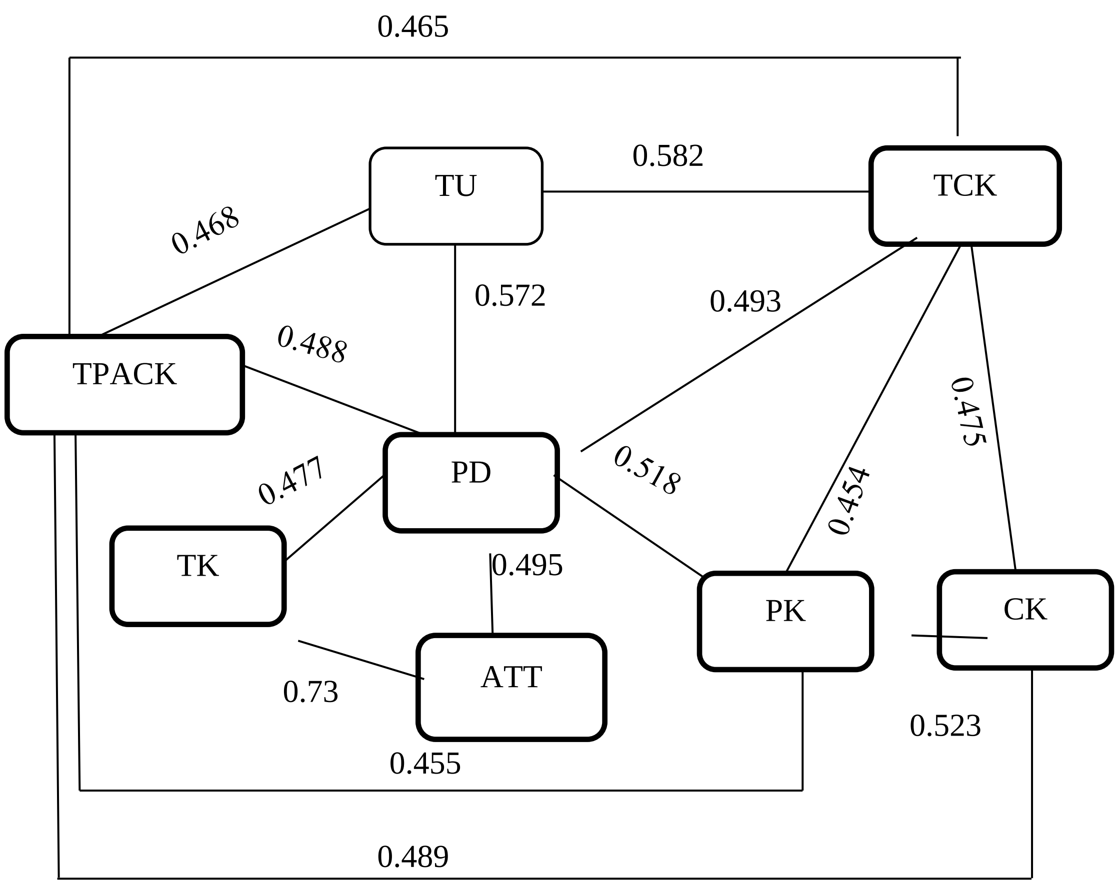

Figure 8. Correlation of factors at Carter High School.

Figure 9 shows a visual model of the relationship of the above factors of the variables at Knightly High School according to the correlation coefficients identified from the multiple linear regressions. The figure shows there is a medium relationship between Technology Knowledge (TK), Pedagogical Knowledge (PK), and Attitude Toward Technology (ATT), and Technology Use (TU). The researcher can therefore predict that Technology Use (TU) is affected by these variables and that as these variables increase a teacher is more likely to incorporate technology into their curriculum. There is also a medium relationship between Technology Knowledge (TK), Attitude Toward Technology (ATT), and Pedagogical Knowledge (PK). The data shows that a teachers Technology Knowledge (TK) is affected by their Attitude Toward Technology (ATT) and vice versa.

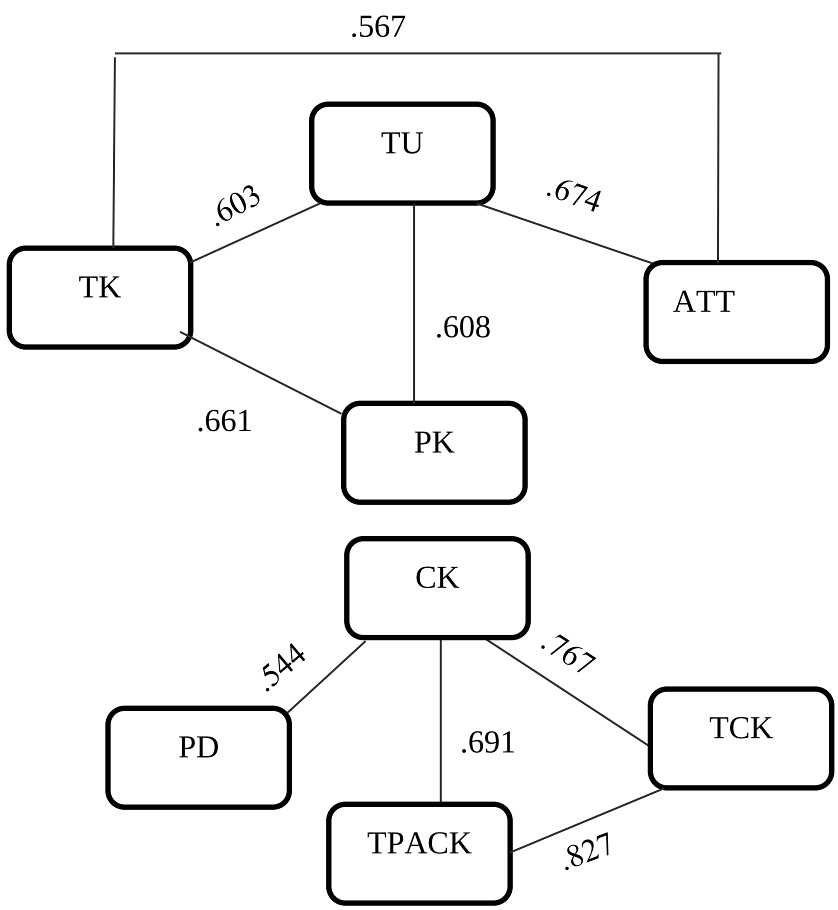

Figure 9. Correlation of factors at Knightly High School.

Content Knowledge (CK) was independent of the above variables but a medium correlation exists with Professional Development (PD), Technology Content Knowledge (TCK), and Technology Pedagogy and Content Knowledge (TPACK). The relationship between Professional Development (PD) and Content Knowledge (CK) can be used to explain that more professional development training classes would increase a teacher's content knowledge. Additionally, there is a strong correlation between Technology Content Knowledge (TCK) and Content Knowledge (CK) and Technology Pedagogy and Content Knowledge (TPACK). This indicates that as teachers increase their content knowledge then there is also an increase in their technology content knowledge, and an increase in their technology pedagogy content knowledge as well.

Teachers at Knightly incorporate technology into their curriculum on a daily basis, which may explain why their content knowledge about technology is higher than Carter High School. Nevertheless, from face-to-face interviews, teachers at Carter High show a strong motivation toward technology integration and appear to only be limited by the lack of availability of consistent access to computers or iPads.

Findings for Hypothesis of Research Question 1

Question 1. Is there a relationship between students who have one-to-one access to school computers compared to those who have scheduled access to school computers and student performance on computerized exams? The Null Hypothesis is: There is no relationship between students who have one-to-one access to school computers compared to those who have to schedule access to school computers and student performance on computerized exams. The Alternate Hypothesis is: There is a relationship between students who have one-to-one access to school computers compared to those who have to schedule access to school computers and student performance on computerized exams.

Table 10 displays the number and percentages of 11th grade students who took the Smarter Balanced Consortium test at Carter High School and Knightly High School that was given in the spring of 2017. Students receive a scaled score on the SBAC assessment that falls on a continuum between 2,189 and 2,862 as shown in Table 1. Based on their scale scores, students are then placed into one of the four achievement levels as determined by SBAC (Smarter Balanced Assessment Consortium, 2017). Achievement level one refers to a student who has not met the standard and is considered novice with scores from 2,280 to 2,542, achievement level two refers to a student who has nearly met the standard and is considered developing with scores ranging between 2,543 - 2,627. Achievement level three refers to a student who has met the standard and is considered proficient with scores ranging between 2,628 - 2,717, and achievement level four refers to a student who has exceeded the standard and considered advanced when scores exceed 2,717.

Sixty-nine students took the exam at Carter High School, and three students exceeded the standard which equated to 4.3% compared to 224 students who took the exam at Knightly High and 38 students exceeded the standard which equates to 17% of the student population for 11th graders who took the exam. Although actual tests scores are not reported to the public, students who exceeded the standard received a score that was above 2,717.

Roughly 16% of 11th-grade students at Carter High, scored between 2,628 – 2717 on the SBAC, compared to roughly 27% of 11th-grade students at Knightly High. Percentages were almost identical for students who nearly met the standard as Carter High had roughly 32% of their students in this category compared to 33% of Knightly High students. Finally, almost half the students who took the test, roughly 48%, at Carter High did not meet the standard compared to only 23% of students at Knightly High School.

The results of Table 10 show a comparison of test scores between students at Carter High School where students have limited access to computers via computer labs and iPads and students at Knightly High School who have a one-to-one device: a Chromebook. The researcher did not have access to aggregated test scores from Scholarly District for the two schools. The research for this question has yielded inconclusive results. The researcher is unable to determine if the difference in test scores is due to students at Knightly High School having one-to-one computers or an unknown variable.

Findings for Hypothesis of Research Question 2

Question 2. How does access to school computers affect the student's performance on computerized assessments when controlling for differences in socioeconomic status and demographics? The Null Hypothesis is: There is no relationship on computerized assessments when controlling for socioeconomic and student demographics. The Alternate Hypothesis is: There is a relationship on computerized assessments when controlling for socioeconomic and student demographics.

Before discussing the findings for the hypothesis of research question 2, it is important to note previous definitions that were defined in this study. Socioeconomic status is defined by the American Psychological Association (APA) as the "social standing or class of an individual or group," which is "often measured as a combination of education, income, and occupation" (American Psychological Association, n.d.). The American Psychological Association website also states that although poverty is not a single factor, it is characterized by psychosocial and physical stressors. The APA further states that, socioeconomic status (SES) encompasses not just income but also educational attainment, financial security, and subjective perceptions of social status and social class (American Psychological Association, n.d.).

The researcher used the students' free lunch status to represent their socioeconomic status because that is a good indicator that family income is low. From Table 4, 545 of the 833 students at Carter High School qualify for free lunch which is 64% of the student population, Knightly High School has a percentage of 38% with 590 of their 1,555-student population qualifying for free lunch. As stated earlier in this study, researchers have noted that both student motivation and a student's socioeconomic status predict academic attainment (Berger & Archer, 2016). Although the socioeconomic status of students was identified and compared from both schools, the researcher did not account for student motivation in this research study.

In comparing the Smarter Balanced Consortium Scores (SBAC) from both schools in Table 10 the students at Knightly High School who did not meet the standard was 23.2% compared to 47.8% of students at Carter High School. The scores between the two schools for students who nearly met the standard were almost identical with roughly 32% for Carter High School and 33% for Knightly High School. However, a larger gap exists for students who exceed the standard with 4.3% representing three students at Carter High School and 17% representing thirty-eight students at Knightly High School.

The glaring question then is, what factors or strategies contribute to the success of students at Knightly High as opposed to students at Carter High School? The principal at Knightly High mentioned that all entering freshmen are immediately enrolled into a two-year preparation program for the Smarter Balanced Consortium exam although the students do not take the exam until eleventh grade. The students at Carter High School receive practice training a couple of months before the actual test is given each spring. However, a definitive answer to this question will require further research to determine the degree these factors have on student performance and will therefore not be answered in this current study.

The researcher is unable to explain the differences between test scores at either school because there was no controlled environment where students were given a pretest or posttest after receiving a training program. Further research is therefore needed to identify the type of program administered at Knightly High School to determine if a comparable program would contribute to increase test scores for the students at Carter High School.

Table 10

Smarter Balance Consortium Scores Between Schools

School	Parameter	Exceeds Standard	Standard Met	Nearly Met	Not Met	Total
Carter High	Count	3	11	22	33	69
	% Within SCHOOL	4.35	15.94	31.9	47.8	100 0
Knightly High	Count	38	60	74	52	224
	% Within SCHOOL	17	26.8	33	23.2	100 0
Total	Count	41	71	96	85	293
	% Within SCHOOL	14	24.2	32.8	29.0	100 0

Comparison of Student Factors. The other student factors the researcher compared in this study were student demographics, specifically ethnicity, culture, and language. Table 11 displays the total number of Limited English Proficient students at both schools for the current school year.

Table 11

Number of Limited English Proficient Students for 2017/2018

School	# LEP Students
Carter High School	250
Knightly High School	24
Grand Total	274

Table 12 displays the data for language classification at Carter High School as provided by the Scholarly School District. Carter High had a significantly larger amount of their student population classified as English Language Learners than did Knightly High and the numbers doubled for both schools to the current amount of 250 for Carter High and 24 for Knightly High. The researcher is unable to determine if the disparity between the numbers of English Language Learners between the two schools has a direct effect on student performance on the Smarter Balanced Consortium exam (SBAC).

Table 12

Language Classification Count for Carter High School for June 2016-17

Language Classification	# Of Students
	June 2016-2017
English Only	600
Initially Fluent English Proficiency	28
Limited English Proficiency	123
Reclassified Fluent English Proficiency	65
Unknown	1
Grand Total	817

Table 13 displays the data for language classification at Knightly High School as provided by Scholarly School District.

Table 13

Language Classification Count for Knightly High School for June 2016-17

Language Classification	# Of Students
	June 2016-2017
English Only	764
Initially Fluent English Proficiency	120
Limited English Proficiency	12
Reclassified Fluent English Proficiency	588
Grand Total	1484

Data provided by the district show that the students at Knightly High School have a higher socioeconomic status than students at Carter High School and their reported SBAC scores are higher. The researcher does not know all the factors that may contribute to higher test scores at Knightly High. The researcher was not able to control for the implementation of the training program that was provided for students at Knightly High school to determine the effects it had on student performance. The research results for this question is inconclusive and the researcher is unable to answer the question, 'How does access to school computers affect the student's performance on computerized assessments when controlling for differences in socioeconomic status and demographics'.

Findings for Hypothesis of Research Question 3

Question 3. What is the relationship between the number of technology training classes educators take and the number of minutes they spend preparing their students for computerized assessments? The Null Hypothesis is: There is no relationship between the number of technology training classes educators take and the number of minutes they spend preparing their students for computerized assessments. The Alternate Hypothesis is: There is a relationship between the number of technology training classes educators take and the number of minutes they spend preparing their students for computerized assessments.

Teachers were asked to list the number of technology training classes they took as one of the open-ended questions on the survey (see Appendix F). The researcher used SPSS to run a correlation (see Table 14) between the number of professional development classes an educator had taken to the number of minutes they reported they spent preparing students for computerized assessments. Ten teachers out of the thirty-six either left the question blank, wrote none, or reported they had taken zero classes. Teachers were also asked to list how many minutes per week they spent preparing students for computerized assessments. Eighteen of the thirty-six teachers left the question blank, wrote none, or reported they spent zero minutes preparing their students for computerized assessments.

Table 14

Correlation between HowMany and Examprep

	Pearson Correlation	*Sig.* (2-tailed)	*N*
Carter High HowMany-Examprep	.487	.406	14 and 5
Knightly High HowMany-Examprep	.109	.797	8 and 10

The researcher has knowledge that many of the math and English classes at Carter High School contain students in Grades 9 through 12, which means these teachers should be spending some minutes per week preparing the eleventh-grade students for the SBAC that is given in the spring. The researcher does not have information about the grade level of any classes at Knightly High School. The zeros in both columns were removed because the survey did not include a question asking teachers the grade level of their classes.

There is no way to know if teachers left the question blank, wrote none, or reported zero because they strictly teach twelfth graders and therefore would not spend any time preparing students for the test. There is also no way to know if teachers should be preparing students for computerized assessments but have chosen not to spend time preparing them for the SBAC. There is also no way to determine if students are prepared for the SBAC by other school personnel such as a coach or teacher with the assignment to specifically train students for the SBAC.

The correlation that was run did not show there was a relationship between how many technology-training classes a teacher had taken in the last five years and the number of minutes per week they spent preparing students for computerized assessments. The researcher, therefore, fails to reject the null hypothesis that there is a relationship between the number of technology training classes educators take and the number of minutes they spend preparing their students for computerized assessments.

Findings of Qualitative Research

Teacher Interviews

The researcher conducted teacher interviews in January and February 2018 of the 2017-2018 school year. Teacher interviews are presented in the Appendices (see Appendix N). NVivo was used to code teacher interviews for common themes.

Teachers interviewed at Carter High School

1. Ms. Simpson, English Department Chair, has a doctorate
2. Mr. Summit, an English teacher, has a master's degree
3. Ms. Waters, an English teacher, has a master's degree

Teachers interviewed at Knightly High School

4. Ms. Walker, English Department Chair, has a master's degree
5. Mr. Oscar, Social Studies teacher, has a master's degree
6. Ms. Ware, Math/Music teacher, has a master's degree

Participant Demographics

Participants interviewed in this study included two male teachers and four female teachers. Four teachers taught English, one taught social studies, and one taught math/music. All teachers interviewed have been teaching over ten years, and two of the six teachers have been teaching over thirty years. There was one caucasian teacher, and the other five were African Americans.

Interview Findings

Six common themes emerged from the coding of the face-to-face interviews (a) time to practice, (b) teacher perception, (c) reaction to technology, (d) preparing for the future, (e) using technology as a tool, and (f) access to technology. These themes were common among most of the interviewees and excerpts of their responses are discussed under each question below.

Question 1

What do students need to do well on computerized assessments? Both, Mr. Summit from Carter High School and Mr. Oscar from Knightly High School similarly answered this question by stating that students would need to have access to technology to do well on computerized assessments. As stated in the background of this study section, students do not have a chance to develop computer literacy when they have limited access to technology such as computers, iPads, or the Internet (Merrill, Hammons, & Tolman, 1996).

Both Ms. Simpson and Ms. Waters from Carter High School along with Ms. Walker from Knightly High School answered this question in a similar fashion by stating that students need to have some level of basic computer skills. Ms. Walker was more specific stating that students should understand how to use the highlighting feature during tests and should understand how to use certain symbols and buttons. Ms. Ware from Knightly High School believes that students should not only be critical thinkers but that they should not be dependent upon the teacher.

Question 2

Why is technology use in your classroom important? When asked this question four of the six participants, Mr. Summit, Ms. Simpson, Ms. Waters, and Ms. Ware, discussed how the world is changing digitally and that students will need to be savvy about technology. Mr. Summit discussed how there is a “paradigm shift” of moving away from using textbooks and using a digital platform. He discussed how technology could help students become critical thinkers as they move from an outdated way of thinking (A. Summit, personal communications, January 12, 2018).

Two of the six participants discussed that technology use in the classrooms allows students an opportunity to practice before taking a computer-based assessment. Two of the six participants discussed how technology can assist students in preparing for technological changes that are taking place now and when they enter college. One participant mentioned that technology has grown from literally nothing, 40 years ago, to the huge digital network we know today.

Question 3

How do you feel technology should be used in the classroom to meet the 21st-century skill sets? Ms. Walker discussed how technology benefits the learning environment by ‘increasing collaboration, motivations, improves reading and writing skills, and makes tasks easier for teachers. (D. Walker, personal communications, January 17, 2018).

Several teachers discussed how technology should be used as a tool such as grammar check or research. Ms. Ware mentioned that technology was a ‘neutralizing tool’ meaning that it allows students an opportunity to explore parts of the world without leaving home or leaving their classroom. She said, “It takes a broad world and makes it smaller.” (F. Ware, personal communications, February 6, 2018).

Question 4

How do students respond to technology time in the classroom? Can you give me examples of what they say/do?

When participants responded to this question, three of the six used the word ‘positive’ as to how their students felt about technology time in the classroom. Two participants used the phrase; ‘They love it’ while one of Ms. Simpson’s student responded by saying, “I am definitely going to do well on this assignment…because I love using the computer.” (B. Simpson, personal communications, January 15, 2018).

Not all participants reported positive responses from their students. Mr. Summit reported that 12th-grade students viewed technology time as adding more work to their daily routine. Ms. Waters reported that some of her students say things like “Why do we have to do this” or “Why can’t we just write it and turn it in?” or “Nobody else is making us use this.” (C. Waters, personal communications, January 17, 2018).

Question 5

What is your overall perception of technology integration into your educational curriculum?

Mr. Summit and Ms. Simpson, of Carter High School, responded similarly when answering this question. Mr. Summit not only reported that technology use was ‘inconsistent’ he stated that, “There is not enough of it be used on a strict regimen such as every day at the same time to become ingrained. Hit and miss because of scheduling because someone else may have the cart or the lab is being used” (A. Summit, personal communications, January 12, 2018). Ms. Simpson, of Carter High School, relayed to me that, “I wish every child on a high school campus were allowed to check-out or have access to computers and iPads during the school day. Ms.

Simpson said that students having anytime-access to technology could give them the tools they need to be successful" (B. Simpson, personal communications, January 15, 2018).

The participants at Knightly High responded differently by referring to 'an increase in class participation,' 'more advanced discussions' and as Mr. Oscar reported, "I think it can bring all the curriculum together such as integrating math, physics, and science" (E. Oscar, personal communications, January 15, 2018).

Question 6

In what ways, do you think technology benefits the learning environment?

Two of the six participants discussed how technology helps students prepare for the future such as taking an online course in college or how technology can assist them in becoming leaders in the 21st century. Several teachers referred to the improvement in reading and writing skills that they have witnessed in their students. One participant mentioned that technology allows students the ability to criticize, question, and evaluate everything in life.

Summary of Interview Findings

Participants were asked six open-ended questions. The researcher gathered data from participant interviews. The researcher used NVivo to identify common themes between respondents' responses to interview questions. Six common themes emerged during the coding process (a) time to practice, (b) teacher perception, (c) reaction to technology, (d) preparing for the future, (e) using technology as a tool, and (f) access to technology.

Overall, responses from all teachers were positive with teachers believing that technology can and does benefit the learning environment. The discovery of teachers having a positive attitude about technology use is key to understanding the impact of technology, as it is an essential factor that will lead a teacher to integrate technology that students need for computerized assessments (Subhi, 1999).

The teachers at Carter High School shared a common concern of their desire for more technology or a better use of the technology that is provided with the access to iPad carts or computer labs. The teachers at Knightly High School shared a common thankfulness and appreciation for being able to use technology, which they believe has attributed to a level of success in their classrooms.

Summary

The results of this mixed-methods grounded theory study were presented using an analytical procedure rather than a statistical procedure. The results of this research study provide a broad look at five factors that have the potential to affect student performance on computerized assessments: teacher attitude/aptitude, professional development, school resources, student demographics, and student socioeconomic status. The results from surveys and face-to-face interviews shed light on the high level of appreciation that educators have concerning technology integration and computerized assessments in general. While teachers at Carter High School have a desire to have more technology on an increased level, the teachers at Knightly High School discuss the success they have experienced by incorporating technology into their curriculum on a daily basis.

The relationship between an educator's technology knowledge (TK) and technology use (TU) was strong and thus indicate a participant's openness to using technology. Additionally, the relationship between participants' Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Content Knowledge (TCK) was strong which indicates that teachers possess the necessary skill to incorporate technology into their classroom, which is a benefit to students.

The lack of technology at Carter High School appears to be a barrier to sufficient technology integration as evidenced by teacher responses from face-to-face interviews. The results of the surveys however indicate that participants are open to receiving professional development training as over 60% (see Table 14) rate their desire to attend a technology class.

District data for per-pupil-expenditures was unavailable, and the researcher was unable to compare resources spent between the two schools. The longevity of teachers as evidenced by the number of years a teacher has been teaching at the current school could be viewed as a critical use of resources as this could indicate that a teacher is highly credentialed an effective in the classroom and therefore a constitute a human resource.

Student demographics between the two schools reveal that Carter High School has a significantly larger population of English Language Learners compared to Knightly High School (see Table 19). Students at Knightly High School have a higher socioeconomic status than students at Carter High School, and the students at Knightly High School have higher SBAC test scores (see Table 4 and 17).

The results of the face-to-face interviews revealed teachers held a favorable view of technology and believed technology integration was essential for the success of students at both schools.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

In this mixed-method grounded research study, the researcher sought to identify teacher attitudes and aptitude about technology to identify how it affected student performance on computerized assessments. The researcher also identified teachers as resources and professional development as a factor to determine the affect they had on student performance. Finally, the researcher sought to identify the effect that student demographics and student socioeconomic status had on student performance on the Smarter Balanced Consortium Assessment (SBAC) exam between two similar high schools.

Summary of the Study

The researcher used a 54-item Likert scale survey to gather quantitative data between two public high schools within the Scholarly District. Knightly High School is a one-to-one school where each student is assigned a Chrome book that is used in class and at home. Teachers at Carter High School must schedule computer time for their students by requesting the use of a shared-iPad cart or computer lab.

The researcher analyzed the results of the quantitative data using IBM's Statistical Package for Research Software Program (SPSS). The researcher gathered qualitative data from participants by conducting face-to-face interviews and then coded the results using NVivo to identify common themes.

This study was designed to answer the following research questions:

1. Is there a relationship between students who have one-to-one access to school computers compared to those who have scheduled access to school computers and student performance on computerized exams?

2. How does access to school computers affect the student's performance on computerized assessments when controlling for differences in socioeconomic status and demographics?
3. What is the relationship between the number of technology training classes educators take and the number of minutes they spend preparing their students for computerized assessments?

The researcher expected to identify the relationships between three teacher factors and student performance on computerized assessments: teacher attitude/aptitude, professional development, and school resources. The researcher hoped to identify the relationship between two student factors: demographics and socioeconomic status. The researcher ran multiple correlations to determine the relationships between all five factors and student performance on computerized assessments.

There is a need for more in-depth research into other factors that may affect student performance such as homelessness, incarceration, chronic absenteeism, the opening of charter schools on public school campuses, and the effect of substitutes on student performance.

The researcher discovered that whether teachers worked at Knightly High School, which is a one-to-one school, or at Carter High School where students only have access to iPads or computer labs, teachers were diligent to seek out resources to prepare students for computerized assessments to give students the practice they needed. Whether a school has one-to-one computers or computer labs, providing students with an avenue whereby they may practice digitally for assessments and classwork is a step in the right direction to preparing students in a global society (Edwards, 2014).

Methodology

The researcher used a mixed-methods (quantitative and qualitative) grounded theory explanatory sequential design structure in this research study. The researcher also used an analytical procedure to compare factors between two schools rather than a statistical method. The researcher distributed a Likert scale survey (see Appendix G), containing 54 questions and 8 open-ended questions, to 47 teachers at Carter High and 65 teachers at Knightly High School. The Likert scale is a 5-point scale with anchors of scale that represented *completely agree* or 100% agreement, four-points that represented 75% agreement, three-points that represented *neutral* or 50% agreement/disagreement, two-points that represented 25% disagreement and one-point that represented *completely disagree* or 0% agreement.

Participants were required to rate themselves in eight categories:

1. Technology Knowledge (TK),
2. Content Knowledge (CK),
3. Pedagogical Knowledge (PK),
4. Technology Use (TU),
5. Technological Content Knowledge (TCK),
6. Professional Development (PD),
7. Technology Pedagogy and Content Knowledge (TPACK), and
8. Attitude Toward Technology (ATT).

The researcher analyzed the survey responses using IBM's Statistical Package for Research Software Program (SPSS). The open-ended questions gave participants an opportunity to discuss technology training classes they may have attended, the types of technology used in their classes, and the amount of time they spent preparing students for computerized assessments. The researcher discussed the survey results in the section on survey findings.

The researcher conducted face-to-face interviews with three teachers from Carter High School and three teachers from Knightly High School (*N* = 6). Participants were interviewed during non-instructional time using interview questions contained on the interview form in Appendix H. The interview results were then coded using NVivo to identify common themes. The researcher discusses the interview results in the section on interview findings.

Survey Findings

The results from the survey reveal several relationships between the participants' demographics and the individual constructs of the survey. One of the relationships identified was a significant negative relationship between the length of education and a participant's attitude toward using technology. It appears that educators who have longevity in the classroom were less likely to have a positive view of technology as evidenced by the number of years a teacher has been teaching (see Table 3).

Interview Findings

The researcher identified six common themes during the coding process (a) time to practice, (b) teacher perception, (c) reaction to technology, (d) preparing for the future, (e) using technology as a tool, and (f) access to technology. While participants at Carter High School revealed a desire for all students to have access to technology, the teachers at Knightly High School revealed that technology allowed them to be better organized and allowed to have better success in their classes. Teachers at both schools identified their students' reactions to technology to be positive as many viewed technology integrations as a necessary tool for the 21st century. Overall the responses about technology from both school and teachers seemed to embrace the idea of technology integration. No teachers at either school reported that the absence of professional development was a reason for their lack of technology use.

The overall theory the researcher has developed from the face-to-face interviews is that teachers most teachers have a favorable view of technology and any lack of technology in their classes is due to a lack of technology rather than a negative attitude about technology.

Reflections

The researcher believed that educators who held a more positive belief about technology would spend more time preparing their students in technology use and for computerized assessment and are more inclined to incorporate technology into their curriculum. More frequently than educators who hold a more negative view of technology. The correlation between attitude toward technology (ATT) and length of education (LENEDU) (see Appendix I) does not appear to validate that claim since there is a negative relationship between the two variables. However, the results of the survey do not delineate between a teacher who has been teaching years and now teaches high-level classes or that teaches mainly seniors who are not required to take the SBAC exam.

The researcher hypothesized that some teachers would indicate that they had not integrated technology because of negative perception about technology. The researcher found, through face-to-face interviews, that the lack of technology implementation was due to a lack of technology rather than a negative perception. The researcher also anticipated that some teachers would identify a lack of professional development or a lack of administrative support as their reason why that had not implemented technology into their classroom. The researcher discovered during face-to-face interviews that teachers were resourceful in seeking assistance from other teachers at their school site or online resources to train themselves how to incorporate technology. Additionally, teachers at Carter High were diligent to seek out laptop/iPad carts or schedule time in the computer lab when needed.

The researcher had anticipated that the school with the lowest socioeconomic status would have the lowest test scores on the Smarter Balanced Consortium (SBAC) exam. The test scores in Table 10 reveal that 79% of students at Carter High School did not meet (nearly met + did not meet) the standard on the SBAC exam compared to 56% (nearly met + did not meet) of students from Knightly High. The students at Knightly High School have a higher socioeconomic status (SES) of 40% compared to 65% of students at Carter High School.

The researcher formed this conjecture because research has shown that students with low socioeconomic status perform lower on standardized and computerized assessments. Borman & Dowling (2010, cited in Palardy et al., 2015) who found that the student population of socioeconomic composition and the ethnic/racial composition and the socioeconomic had nearly twice the effect on student achievement test scores compared with the students' own race/ethnicity or SES.

More research is needed to study the strategies that are used at Knightly High School to determine training programs they immerse their incoming 9th graders into when they enter high school. The relationship between significant amounts of English Language Learners at Carter High may contribute to low-test scores as ELLs perform significantly below their English-speaking peers (Khong & Saito, 2014).

Limitations

The findings of this research study are limited by the small sample size. Carter High School has 47 teachers and 21 teachers completed by survey. Knightly High School has 65 teachers and 15 teachers completed the survey. The researcher anticipates that if this study is duplicated at schools with more teachers or duplicated at several schools within or outside of the district the results would be different.

Another limitation of this study was the unavailability of aggregated student test scores from the Smarter Balanced Consortium assessment or the interim assessment data. Carter High School did not administer the interim assessment in fall of 2016. In the absence of this data, the researcher only compared overall test scores between the two schools.

In comparing the test scores at both schools, the researcher noticed that SBAC scores at Knightly were higher than Carter High School. However, the researcher could not identify the reason for the difference. The researcher does note the following factors discovered during this study, several of which research has shown to affect student performance negatively:

- Carter High has a higher socioeconomic status with 65% of students qualifying for free-lunch status compared to 40% at Knightly High School.
- Carter High School has a larger population of LEP students who struggle to understand English (30%) compared to 2% at Knightly High School,
- The math department at Carter High school has had a consistent level of teacher turnover in the last four years, and
- Knightly High School students receive two years of purposeful training before they take the SBAC exam.

The researcher acknowledges that any of the above known factors, and other unknown factors, could have contributed to student performance on the SBAC exam. Another limitation of this study is the fact that not all teachers reported the number of minutes they prepare students to take computerized assessments. Some teachers may only have seniors and would therefore not be required to prepare students because the SBAC is only given to students in Grade 11.

Conclusions/Recommendations for Further Research

In this research study the researcher sought to identify five factors and the relationship they have on student performance at two high schools that were similar in demographics, socioeconomic status, and magnet status. The five factors that were used in this study were teacher attitude/aptitude, professional development, school resources, student demographics and student socioeconomic status.

The researcher discovered from the results of the surveys that there was a negative relationship between the length of time a teacher has taught and their attitude about technology which may help districts and schools understand the benefit of incorporating technology into preservice teachers training programs. Additionally, schools and districts may benefit from continued professional development classes for employees to help them stay abreast of changes in technology. The researcher also found a positive relationship between a teacher's attitude and their technology knowledge (TK).

The findings of this research study represent a small step to understanding the factors that affect student performance on computerized assessments. The researcher would recommend a broader study that would include a factor analysis to determine relationships that may exist that might contribute to low performance on computerized tests. Future factors could consist of how the rise in homelessness and foster youth or how student incarceration affects student performance upon a student's release from the system. Academic factors for further research would be whether a student matriculated through middle school with substitute teachers or had a fully credentialed teacher their entire middle school experience. Research on these topics and more may have already been done, however the researcher is employed at a school where these factors have been discussed in staff meetings during the current school year.

The researcher acknowledges that this study was limited by the small sample size at both schools and could be expanded to include high schools that have more teachers and students or multiple high schools within the same district. Another beneficial research study would be a comparison of a factor analysis between public charter schools that are becoming popular on the campuses of public high schools.

The researcher would recommend a review of student test data as they matriculate from middle schools into high schools to determine prior technology knowledge students may already have before entering high school. The researcher would also recommend a controlled environment where students take a pretest and posttest, and then receive a training class after the pretest. Finally, a more in-depth research study into the different strategies a school could use in preparing students for computerized assessments may be critical to improving the success level for all students.

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APPENDIX A

Site Authorization Form Carter High School

Title of the Study	Influence of teachers' technology attitude and aptitude on students' performance on computerized assessments.
Researcher/s	Charlotte Ashford
Researcher/s' Affiliation with Site	Math Teacher
Researcher/s' Phone Numbers	310-367-0639
Researcher/s' CUI Email Address (or other if non-CUI affiliated)	Charlotte.ashford@eagles.cui.edu
Researcher/s' University Supervisor	Dr. Margaret Christmas Thomas
University Supervisor's Phone & E-mail	914-214-3361 margaret.christmasthomas@cui.edu
Location/s where Study Will Occur	Carter High School Scholarly District

Purpose of the Study (1-2 paragraphs):

The purpose of this research study is to identify how teacher attitudes and aptitude influence student performance on computerized assessments. The researcher will identify other teacher factors that affect student performance such as professional development and resources. Additionally, the researcher will explore how student performance is affected by student demographics, and student's socioeconomic status.

This study was designed to answer the following research questions:

1. How does access to one-to-one computers or computer labs relate to quantity and quality of preparedness for computerized assessments for 11th-grade students between two high schools?

2. How does quantity and quality of preparedness, individually and aggregately, affect the student's performance on computerized assessment when controlling for differences in socioeconomic status and demographics?

3. What technology training programs and support are beneficial for teachers? To what degree are technology training programs and support effective for these teachers?

The researcher will compare data between two similar schools in terms of demographics and ethnicity while controlling for variables such as socioeconomic status, professional development, and school resources. This study will use three independent variable factors: School (resources, Student pre/post computerized test scores, and Teacher (beliefs, technology use, and TPACK).

Procedures to be Followed:

For this research study, the researcher will collect data through a survey using a five-point Likert-type scale that will measure a teacher's Technological Pedagogical Content Knowledge (TPACK) in the area of Science, Math, Literacy, and Social Studies. TPACK is being used as the theoretical framework for this research study as the researcher attempts to identify knowledge teachers need to integrate technology into their curriculum to prepare students for computerized assessments. Additionally, participants will be asked to answer questions in the following areas; professional development, technology use, attitude towards computers, and additional questions based on respondent's answer to prior questions.

Independent variables → Dependent variables

Survey Data – Quantitative (general trends and relationships)

Interview Data – Qualitative (narratives, process, context)

The researcher will gather initial demographic information about each participant such as age, race, gender, education, and experience at the end of the survey and create a data sheet for the initial contact session with each participant. The researcher will have a staff member administer and collect the surveys to minimize anxiety from the presence of the researcher. All participants will be advised that they have the option to end their participation in the study at any time without fear of loss or penalty.

Participants will be asked to stay after a regular staff meeting to complete the survey. Participants may be compensated with a $5 Starbucks or Jamba Juice gift card as a thank you gift for completing the survey. The gift card is not contingent on participants completing the survey as all participants will receive a raffle ticket for their completed survey. The researcher will provide 10 gift cards for each site. The raffle will take place once everyone completes the survey. Face-to-face interviews of three teachers will take place during lunch or immediately after school.

The researcher plans to use the data from the face-to-face interviews to identify best practices or strategies that would benefit any teacher looking to incorporate technology into their curriculum. The researcher will code the interview data into themes to identify similarity and differences of teacher strategies between two schools.

The researcher will transport all surveys in a portable locked case that only the researcher has the combination to. Additionally, the researcher will store the case in a locked cabinet for extra protection while at school and at home. The surveys will be kept for 3 years, then destroyed thereafter.

Time and Duration of the Study:

The researcher plans to give participants the initial survey in January and also conduct face-to-face interviews in January. The anticipated length of the study is one semester.

Benefits of the Study:

The benefits to the participants and others may include identifying technology training programs designed to assist in technology integration into future curriculum. The researcher will use qualitative data to identify patterns that successful teachers use that can be implemented to improve low performing students on computerized assessments.

Persons who will have access to the records, data, tapes, or other documentation):

Principal researcher and University staff overseeing the research

Date when the records, data, tapes, or other documentation will be destroyed: January 8, 2021

APPENDIX B

Site Authorization Form Knightly High School

Title of the Study	Influence of teachers' technology attitude and aptitude on students' performance on computerized assessments.
Researcher/s	Charlotte Ashford
Researcher/s' Affiliation with Site	Math Teacher
Researcher/s' Phone Numbers	310-367-0639
Researcher/s' CUI Email Address (or other if non-CUI affiliated)	Charlotte.ashford@eagles.cui.edu
Researcher/s' University Supervisor	Dr. Margaret Christmas Thomas
University Supervisor's Phone & E-mail	914-214-3361 margaret.christmasthomas@cui.edu
Location/s where Study Will Occur	Knightly High School Scholarly District

Purpose of the Study (1-2 paragraphs):

The purpose of this research study is to identify how teacher attitudes and aptitude influence student performance on computerized assessments. The researcher will identify other teacher factors that affect student performance such as professional development and resources. Additionally, the researcher will explore how student performance is affected by student demographics, and student's socioeconomic status.

This study was designed to answer the following research questions:

1. How does access to one-to-one computers or computer labs relate to quantity and quality of preparedness for computerized assessments for 11th-grade students between two high schools?

2. How does quantity and quality of preparedness, individually and aggregately, affect the student's performance on computerized assessment when controlling for differences in socioeconomic status and demographics?

3. What technology training programs and support are beneficial for teachers? To what degree are technology training programs and support effective for these teachers?

The researcher will compare data between two similar schools in terms of demographics and ethnicity while controlling for variables such as socioeconomic status, professional development, and school resources. This study will use three independent variable factors: School (resources, Student pre/post computerized test scores, and Teacher (beliefs, technology use, and TPACK).

Procedures to be Followed:

For this research study, the researcher will collect data through a survey using a five-point Likert-type scale that will measure a teacher's Technological Pedagogical Content Knowledge (TPACK) in the area of Science, Math, Literacy, and Social Studies. TPACK is being used as the theoretical framework for this research study as the researcher attempts to identify knowledge teachers need to integrate technology into their curriculum to prepare students for computerized assessments. Additionally, participants will be asked to answer questions in the following areas; professional development, technology use, attitude towards computers, and additional questions based on respondent's answer to prior questions.

Independent variables → Dependent variables

Survey Data – Quantitative (general trends and relationships)

Interview Data – Qualitative (narratives, process, context)

The researcher will gather initial demographic information about each participant such as age, race, gender, education, and experience at the end of the survey and create a data sheet for the initial contact session with each participant. The researcher will have a staff member administer and collect the surveys to minimize anxiety from the presence of the researcher. All participants will be advised that they have the option to end their participation in the study at any time without fear of loss or penalty.

Participants will be asked to stay after a regular staff meeting to complete the survey. Participants may be compensated with a $5 Starbucks or Jamba Juice gift card as a thank you gift for completing the survey. The gift card is not contingent on participants completing the survey as all participants will receive a raffle ticket for their completed survey. The researcher will provide 10 gift cards for each site. The raffle will take place once everyone completes the survey. Face-to-face interviews of three teachers will take place during lunch or immediately after school.

The researcher plans to use the data from the face-to-face interviews to identify best practices or strategies that would benefit any teacher looking to incorporate technology into their curriculum. The researcher will code the interview data into themes to identify similarity and differences of teacher strategies between two schools.

The researcher will transport all surveys in a portable locked case that only the researcher has the combination to. Additionally, the researcher will store the case in a locked cabinet for extra protection while at school and at home. The surveys will be kept for 3 years, then destroyed thereafter.

Time and Duration of the Study:

The researcher plans to give participants the initial survey in January and also conduct face-to-face interviews in January. The anticipated length of the study is one semester.

Benefits of the Study:

The benefits to the participants and others may include identifying technology training programs designed to assist in technology integration into future curriculum. The researcher will use qualitative data to identify patterns that successful teachers use that can be implemented to improve low performing students on computerized assessments.

Persons who will have access to the records, data, tapes, or other documentation):

Principal researcher and University staff overseeing the research

Date when the records, data, tapes, or other documentation will be destroyed: January 8, 2021

APPENDIX C

Concordia IRB Authorization

CONCORDIA UNIVERSITY IRVINE

INSTITUTIONAL REVIEW BOARD DECISION

☑ Exempt Review 45 CFR 46.101 ☐ Expedited Review 45 CFR 46.110 ☐ Full Board Review 45 CFR 46

Review Date	12/04/2017
IRB#	3766
Title of Project	Influence of Teachers' technology attitude and aptitude on students' performance on computerized assessments
Researcher/s	Charlotte Ashford

☑ **APPROVED**

Effective duration of IRB Approval: 12/04/2017 to 12/04/2018

Conditional approval pending signed site authorization.

For Exempt Approved, Please Note: *while your project is exempt from providing Informed Consent information to the IRB, your project must still obtain participants' informed consent.*
For Expedited and Full Board Approved, Please Note:
a.The IRB's approval is only for the project protocol named above. Any changes aresubject to review and approval by the IRB.
b.Any adverse events must be reported to the IRB.
c.An annual report or report upon completion is required for each project. If the project isto continue beyond the twelve month period, a request for continuation of approvalshould be made in writing. Any deviations from the approved protocol should be noted.

☐ **NEEDS REVISION AND RESUBMISSION**

☐ **NOT APPROVED**

Printed Name IRB Reviewer Catherine Webb

Signature of IRB Reviewer Catherine Webb, Ed.D

APPENDIX D

Scholarly District Authorization to Conduct Research Study

December 18, 2017

Charlotte Ashford
1530 Concordia West
Irvine, CA 92612

Dear Researcher:

The Scholarly District Committee for External Research Review has approved your request to conduct your research study entitled "The influences of teacher attitude and aptitude This action by the committee is an approval to conduct your student in SCHOARLY DISTRICT schools according to the terms presented in the Statement of Agreement for External Researchers and signed on November 17, 2017. This letter does not:

Create any obligation for district personnel, students, or parents to participate. All participants must be completely voluntary and the confidentiality of all sources must be maintained.

Create any obligation on the part of the principal or staff to engage in research activities that occur during instructional or work time.

The approval is valid for one year from the date of this letter. At the conclusion of your study or within a year of the date of this letter, whichever comes first, please send a practitioner-friendly summary (PowerPoint presentation, Infographic, research brief, etc.) of your findings and copies of any reports to my attention. I wish you the best of luck in your research endeavors.

Sincerely,

Coordinator

Committee for External Research Review

APPENDIX E

Teacher Consent Form for Participation in a Research Study

Concordia University

Title of Study: The Influence of teachers' technology attitude and aptitude on students' performance on computerized assessments

Researcher's Name: Charlotte Ashford

Researcher's Contact Information: 310-367-0639

Charlotte.ashford@eagles.cui.edu

You are invited to participate in a research study conducted by (Charlotte Ashford). **The purpose** of this research study is to identify how teacher attitudes and aptitude influence student performance on computerized assessments. The researcher will identify other teacher factors that affect student performance such as professional development and resources. Additionally, the researcher will explore how student performance is affected by student demographics, and a student's socioeconomic status.

This study was designed to answer the following research questions:

1. How does access to one-to-one computers relate to quantity and quality of preparedness for computerized assessments for 11th-grade students between two high schools?
2. How does quantity and quality of preparedness, individually and aggregately, affect the student's performance on computerized assessment when controlling for differences in socioeconomic status and demographics?
3. What technology training programs and support are beneficial for teachers? To what degree are technology-training programs and support effective for these teachers?

<u>LENGTH OF THE STUDY</u>

The study will take one semester to complete. Individuals who are interviewed will be interviewed in their room during non-instructional time to provide an environment of familiarity and comfort. The interview will take between 30-45 minutes.

<u>YOUR LEVEL OF INVOLVEMENT</u>

You will be asked to complete a consent form followed by an initial survey form that will take approximately 20 minutes to complete. You may also be asked to answer interview questions in a face-to-face session that will take place during non-instructional time.

Potential Risks

You may feel discomfort as you identify any negative perceptions you have about technology integration or lack of technology experience. All identifiable information that relates to teachers in the study, the school, and the district will be kept confidential. The researcher will be the only person with access to the data in this study and all data will be locked and stored in a cabinet where only the researcher has the key. The data will be kept for 3 years, then destroyed thereafter. The rules and regulations that are established by the National Institute of Health and Extramural Research is being followed to minimize any risks associated with this study.

Potential Benefits

The benefits to the participants and others may include identifying technology training programs designed to assist in technology integration into future curriculum and to identify strategies to assist students to improve their performance on computerized assessments.

Confidentiality

Each participant will be given a pseudo name and your identity will not be provided to any publication because of this study.

Voluntary participation

Your participation in this research study is voluntary. All participants will receive a Starbucks or Jamba Juice gift card as a thank you for completing the survey. You may withdraw your consent to participate in this study at any time without penalty or loss of any kind.

Contact information

If you have any concerns or questions about your rights as a research participant, please contact the Concordia University Institutional Review Board irb@cui.edu. If you have any concerns or questions during this study, please contact Charlotte Ashford, Principal Investigator at Concordia University at 310-367-0639.

Consent

I have read this consent form and have been given the opportunity to ask questions. I give my consent to participate in this study. As copy of this consent form will be given to you.

Participant's signature________________________________ Date: ________________

APPENDIX F

Initial Interview

My name is Charlotte Ashford and I am conducting a survey to determine how teachers' perspective and attitude about technology affects student performance on computerized exams. Any information you provide for the survey will remain confidential. I plan to use the information gained from the survey to help me understand teacher beliefs as one of the factors that influence student performance. Additionally, I would like to assist teachers in preparing students to be successful on computerized exams, as they become 21st century learners.

Day of Interview:

Time:

Location:

Interviewer:

Interviewee:

Briefly describe the project: The purpose of this research study is to identify how teacher attitudes and aptitude influence student performance on computerized assessments. The researcher will identify other teacher factors that affect student performance such as professional development and resources. Additionally, the researcher will explore how student performance is affected by student demographics, and student's socioeconomic status.

Please list the department you work in at your school ________________________

Demographics

1. What ethnicity do you most closely identify with? __________________________
2. Circle your Gender: a. Female b. Male

3. What is your age? _______________

4. At your school, what is your current position? _____________________________________

5. If you are a teacher, what subjects do you teach? ___________________________________

   ____

6. How long have you taught this subject? ____

7. What prior subjects have you taught?

   ____

8. How long have you been an educator? ____________________________________

9. What is your highest educational level? a. Associates degree b. Bachelor's degree

   c. Master's degree d. Doctorate degree

10. How long have you been teaching at your current school? _______________________

APPENDIX G

Likert Survey

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. For each of the questions below, circle the response that most closely aligns with how you feel about the statement, where 1 = Completely Disagree, and 5 = Completely Agree and 2, 3, 4 is a continuum between 1 and 5

	Completely Disagree				Completely Agree
TK (Technology Knowledge)					
1. I know how to solve my own technical problems.	1	2	3	4	5
2. I can learn technology easily.	1	2	3	4	5
3. I keep up with important new technologies.	1	2	3	4	5
4. I frequently play around the technology.	1	2	3	4	5
5. I know about a lot of different technologies.	1	2	3	4	5
6. I have the technical skills I need to use technology.	1	2	3	4	5
CK (Content Knowledge)					
Mathematics					
7. I have sufficient knowledge about mathematics.	1	2	3	4	5
8. I can use a mathematical way of thinking.	1	2	3	4	5
9. I have various ways and strategies of developing my understanding of mathematics.	1	2	3	4	5
Social Studies					
10. I have sufficient knowledge about social studies.	1	2	3	4	5
11. I can use a historical way of thinking.	1	2	3	4	5
12. I have various ways and strategies of developing my understanding of social studies.	1	2	3	4	5

Science					
13. I have sufficient knowledge about science.	1	2	3	4	5
14. I can use a scientific way of thinking.	1	2	3	4	5
15. I have various ways and strategies of developing my understanding of science.	1	2	3	4	5
Literacy					
16. I have sufficient knowledge about literacy.	1	2	3	4	5
17. I can use a literary way of thinking.	1	2	3	4	5
18. I have various ways and strategies of developing my understanding of literacy.	1	2	3	4	5
PK (Pedagogical Knowledge)	**Completely Disagree**				**Completely Agree**
19. I know how to assess student performance in a classroom.	1	2	3	4	5
20. I can adapt my teaching based-upon what students currently understand or do not understand.	1	2	3	4	5
21. I can adapt my teaching style to different learners.	1	2	3	4	5
22. I can assess student learning in multiple ways.	1	2	3	4	5
23. I can use a wide range of teaching approaches in a classroom setting.	1	2	3	4	5
24. I am familiar with common student understandings and misconceptions.	1	2	3	4	5
25. I know how to organize and maintain classroom management.	1	2	3	4	5

TU (Technology Use)					
26. I am familiar with the districts' technology plan.	1	2	3	4	5
27. I feel confident incorporating technology into my curriculum.	1	2	3	4	5
28. My students are well prepared for computerized assessments.	1	2	3	4	5
29. My students are well prepared for paper-and-pencil assessments.	1	2	3	4	5
TCK (Technological Content Knowledge)					
30. I know about technologies that I can use for understanding and doing mathematics.	1	2	3	4	5

31. I know about technologies that I can use for understanding and doing literacy.	1	2	3	4	5
32. I know about technologies that I can use for understanding and doing science.	1	2	3	4	5
33. I know about technologies that I can use for understanding and doing social studies.	1	2	3	4	5

PD (Professional Development)	**Completely Disagree**				**Completely Agree**
34. I would like to attend a technology training class.	1	2	3	4	5
35. I can choose technologies that enhance students' learning for a lesson.	1	2	3	4	5
36. My teacher preparation program provided technology training.	1	2	3	4	5
37. My school provides in-house technology training.	1	2	3	4	5
38. The technology training at my school adequately prepares me to integrate technology in my curriculum.	1	2	3	4	5
39. I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.	1	2	3	4	5
40. My school provides technology training for teachers outside of class time.	1	2	3	4	5
41. I can teach others how to use technology in their class.	1	2	3	4	5
42. I have taken a technology training class in the last five (5) years.	1	2	3	4	5
TPACK (Technology Pedagogy and Content Knowledge)					
43. I can teach lessons that appropriately combine mathematics, technologies and teaching approaches.	1	2	3	4	5
44. I can teach lessons that appropriately combine literacy, technologies and teaching approaches.	1	2	3	4	5
45. I can teach lessons that appropriately combine science, technologies and teaching approaches.	1	2	3	4	5
46. I can teach lessons that appropriately combine social studies, technologies and teaching approaches.	1	2	3	4	5
ATT (Attitude Towards Technology)					
47. Technology can help me do my work better.	1	2	3	4	5

48. I find it easy to use technology (projector, computers, Smartboards, etc.)	1	2	3	4	5
49. I am comfortable using computers.	1	2	3	4	5
50. I do not like using computers.	1	2	3	4	5
51. I know a lot about computers.	1	2	3	4	5
52. Everyone should know how to use computers.	1	2	3	4	5
53. I find computers friendly.	1	2	3	4	5
54. Computers in school is a good idea.	1	2	3	4	5

Survey open-ended questions

55. List the types of technology training you have received in the last five years?

____

____

56. How many technology-training classes have you taken in the last five years? ___________

57. Explain in detail as best you can about a technology training you've attended and how you have applied it to your profession.

____

____

58. My classroom is equipped with (check all that apply)

    ___ Smartboard
    ___ Projector
    ___ Laptop/computer
    ___ Other Technology (please list) ____

59. In my classroom, my students have access to (check all that apply)

    ___ iPads
    ___ Laptops
    ___ Other Technology (please list) ____

60. How many minutes per week do you spend preparing students to take computerized exams?

_______________ (minutes/weeks)

61. How many minutes per week do you use the following technology during instruction?

_______ Smartboard

_______ Laptop

_______ iPad

62. How many minutes per week do your students use the following technology during class?

_______ Laptop

_______iPad

_______ Smartphone

APPENDIX H

Teacher Interview Questions

1. What do students need in order to do well on computerized assessments?

   ____

   ____

2. Why is technology use in your classroom important? ______________________

   ____

3. How do you feel technology should be used in the classroom to meet the 21st Century skill sets? ____

   ____

4. How do students respond to technology time in the classroom? Can you give me examples of what they say/do?

   ____

   ____

5. What is your overall perception of technology integration into your educational curriculum?

   ____

   ____

6. In what ways, do you think technology benefits the learning environment?

   ____

   ____

APPENDIX I

Correlation: Length of Education and Survey Totals

		LENEDU	TK TOTAL	TCK TOTAL	TU TOTAL	PK TOTAL	CK TOTAL	PD TOTAL	TPACK TOTAL	ATT TOTAL
LENEDU	Pearson Correlation	1	-.202	.177	.131	-.016	.092	.140	.215	-.387*
	Sig. (2-tailed)		.238	.301	.445	.925	.592	.415	.209	.020
	N	36	36	36	36	36	36	36	36	36
TKTOTAL	Pearson Correlation	-.202	1	.153	.411*	.347*	.043	.432**	.271	.617**
	Sig. (2-tailed)	.238		.374	.013	.038	.804	.009	.109	.000
	N	36	36	36	36	36	36	36	36	36
TCKTOTAL	Pearson Correlation	.177	.153	1	.262	.440**	.608**	.381*	.595**	.086
	Sig. (2-tailed)	.301	.374		.122	.007	.000	.022	.000	.617
	N	36	36	36	36	36	36	36	36	36
TUTOTAL	Pearson Correlation	.131	.411*	.262	1	.284	-.024	.511**	.274	.254
	Sig. (2-tailed)	.445	.013	.122		.093	.889	.001	.105	.134
	N	36	36	36	36	36	36	36	36	36
PKTOTAL	Pearson Correlation	-.016	.347*	.440**	.284	1	.402*	.387*	.348*	.263
	Sig. (2-tailed)	.925	.038	.007	.093		.015	.020	.037	.121
	N	36	36	36	36	36	36	36	36	36
CKTOTAL	Pearson Correlation	.092	.043	.608**	-.024	.402*	1	.251	.565**	.070
	Sig. (2-tailed)	.592	.804	.000	.889	.015		.140	.000	.685
	N	36	36	36	36	36	36	36	36	36
PDTOTAL	Pearson Correlation	.140	.432**	.381*	.511**	.387*	.251	1	.418*	.384*
	Sig. (2-tailed)	.415	.009	.022	.001	.020	.140		.011	.021
	N	36	36	36	36	36	36	36	36	36
TPACKTOT	Pearson Correlation	.215	.271	.595**	.274	.348*	.565**	.418*	1	.186

	Sig. (2-tailed)	.209	.109	.000	.105	.037	.000	.011		.278
	N	36	36	36	36	36	36	36	36	36
ATTTOTAL	Pearson Correlation	-.387*	.617**	.086	.254	.263	.070	.384*	.186	1
	Sig. (2-tailed)	.020	.000	.617	.134	.121	.685	.021	.278	
	N	36	36	36	36	36	36	36	36	36

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

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

APPENDIX J

Correlation: Age of Participant and Survey Totals

		AGE	TK TOTAL	CK TOTAL	PK TOTAL	TU TOTAL	TCK TOTAL	PD TOTAL	TPACK TOTAL	ATT TOTAL
AGE	Pearson Correlation	1	-.281	.019	-.099	.026	.117	.077	-.014	-.075
	Sig. (2-tailed)		.107	.916	.579	.885	.509	.666	.937	.674
	N	34	34	34	34	34	34	34	34	34
TKTOTAL	Pearson Correlation	-.281	1	.043	.347*	.411*	.153	.432**	.271	.617**
	Sig. (2-tailed)	.107		.804	.038	.013	.374	.009	.109	.000
	N	34	36	36	36	36	36	36	36	36
CKTOTAL	Pearson Correlation	.019	.043	1	.402*	-.024	.608**	.251	.565**	.070
	Sig. (2-tailed)	.916	.804		.015	.889	.000	.140	.000	.685
	N	34	36	36	36	36	36	36	36	36
PKTOTAL	Pearson Correlation	-.099	.347*	.402*	1	.284	.440**	.387*	.348*	.263
	Sig. (2-tailed)	.579	.038	.015		.093	.007	.020	.037	.121
	N	34	36	36	36	36	36	36	36	36
TUTOTAL	Pearson Correlation	.026	.411*	-.024	.284	1	.262	.511**	.274	.254
	Sig. (2-tailed)	.885	.013	.889	.093		.122	.001	.105	.134
	N	34	36	36	36	36	36	36	36	36
TCKTOTAL	Pearson Correlation	.117	.153	.608**	.440**	.262	1	.381*	.595**	.086
	Sig. (2-tailed)	.509	.374	.000	.007	.122		.022	.000	.617
	N	34	36	36	36	36	36	36	36	36

PDTOTAL	Pearson Correlation	.077	.432**	.251	.387*	.511**	.381*	1	.418*	.384*
	Sig. (2-tailed)	.666	.009	.140	.020	.001	.022		.011	.021
	N	34	36	36	36	36	36	36	36	36
TPACKTOT	Pearson Correlation	-.014	.271	.565**	.348*	.274	.595**	.418*	1	.186
	Sig. (2-tailed)	.937	.109	.000	.037	.105	.000	.011		.278
	N	34	36	36	36	36	36	36	36	36
ATTTOTAL	Pearson Correlation	-.075	.617**	.070	.263	.254	.086	.384*	.186	1
	Sig. (2-tailed)	.674	.000	.685	.121	.134	.617	.021	.278	
	N	34	36	36	36	36	36	36	36	36

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

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

APPENDIX K

Correlation: Length Participant Has Taught Subject and Survey Totals

		LENOFSUB	TKTOTAL	CKTOTAL	PKTOTAL	TUTOTAL	TCKTOTAL	PDTOTAL	TPACKTOTAL	ATTTOTAL
LENOFSUB	Pearson Correlation	1	-.117	-.036	.038	.255	.163	.249	-.050	-.316
	Sig. (2-tailed)		.498	.835	.827	.134	.344	.143	.771	.061
	N	36	36	36	36	36	36	36	36	36
TKTOTAL	Pearson Correlation	-.117	1	.043	.347*	.411*	.153	.432**	.271	.617**
	Sig. (2-tailed)	.498		.804	.038	.013	.374	.009	.109	.000
	N	36	36	36	36	36	36	36	36	36
CKTOTAL	Pearson Correlation	-.036	.043	1	.402*	-.024	.608**	.251	.565**	.070
	Sig. (2-tailed)	.835	.804		.015	.889	.000	.140	.000	.685
	N	36	36	36	36	36	36	36	36	36
PKTOTAL	Pearson Correlation	.038	.347*	.402*	1	.284	.440**	.387*	.348*	.263
	Sig. (2-tailed)	.827	.038	.015		.093	.007	.020	.037	.121
	N	36	36	36	36	36	36	36	36	36
TUTOTAL	Pearson Correlation	.255	.411*	-.024	.284	1	.262	.511**	.274	.254
	Sig. (2-tailed)	.134	.013	.889	.093		.122	.001	.105	.134
	N	36	36	36	36	36	36	36	36	36
TCKTOTAL	Pearson	.163	.153	.608**	.440**	.262	1	.381*	.595**	.086

	Correlation									
	Sig. (2-tailed)	.344	.374	.000	.007	.122		.022	.000	.617
	N	36	36	36	36	36	36	36	36	36
PDTOTAL	Pearson Correlation	.249	.432**	.251	.387*	.511**	.381*	1	.418*	.384*
	Sig. (2-tailed)	.143	.009	.140	.020	.001	.022		.011	.021
	N	36	36	36	36	36	36	36	36	36
TPACKTOT	Pearson Correlation	-.050	.271	.565**	.348*	.274	.595**	.418*	1	.186
	Sig. (2-tailed)	.771	.109	.000	.037	.105	.000	.011		.278
	N	36	36	36	36	36	36	36	36	36
ATTTOTAL	Pearson Correlation	-.316	.617**	.070	.263	.254	.086	.384*	.186	1
	Sig. (2-tailed)	.061	.000	.685	.121	.134	.617	.021	.278	
	N	36	36	36	36	36	36	36	36	36

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

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

APPENDIX L

Frequency of Age of Participants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	25	1	2.8	2.9	2.9
	27	1	2.8	2.9	5.9
	29	1	2.8	2.9	8.8
	32	1	2.8	2.9	11.8
	35	1	2.8	2.9	14.7
	37	3	8.3	8.8	23.5
	39	1	2.8	2.9	26.5
	40	1	2.8	2.9	29.4
	41	1	2.8	2.9	32.4
	42	2	5.6	5.9	38.2
	43	3	8.3	8.8	47.1
	44	2	5.6	5.9	52.9
	46	3	8.3	8.8	61.8
	48	1	2.8	2.9	64.7
	51	2	5.6	5.9	70.6
	54	1	2.8	2.9	73.5
	55	1	2.8	2.9	76.5
	56	1	2.8	2.9	79.4
	57	2	5.6	5.9	85.3
	58	1	2.8	2.9	88.2
	59	2	5.6	5.9	94.1
	63	1	2.8	2.9	97.1
	65	1	2.8	2.9	100.0
	Total	34	94.4	100.0	
Missing	System	2	5.6		
Total		36	100.0		

APPENDIX M

Correlation: Between Both Schools and Survey Totals

SCHOOL		SCHOOL	TK TOTAL	CK TOTAL	PK TOTAL	TU TOTAL	TCK TOTAL	PD TOTAL	TPACK TOT	ATT TOTAL
SCHOOL Carter	Pearson Correlation	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]
	Sig. (2-tailed)		.	.	.	.	.	.	.	.
	N	21	21	21	21	21	21	21	21	21
TKTOTAL	Pearson Correlation	.[a]	1	-.057	.070	.390	.093	.477*	.252	.730**
	Sig. (2-tailed)	.		.806	.762	.080	.688	.029	.270	.000
	N	21	21	21	21	21	21	21	21	21
CKTOTAL	Pearson Correlation	.[a]	-.057	1	.523*	.142	.475*	.169	.489*	-.091
	Sig. (2-tailed)	.	.806		.015	.539	.030	.463	.024	.694
	N	21	21	21	21	21	21	21	21	21
PKTOTAL	Pearson Correlation	.[a]	.070	.523*	1	.226	.454*	.518*	.455*	.155
	Sig. (2-tailed)	.	.762	.015		.324	.039	.016	.038	.501
	N	21	21	21	21	21	21	21	21	21
TUTOTAL	Pearson Correlation	.[a]	.390	.142	.226	1	.582**	.572**	.468*	.431
	Sig. (2-tailed)	.	.080	.539	.324		.006	.007	.033	.051
	N	21	21	21	21	21	21	21	21	21
TCKTOTAL	Pearson Correlation	.[a]	.093	.475*	.454*	.582**	1	.493*	.465*	.132
	Sig. (2-tailed)	.	.688	.030	.039	.006		.023	.034	.567
	N	21	21	21	21	21	21	21	21	21
PDTOTAL	Pearson Correlation	.[a]	.477*	.169	.518*	.572**	.493*	1	.488*	.495*

	Sig. (2-tailed)	.	.029	.463	.016	.007	.023		.025	.022
	N	21	21	21	21	21	21	21	21	21
TPACKTOT	Pearson Correlation	.[a]	.252	.489*	.455*	.468*	.465*	.488*	1	.305
	Sig. (2-tailed)	.	.270	.024	.038	.033	.034	.025		.179
	N	21	21	21	21	21	21	21	21	21
ATTTOTAL	Pearson Correlation	.[a]	.730**	-.091	.155	.431	.132	.495*	.305	1
	Sig. (2-tailed)	.	.000	.694	.501	.051	.567	.022	.179	
	N	21	21	21	21	21	21	21	21	21
SCHOOL Knightly	Pearson Correlation	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]
	Sig. (2-tailed)		.	.	.	.	.	.	.	.
	N	15	15	15	15	15	15	15	15	15
TKTOTAL	Pearson Correlation	.[a]	1	.184	.661**	.603*	.249	.373	.325	.567*
	Sig. (2-tailed)	.		.512	.007	.017	.371	.171	.238	.027
	N	15	15	15	15	15	15	15	15	15
CKTOTAL	Pearson Correlation	.[a]	.184	1	.265	.073	.767**	.544*	.691**	.132
	Sig. (2-tailed)	.	.512		.339	.796	.001	.036	.004	.640
	N	15	15	15	15	15	15	15	15	15
PKTOTAL	Pearson Correlation	.[a]	.661**	.265	1	.608*	.421	.240	.194	.383
	Sig. (2-tailed)	.	.007	.339		.016	.118	.389	.489	.159
	N	15	15	15	15	15	15	15	15	15
TUTOTAL	Pearson Correlation	.[a]	.603*	.073	.608*	1	.089	.340	.231	.674**
	Sig. (2-tailed)	.	.017	.796	.016		.754	.215	.407	.006
	N	15	15	15	15	15	15	15	15	15

TCKTOTAL	Pearson Correlation	.[a]	.249	.767**	.421	.089	1	.270	.827**	-.066
	Sig. (2-tailed)	.	.371	.001	.118	.754		.330	.000	.815
	N	15	15	15	15	15	15	15	15	15
PDTOTAL	Pearson Correlation	.[a]	.373	.544*	.240	.340	.270	1	.344	.420
	Sig. (2-tailed)	.	.171	.036	.389	.215	.330		.210	.119
	N	15	15	15	15	15	15	15	15	15
TPACKTOT	Pearson Correlation	.[a]	.325	.691**	.194	.231	.827**	.344	1	-.067
	Sig. (2-tailed)	.	.238	.004	.489	.407	.000	.210		.814
	N	15	15	15	15	15	15	15	15	15
ATTTOTAL	Pearson Correlation	.[a]	.567*	.132	.383	.674**	-.066	.420	-.067	1
	Sig. (2-tailed)	.	.027	.640	.159	.006	.815	.119	.814	
	N	15	15	15	15	15	15	15	15	15

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

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

a. Cannot be computed because at least one of the variables is constant.

APPENDIX N

Teacher Interviews

Mr. A. Summit – Carter High School
English Teacher
January 12, 2018

1. What do students need in order to do well on computerized assessments?

In order to do well on computerized assessments students, need to have access to technology before the day of the test. Regular trips to iPad cart, technology etc. so it becomes a regular occurrence and students are not doing it in an unfamiliar environment. Students use them on a regular basis they will be more comfortable when it is time to take test. Use technology once a week, iPad, phone, Google docs.

2. Why is technology use in your classroom important?

Mr. Summit stated that because there is a paradigm shift in education by moving away from 70s 80s of moving away from textbooks. Technology makes it more comparable to what they will experience in college. More technology use technology in college. Technology helps move students away from an outdated way of learning. Students can access information from multiple sources and become critical thinkers

3. How do you feel technology should be used in the classroom to meet the 21st century skill sets?

There is a right and wrong way to use technology. Right way is a tool rather than a distraction. Students can use technology for calculators or to look something up rather than for social media.

4. How do your students respond to technology time in the classroom? Can you give me examples of what they say/do?

They love it. We have iPads, when do we get the iPads. Meet them half way. 9th graders don't want to read but look forward to technology. Seniors are not as thrilled. It could be how technology was used in middle school, cool math games. Seniors think oh crap and view it as more work.

5. What is your overall perception of technology integration into your education curriculum?

It is inconsistent. There is not enough of it to be used on a strict regimen such as every day at same time to become ingrained. Hit and miss because of scheduling because someone else may have cart or the lab is being used. Every class needs to have their own cart. Scheduling problems. Then you can consolidate and make electronic student portfolio so I could see what they have done. Students and parents could view student digital portfolio

6. In what ways, do you think technology benefits the learning environment?

It brings today and age into an older paradigm. Things are going digital and colleges are doing more things on line. When they get to college students would be prepared and hard copies would be more of a markup for revision.

Ms. B. Simpson – Carter High School
English Teacher
January 15, 2018

1. What do students need in order to do well on computerized assessments?

In order for students to do well on computerized assessments, they need to master both content specific skills and computer skills. Students need to know the content of the assessment as well as how to navigate the computer. A lot of students know the information but get frustrated when it comes to using computers for their answers. With content specific lessons that utilize computers, students can practice using computers. In turn, practice can help students do well on computerized assessments.

2. Why is technology use in your classroom important?

The world is becoming more technologically advanced every day. This technological advancement includes standardized assessments and computer-based assessments. Thus, in order to prepare students for the demands of the 21st century, using technology in the classroom is extremely important. Using technology in the classroom provides students with the practice they need prior to a computer-based assessment being administered.

3. How do you feel technology should be used in the classroom to meet the 21st century skill sets?

Technology should be used weekly, if not daily, in the classroom to meet the 21st century skill sets. Teachers have to incorporate technology-based assignments into their lesson plans every week. Students have to practice navigating computers, iPads, and even smart phones for academic purposes daily in order to be successful in this technologically advanced world. Thus, technology should be used often in the classroom for preparation purposes.

4. How do your students respond to technology time in the classroom? Can you give me examples of what they say/do?

Students respond positively to technology time in the classroom. Most students do not have computers at home, thus, they love opportunities for computer time when allotted in class. A student once said, “I am definitely going to do well on this assignment… because I love using the computer.” They also enjoy activities that are assigned where smartphones can be used. Kahoot activities allow them to use smartphones. Kahoot activities are met with excitement every time they are utilized. Students get real competitive and try to be on the team that wins academic games using this technology. They cheer and truly focus on instruction during these periods.

5. What is your overall perception of technology integration into your education curriculum?

I have a positive perception about technology integration into my educational curriculum. I wish every child on a high school campus were allowed to checkout or have access to computers and iPads during the school day. This could give them the tools they need to be successful. Teachers would also need to be trained on the logistics of computer utilization in the classroom. Once trained, teachers would be more willing to incorporate such lessons into their curriculum. If they incorporate these lessons into the curriculum, then students would be successful at higher rates.

6. In what ways, do you think technology benefits the learning environment?

Technology enhances the learning environment. Students get hands-on and real-life models that can matriculate into success. Everyone needs to know more about the mechanisms of a computer and technology in general. Providing such opportunities to students empowers them to be leaders in the 21^{st} century. Technology has to be used in the classroom in order to help students succeed.

Ms. C. Waters – Carter High
English Teacher
January 17, 2018

1. What do students need in order to do well on computerized assessments?

Students need basic computer skills; clear instructions, and confidence in using technology. They also need well-maintained devices.

2. Why is technology use in your classroom important?

We are living in a sign of the times where differentiation is important. There should be more student-centered teaching and technological aids. Technology increases student motivation and increases learning and teaching.

3. How do you feel technology should be used in the classroom to meet the 21st century skill sets?

All of the above reasons, plus it can be used to assist struggling students, to keep advanced students motivated; to promote collaboration; and to increase analytical and critical thinking skills. This can be accomplished through apps such as Kahoot!, Google Classroom, Schoology, iPads, Desktops, phones, LCD projector and document viewers.

4. How do your students respond to technology time in the classroom? Can you give me examples of what they say/do?

Many students respond positively although some respond negatively. They say things like "Why do we have to do this? Or "Why can't we just write it and turn it in?" "Nobody else is making us use this." "This is fun. How come more teachers aren't using this?" I need my password so I can get into Google Classroom. "Can somebody help me? This is hard."

5. What is your overall perception of technology integration into your education curriculum?

I believe my integration is a blessing because I have noticed more understanding from students; an increase in class participation and more advanced discussions.

6. In what ways, do you think technology benefits the learning environment?

Technology benefits the learning environment by increasing collaboration, motivation, improved reading and writing skills and makes tasks easier for teachers. Technology also helps me to have better organizational skills and creates transparency in the classroom.

Ms. D. Walker – Knightly High School
English Teacher
January 23, 2018

1. What do students need in order to do well on computerized assessments?

Students need assistance in understanding the different symbols and buttons that are associated with the exam. Such as, the section to take notes, where the highlighter pen may be, where they can re-visit the question later (if possible) and also where to save their work if needed. Students also need to know the scoring value on the exam such as what happens if they skip a question, or forget to answer a question.

2. Why is technology use in your classroom important?

Technology use is important in my classroom because students need to understand what technology looks like in a classroom setting. They need to understand how to respond to questions and to be updated with the current technological advances being made on college campuses and assessments.

3. How do you feel technology should be used in the classroom to meet the 21st century skill sets?

There should be more researched based assignments, not a simple cut and paste but an actual assignment that allows students to become familiar with technology. Technology is constantly changing and students need to adjust and understand technology so it needs to be used as an assistance tool to help them improve their knowledge of information.

4. How do your students respond to technology time in the classroom? Can you give me examples of what they say/do?

Most of my student's welcome technology. They appreciate the fact that they can go at their own pace and I can tailor the assignment to their needs vs. them adjusting to the assignment. They have shared that they appreciate the fact that they have until midnight to turn in an assignment vs. having to have it done by the end of the period or losing it later.

5. What is your overall perception of technology integration into your education curriculum?

My overall perception is that, I truly appreciate the different levels in which I am able to integrate the information with ease in to my classroom.

6. In what ways, do you think technology benefits the learning environment?

Technology benefits the learning environment because it allows students to be self-guided learners. It allows students to move ahead or slow down on assignments that need additional assistance on. It also allows for students to focus on the work vs. going off topic and discussing other topics.

Mr. E. Oscar - Knightly High School
Social Studies Teacher
January 26, 2018

1. What do students need in order to do well on computerized assessments?

They must have access to the equipment and also have a passion, which is an asset for this generation, which they are accustomed to using.

2. Why is technology use in your classroom important?

This generation is enthusiastic about technology. They embrace it and it is an easy flow for them to utilize in the class. They were born into technology.

3. How do you feel technology should be used in the classroom to meet the 21st century skill sets?

Technology should complement their reading skills and writing skills by making connection to the real world to encourage them to do more reading than usual. They are also able to grammar check, which also improves their writing skills

4. How do your students respond to technology time in the classroom? Can you give me examples of what they say/do?

They respond positively because it is a fun thing to do which is similar to texting. YouTube is a source they embrace and willing to gather information from that website. They know that they can get that information on their own rather than going to the teacher.

5. What is your overall perception of technology integration into your education curriculum?

I think it is important for all educators to also embrace technology because that is the language they speak. I think it can bring the entire curriculum together such as integrating math, physics, and science. With technology they are able to understand more about the real world such as making connections with the real world. Technology brings that to reality.

6. In what ways, do you think technology benefits the learning environment?

We all benefit from technology. We are able to transition from one phase of our lesson to another phase, student, teacher and the community. It makes us utilize the benefits of improvement in science. Makes us have more connections to what's going on spatial in the earth. It exposes us to the world beyond. Even from the kindergarten level they are exposed to the world at an early age. What we used to perceive as cartoons is reality right now and they can make connections to the cartoon of what is happening in the world today.

Ms. F. Ware – Knightly High School
Math/Music Teacher
February 6, 2018

1. What do students need in order to do well on computerized assessments?

Students need to be expected to teach themselves and others. They should be able to get outside of themselves and be critical thinkers. Students should not be dependent on the teacher.

2. Why is technology use in your classroom important?

Technology is important because things are changing. I've watched technology grow from nothing into the current form. I've taught Pascal Fortran. I have a credential in computers, math, and music. Technology helps students embrace change in a digital form.

3. How do you feel technology should be used in the classroom to meet the 21st century skill sets?

Technology should be used as a research tool in the classroom. Technology can help students discern what is fake, and what is not. It is a neutralizing tool. It takes a broad world and makes it smaller.

4. How do your students respond to technology time in the classroom? Can you give me examples of what they say/do?

They love it. They are able to use PowerPoint. Some of them put their earphones on and watch movies or listen to music.

5. What is your overall perception of technology integration into your education curriculum?

It is necessary because of the way the world is changing and becoming more digital.

6. In what ways, do you think technology benefits the learning environment?

It allows students to critique, question, research, and evaluate everything since you can't trust the human brain.

APPENDIX O

Multiple Linear Regressions (TUTOTAL)

Descriptive Statistics

SCHOOL		Mean	Std. Deviation	*N*
Carter	TUTOTAL	13.48	2.562	21
	TKTOTAL	21.90	4.549	21
	CKTOTAL	47.86	6.792	21
	PKTOTAL	31.29	3.379	21
	TCKTOTAL	13.48	3.296	21
	PDTOTAL	30.00	6.863	21
	TPACKTOT	13.10	3.885	21
	ATTTOTAL	36.62	3.074	21
Knightly	TUTOTAL	16.53	2.066	15
	TKTOTAL	22.27	4.978	15
	CKTOTAL	44.80	7.408	15
	PKTOTAL	30.93	3.955	15
	TCKTOTAL	12.60	3.203	15
	PDTOTAL	32.20	5.130	15
	TPACKTOT	12.40	3.112	15
	ATTTOTAL	34.73	3.240	15

Correlations

SCHOOL			TUTOTAL	TKTOTAL	CKTOTAL	PKTOTAL	TCKTOTAL	PDTOTAL	TPACKTOTAL	ATTTOTAL
Carter	Pearson Correlation	TUTOTAL	1.000	.390	.142	.226	.582	.572	.468	.431
		TKTOTAL	.390	1.000	-.057	.070	.093	.477	.252	.730
		CKTOTAL	.142	-.057	1.000	.523	.475	.169	.489	-.091
		PKTOTAL	.226	.070	.523	1.000	.454	.518	.455	.155
		TCKTOTAL	.582	.093	.475	.454	1.000	.493	.465	.132
		PDTOTAL	.572	.477	.169	.518	.493	1.000	.488	.495

		TPACKTOT	.468	.252	.489	.455	.465	.488	1.000	.305
		ATTTOTAL	.431	.730	-.091	.155	.132	.495	.305	1.000
	Sig. (1-tailed)	TUTOTAL	.	.040	.270	.162	.003	.003	.016	.026
		TKTOTAL	.040	.	.403	.381	.344	.014	.135	.000
		CKTOTAL	.270	.403	.	.008	.015	.231	.012	.347
		PKTOTAL	.162	.381	.008	.	.019	.008	.019	.251
		TCKTOTAL	.003	.344	.015	.019	.	.012	.017	.284
		PDTOTAL	.003	.014	.231	.008	.012	.	.012	.011
		TPACKTOT	.016	.135	.012	.019	.017	.012	.	.090
		ATTTOTAL	.026	.000	.347	.251	.284	.011	.090	.
	N	TUTOTAL	21	21	21	21	21	21	21	21
		TKTOTAL	21	21	21	21	21	21	21	21
		CKTOTAL	21	21	21	21	21	21	21	21
		PKTOTAL	21	21	21	21	21	21	21	21
		TCKTOTAL	21	21	21	21	21	21	21	21
		PDTOTAL	21	21	21	21	21	21	21	21
		TPACKTOT	21	21	21	21	21	21	21	21
		ATTTOTAL	21	21	21	21	21	21	21	21
Knightly	Pearson Correlation	TUTOTAL	1.000	.603	.073	.608	.089	.340	.231	.674
		TKTOTAL	.603	1.000	.184	.661	.249	.373	.325	.567
		CKTOTAL	.073	.184	1.000	.265	.767	.544	.691	.132
		PKTOTAL	.608	.661	.265	1.000	.421	.240	.194	.383
		TCKTOTAL	.089	.249	.767	.421	1.000	.270	.827	-.066
		PDTOTAL	.340	.373	.544	.240	.270	1.000	.344	.420
		TPACKTOT	.231	.325	.691	.194	.827	.344	1.000	-.067
		ATTTOTAL	.674	.567	.132	.383	-.066	.420	-.067	1.000
	Sig. (1-tailed)	TUTOTAL	.	.009	.398	.008	.377	.108	.204	.003
		TKTOTAL	.009	.	.256	.004	.185	.086	.119	.014
		CKTOTAL	.398	.256	.	.170	.000	.018	.002	.320
		PKTOTAL	.008	.004	.170	.	.059	.194	.244	.079
		TCKTOTAL	.377	.185	.000	.059	.	.165	.000	.407
		PDTOTAL	.108	.086	.018	.194	.165	.	.105	.059

		TPACKTOT	.204	.119	.002	.244	.000	.105	.	.407
		ATTTOTAL	.003	.014	.320	.079	.407	.059	.407	.
	N	TUTOTAL	15	15	15	15	15	15	15	15
		TKTOTAL	15	15	15	15	15	15	15	15
		CKTOTAL	15	15	15	15	15	15	15	15
		PKTOTAL	15	15	15	15	15	15	15	15
		TCKTOTAL	15	15	15	15	15	15	15	15
		PDTOTAL	15	15	15	15	15	15	15	15
		TPACKTOT	15	15	15	15	15	15	15	15
		ATTTOTAL	15	15	15	15	15	15	15	15

Variables Entered/Removed[a]

SCHOOL	Model	Variables Entered	Variables Removed	Method
Carter	1	TCKTOTAL	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
Knightly	1	ATTTOTAL	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a. Dependent Variable: TUTOTAL

Model Summary[b]

SCHOOL	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
Carter	1	.582[a]	.339	.304	2.138	1.770
Knightly	1	.674[c]	.454	.412	1.584	1.799

a. Predictors: (Constant), TCKTOTAL
b. Dependent Variable: TUTOTAL
c. Predictors: (Constant), ATTTOTAL

ANOVA[a]

SCHOOL	Model		Sum of Squares	Df	Mean Square	F	Sig.
Carter	1	Regression	44.425	1	44.425	9.723	.006[b]
		Residual	86.813	19	4.569		
		Total	131.238	20			
Knightly	1	Regression	27.127	1	27.127	10.815	.006[c]
		Residual	32.607	13	2.508		
		Total	59.733	14			

a. Dependent Variable: TUTOTAL
b. Predictors: (Constant), TCKTOTAL
c. Predictors: (Constant), ATTTOTAL

Coefficients[a]

			Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
SCHOOL	Model		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
Carter	1	(Constant)	7.382	2.009		3.674	.002	3.177	11.588					
		TCKTOTAL	.452	.145	.582	3.118	.006	.149	.756	.582	.582	.582	1.000	1.000
Knightly	1	(Constant)	1.609	4.556		.353	.730	-8.234	11.453					
		ATTTOTAL	.430	.131	.674	3.289	.006	.147	.712	.674	.674	.674	1.000	1.000

a. Dependent Variable: TUTOTAL

Excluded Variables[a]

SCHOOL	Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance	VIF	Minimum Tolerance
Carter	1	TKTOTAL	.339[b]	1.935	.069	.415	.991	1.009	.991
		CKTOTAL	-.173[b]	-.809	.429	-.187	.775	1.291	.775
		PKTOTAL	-.048[b]	-.223	.826	-.053	.794	1.260	.794
		PDTOTAL	.376[b]	1.866	.078	.403	.757	1.321	.757
		TPACKTOT	.251[b]	1.207	.243	.274	.784	1.276	.784
		ATTTOTAL	.360[b]	2.071	.053	.439	.982	1.018	.982
Knightly	1	TKTOTAL	.326[c]	1.352	.201	.363	.678	1.474	.678
		CKTOTAL	-.016[c]	-.075	.942	-.022	.983	1.018	.983
		PKTOTAL	.410[c]	2.068	.061	.513	.853	1.172	.853
		PDTOTAL	.069[c]	.293	.775	.084	.823	1.215	.823
		TPACKTOT	.277[c]	1.399	.187	.374	.996	1.004	.996
		TCKTOTAL	.134[c]	.636	.537	.181	.996	1.004	.996

a. Dependent Variable: TUTOTAL
b. Predictors in the Model: (Constant), TCKTOTAL
c. Predictors in the Model: (Constant), ATTTOTAL

Collinearity Diagnostics[a]

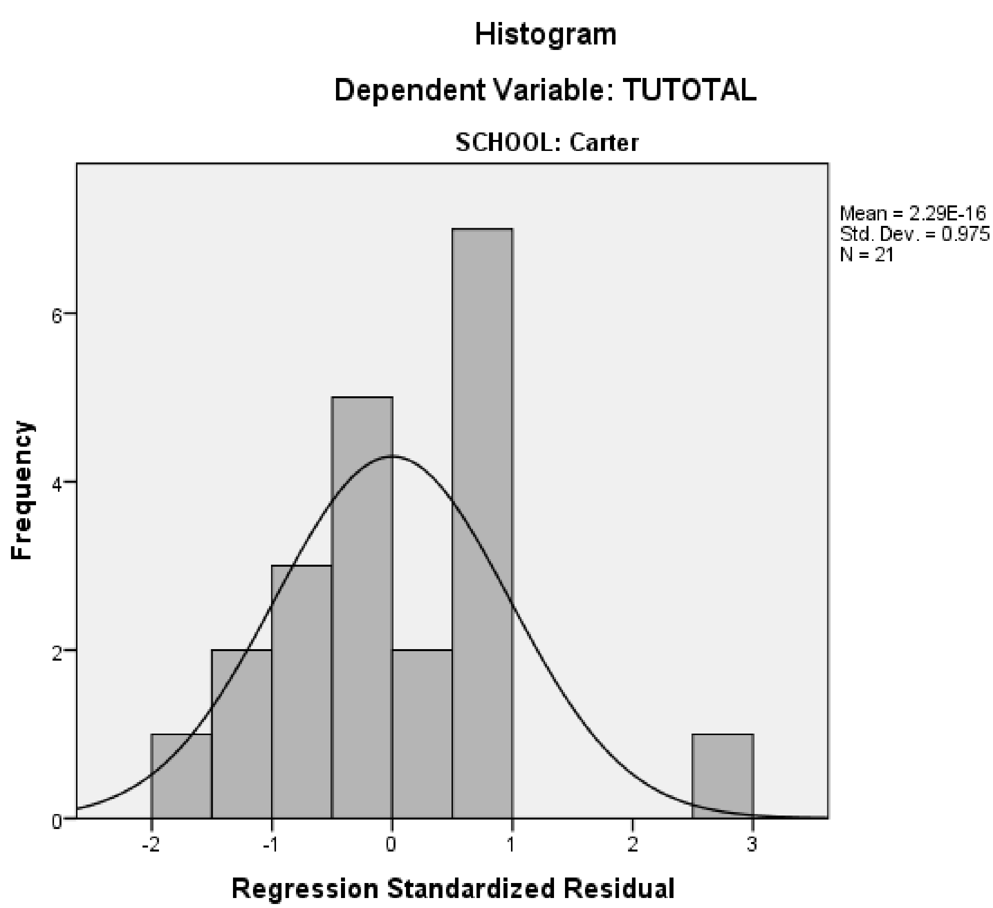
SCHOOL	Model	Dimension	Eigenvalue	Condition Index	Variance Proportions (Constant)	TCKTOTAL	ATTTOTAL
Carter	1	1	1.973	1.000	.01	.01	
		2	.027	8.498	.99	.99	
Knightly	1	1	1.996	1.000	.00		.00
		2	.004	22.240	1.00		1.00

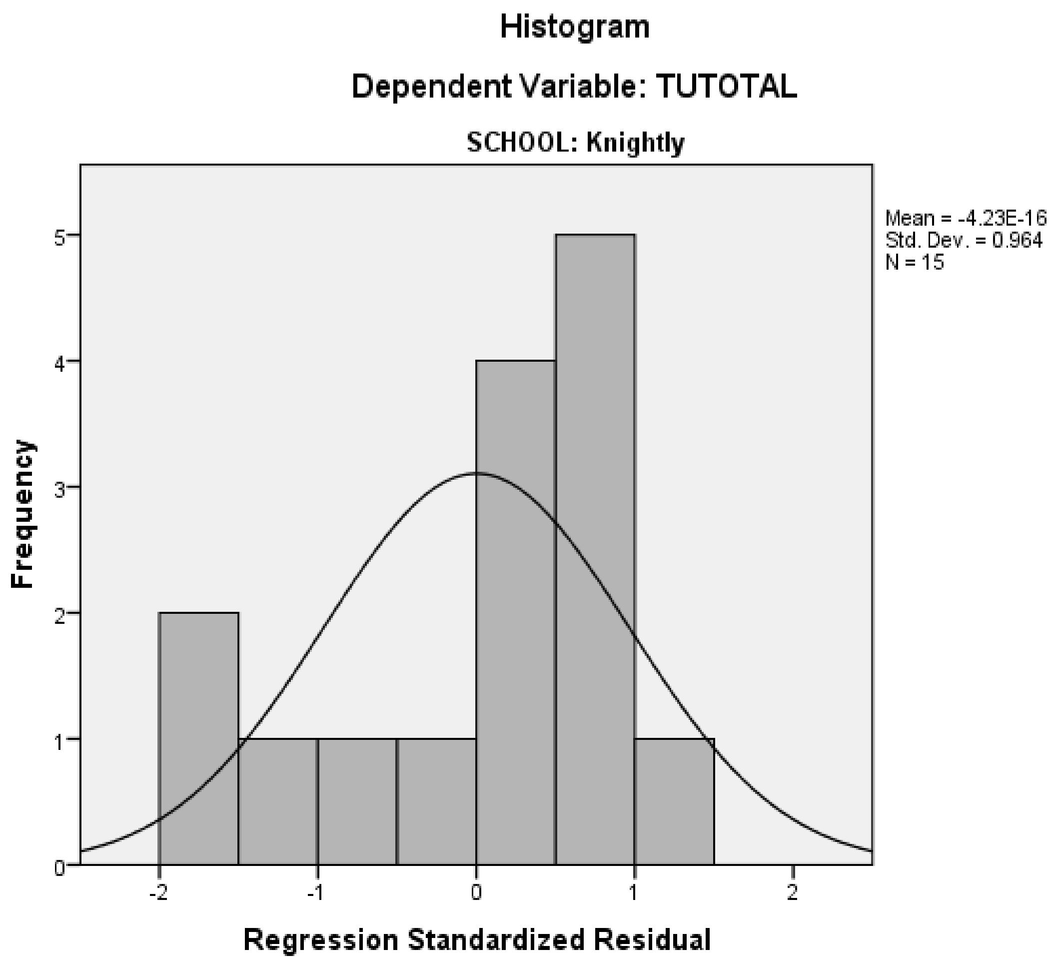
a. Dependent Variable: TUTOTAL

Residuals Statistics[a]

SCHOOL		Minimum	Maximum	Mean	Std. Deviation	*N*
Carter	Predicted Value	11.00	16.43	13.48	1.490	21
	Residual	-3.809	5.383	.000	2.083	21
	Std. Predicted Value	-1.662	1.979	.000	1.000	21
	Std. Residual	-1.782	2.518	.000	.975	21
Knightly	Predicted Value	14.50	18.80	16.53	1.392	15
	Residual	-2.937	1.922	.000	1.526	15
	Std. Predicted Value	-1.461	1.626	.000	1.000	15
	Std. Residual	-1.854	1.214	.000	.964	15

a. Dependent Variable: TUTOTAL




Histogram
Dependent Variable: TUTOTAL
SCHOOL: Knightly
Mean = -4.23E-16
Std. Dev. = 0.964
N = 15
Frequency
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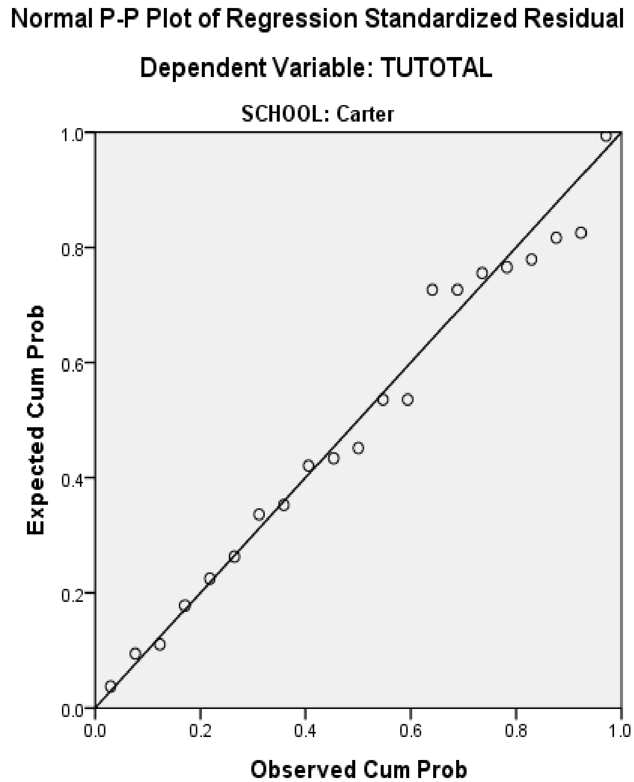
1
2
3
4
5
-2
-1
0
1
2
Regression Standardized Residual


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: TUTOTAL
SCHOOL: Carter
Expected Cum Prob
Observed Cum Prob
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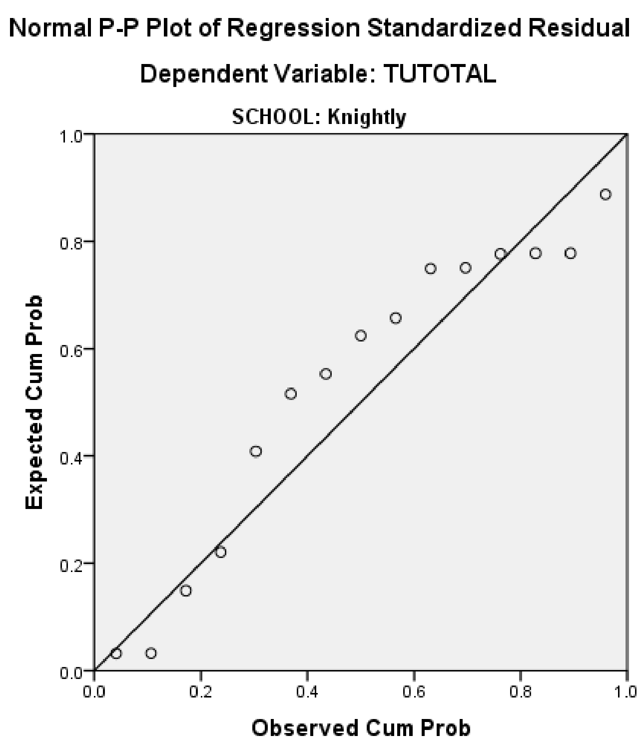
0.2
0.4
0.6
0.8
1.0


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: TUTOTAL
SCHOOL: Knightly
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

APPENDIX P

Frequency Table of Survey Totals

Table P1

Percentage Responses on the Items Under the Technology Knowledge (TK) Construct (N = 34)

Item code	Control Likert Item	*Completely Disagree*	*Disagree*	*Neutral*	*Agree*	*Comp letely Agree*
TK1	I know how to solve my own technical problems.	2.80%	11.10%	33.30%	38.90 %	13.90%
TK2	I can learn technology easily.	0%	2.80%	30.60%	30.60 %	36.10%
TK3	I keep up with important new technologies.	0%	5.60%	44.40%	36.10 %	13.90%
TK4	I frequently play around with technology.	2.80%	2.80%	36.10%	38.90 %	19.40%
TK5	I know a lot about different technologies.	2.80%	8.30%	41.70%	33.30 %	13.90%
TK6	I have the technical skills I need to use technology.	0%	8.30%	30.60%	33.30 %	27.80%

Table P2

Percentage Responses on the Items Under the Content Knowledge (CK) Construct (N = 34)

Item Code	Control Likert Item	*Completely Disagree*	*Disagree*	*Neutral*	*Agree*	*Completely Agree*
CK1	I have sufficient knowledge about mathematics.	5.60%	5.60%	27.80%	36.10%	25.00%
CK2	I can use a mathematical way of thinking.	8.30%	5.60%	27.80%	33.30%	25.00%
CK3	I have various ways and strategies of developing my understanding of math.	8.30%	8.30%	19.40%	30.60%	33.30%
CK4	I have sufficient knowledge about social studies.	2.80%	11.10%	19.40%	25.00%	41.70%
CK5	I can use a historical way of thinking.	2.80%	11.10%	13.90%	27.80%	44.40%
CK6	I have various ways and strategies of developing my understanding of social studies.	5.60%	8.30%	22.20%	19.40%	44.40%
CK7	I have sufficient knowledge about science.	0%	16.70%	47.20%	25.00%	11.10%
CK8	I can use a scientific way of thinking.	2.80%	16.70%	19.40%	44.40%	16.70%

CK9	I have various ways and strategies of developing my understanding of science.	2.80%	16.70%	27.80%	38.90%	13.90%
CK10	I have sufficient knowledge about literacy.	0%	0%	2.80%	47.20%	50.00%
CK11	I can use a literary way of thinking.	0%	0%	8.30%	33.30%	58.30%
CK12	I have various ways and strategies of developing my understanding of literacy.	0%	0%	8.30%	41.70%	50.00%

Table P3

Percentage Responses on the Items Under the Pedagogical Knowledge (PK) Construct (N = 34)

Item code	Control Likert Item	*Completely Disagree*	*Disagree*	*Neutral*	*Agree*	*Completely Agree*
PK1	I know how to assess student performance in a classroom.	0%	0%	2.80%	47.20 %	50.00%
PK2	I can adapt my teaching based-upon what students currently understand or do not understand.	0%	0%	0%	44.40 %	55.60%
PK3	I can adapt my teaching style to different learners.	0%	0%	8.30%	36.10 %	55.60%
PK4	I can assess student learning in multiple ways.	0%	0%	8.30%	38.90 %	52.80%
PK5	I can use a wide range of teaching approaches in a classroom setting.	0%	0%	11.10%	41.70 %	47.20%
PK6	I am familiar with common student understandings and misconceptions.	0%	0%	13.90%	38.90 %	47.20%
PK7	I know how to organize and maintain classroom management.	0%	0%	5.60%	38.9	55.60%

Table P4

Percentage Responses on the Items Under the Technology Use (TU) Construct (N = 34)

Item Code	Control Likert Item	*Completely Disagree*	*Disagree*	*Neutral*	*Agree*	*Completely Agree*
TU1	I am familiar with the districts' technology plan.	5.60%	11.10%	47.20%	25.00%	11.10%
TU2	I feel confident incorporating technology into my curriculum.	0%	2.80%	36.10%	30.60%	30.60%
TU3	My students are well prepared for computerized assessments.	0%	19.40%	30.60%	30.60%	19.40%
TU4	My students are well prepared for paper-and-pencil assessments.	0%	2.80%	19.40%	41.70%	36.10%

Table P5

Percentage Responses on the Items Under the Technological Content Knowledge (TCK) Construct (N = 34)

Item code	Control Likert Item	*Completely Disagree*	*Disagree*	*Neutral*	*Agree*	*Completely Agree*
TCK1	I know about technologies that I can use for understanding and doing mathematics.	8.30%	13.90%	33.30%	36.10%	8.30%
TCK2	I know about technologies that I can use for understanding and doing literacy.	0%	11.10%	27.80%	38.90%	22.20%
TCK3	I know about technologies that I can use for understanding and doing science.	8.30%	30.60%	27.80%	25.00%	8.30%
TCK4	I know about technologies that I can use for understanding and doing social studies.	11.10%	16.70%	30.60%	22.20%	19.40%

Table P6

Percentage Responses on the Items Under Professional Development (PD) Construct (N = 34)

Item Code	Control Likert Item	*Completely Disagree*	*Disagree*	*Neutral*	*Agree*	*Completely Agree*
PD1	I would like to attend a technology training class.	2.80%	2.80%	11.10%	22.20%	61.10%
PD2	I can choose technologies that enhance students' learning for a lesson.	0%	5.60%	16.70%	33.30%	44.40%
PD3	My teacher preparation program provided technology training.	8.30%	27.80%	36.10%	2.80%	25.00%
PD4	My school provides in-house technology training.	8.30%	25.00%	36.10%	16.70%	13.90%
PD5	The technology training at my school adequately prepares me to integrate technology in my curriculum.	11.10%	33.30%	30.60%	22.20%	2.80%

PD6	I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.	0%	13.90%	22.20%	33.30%	30.60%
PD7	I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.	13.90%	27.80%	19.40%	27.80%	11.10%
PD8	I can teach others how to use technology in their class.	11.10%	5.60%	47.20%	25.00%	11.10%
PD9	I have taken a technology training class in the last five (5) years.	13.90%	5.60%	22.20%	22.20%	36.10%

Table P7

Percentage Responses on the Items Under the Technology Pedagogy and Content Knowledge (TPACK) Construct (N = 34)

Item Code	Control Likert Item	*Completel y Disagree*	*Disagree*	*Neutral*	*Agree*	*Completely Agree*
TPACK 1	I can teach lessons that appropriately combine mathematics, technologies and teaching approaches.	16.70%	22.20%	22.20%	22.20%	16.70%
TPACK 2	I can I can teach lessons that appropriately combine literacy, technologies and teaching approaches.	2.8%%	5.60%	38.90%	25.00%	27.80%
TPACK 3	I can teach lessons that appropriately combine science, technologies and teaching approaches.	19.40%	22.20%	30.60%	13.90%	13.90%
TPACK 4	I can teach lessons that appropriately combine social studies, technologies and teaching approaches.	11.10%	11.10%	33.30%	25.00%	19.40%

Table P8

Percentage Responses on the Items Under the Attitude Towards Technology (ATT) Construct (N = 34)

	Control Likert Item	*Completely Disagree*	*Disagree*	*Neutral*	*Agree*	*Completely Agree*
ATT1	Technology can help me do my work better.	0%	0%	5.60%	25.00%	69.40%
ATT2	I find it each to use technology (projector, computers, Smartboards, etc.)	0%	0%	5.60%	36.10%	58.30%
ATT3	I am comfortable using computers.	0%	0%	5.60%	25.00%	69.40%
ATT4	I do not like using computers.	97.20%	0%	0%	0%	2.80%
ATT5	I know a lot about computers.	0%	8.30%	41.70%	36.10%	13.90%
ATT6	Everyone should know how to use computers.	2.80%	0%	5.60%	19.40%	72.20%
ATT7	I find computers friendly.	0%	2.80%	19.4	33.30%	44.40%
ATT8	Computers in school are a good idea.	0%	0%	3%	14%	83%