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Student Achievement versus Technology in the

Catholic Classroom: Correlation

or Added Bonus

by

Cheryl L. Boze Hall

March, 2017

A Dissertation submitted to the Education Faculty of Lindenwood University in

partial fulfillment of the requirements for the degree of

Doctor of Education

School of Education

Student Achievement versus Technology in the

Catholic Classroom: Correlation or

Added Bonus

by

Cheryl L. Boze Hall

This Dissertation has been approved as partial fulfillment

of the requirements for the degree of

Doctor of Education

Lindenwood University, School of Education

Kathy Grover — March 23, 2017

Dr. Kathy Grover, Dissertation Chair — Date

Sherry DeVore — March 23, 2017

Dr. Sherry DeVore, Committee Member — Date

Rebecca Bernard — March 23, 2017

Dr. Rebecca Bernard, Committee Member — Date

Declaration of Originality

I do hereby declare and attest to the fact that this is an original study based solely upon my own scholarly work at Lindenwood University and that I have not submitted it for any other college or university course or degree.

Full Legal Name: Cheryl L. Boze Hall

Signature: Cheryl L. Boze Hall Date: 3/23/2017

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Abstract

Spending limited educational budgets on technology for classrooms is a strategy many school districts have used to increase student achievement (Levenson, Baehr, Smith, & Sullivan, 2014). In recent years, the technology movement allowed for arbitrary purchasing of devices with little to no pedagogical planning for how technology device usage was expected to increase student achievement (Johnston, 2014). The purpose of this study was to analyze the correlation between student achievement and the amount of money spent on technology hardware, technology software, and technology-related professional development. The research design incorporated quantitative methods through collection of test scores and survey data regarding school budgets and educational technology expenditures. The data were analyzed to reveal the strength, if any, of correlations between the amount of money spent on technology hardware, technology software, and technology-related professional development and student achievement among third, fifth, and eighth-grade students. The target population of the study consisted of 23 elementary principals within a Catholic diocese in southwest Missouri. A convenience sampling was conducted with 100% participation. De-identified core battery scores from the Iowa Test of Basic Skills (ITBS) were provided by the superintendent of the diocese for grades three, five, and eight. The data collected and analyzed in this study revealed weak or no significant positive correlations between the amount of money spent on technology hardware, technology software, or technology-related professional development and ITBS test scores in grades three, five, and eight for the academic years 2011-2012, 2012-2013, and 2013-2014.

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Chapter One: Introduction

The United States economy now relies more heavily on innovation, knowledge, and information than on the industrial skills of previous centuries (Bellanca & Brandt, 2010). Skills needed in the 21st century are collaboration, critical thinking, and the ability to analyze and synthesize information (Dede, 2014). People who can reinvent themselves in an ever-changing marketplace will succeed (Bellanca & Brandt, 2010). Researchers have found technology, when implemented correctly, results in increased student achievement (Hew & Tan, 2016). However, today's educational systems have not kept up with current technology as first anticipated in the beginning of the 21st century (International Society for Technology in Education [ISTE], 2014).

To ensure students have technology for learning in their hands, schools must find ways to increase mobility and bandwidth within the school environment in order for all students to have greater access to multiple software programs, individual devices, and remote access throughout the day (Blair, 2012). In addition, professional development for educators is an essential component for authentic technology integration to be an effective instructional tool (Hanover Research, 2014). The background issues relevant to the study are addressed in this chapter. Following the background are the theoretical framework and purpose of the study, in addition to the research questions and hypotheses. Limitations and assumptions, as well as key term definitions, are provided at the end of this chapter.

Background of the Study

Education is being transformed and molded by the availability and use of technology as during no other time in history (McKenzie, 2012). In the 21st century, technology is the lens through which students think, learn, and understand the world (Prensky, 2013). The phenomenon known as the digital divide has impacted schools with limited funding to provide the instructional technologies needed for the 21st-century learning environment (Sundeen & Sundeen, 2013). Students of today need a classroom environment that incorporates skills required in the 21st century (Witte, Gross, & Latham, 2015). Effective professional development is key to prepare teachers to properly implement technology-integrated curriculum, and proper implementation is key to student achievement (Hew & Tan, 2016). To prepare students in a 21st-century educational environment, learning must be facilitated through integration of instructional technologies (Neupane, 2014).

The role of technology in the classroom may be viewed as resource-based, productivity-based, and as a delivery system (Yuan-Hsuan, Waxman, Jiun-Yu, Michko, & Lin, 2013). Students need basic and factual understanding of content when using technology for further learning (Yuan-Hsuan et al., 2013). Project-based lessons provide a wide scope of learning in the classroom and allow students to understand the interconnectedness of multiple domains (Yuan-Hsuan et al., 2013). Students today not only need literacy and numeracy skills, students now need the ability to collaborate, think critically, create, and communicate to be successful (Blair, 2012). An increase in project-based learning, which requires collaboration, critical thinking, creativity, and communication, was found to be the motivating factor for gains in student achievement (Hew & Tan, 2016).

Of America’s public schools and libraries, 99% reported having an internet connection in 2006, although none reported how many or what kind of internet connections were available to the public (Ross, 2015). It is imperative all schools have access to modern technology and broadband internet connectivity if education is to be viewed as an equalizer for all Americans (Bayse, 2014). Students from high-poverty schools are less likely to have technology-rich learning experiences than students from low-poverty schools (Herold, 2016a).

Because knowledge and information grow and change exponentially, students need not only basic content knowledge, but the skills to apply and transform information for useful and creative endeavors (Bellanca & Brandt, 2010). The academic basics, such as reading and math, may remain the same, but the methods used for delivery of content and engagement of students are vastly different than in the past (Blair, 2012). The greatest gains students receive within a technology-rich classroom are engagement and the desire to learn (Collins & Halverson, 2009).

In a report prepared for the Institute of Education Sciences in 2011, increased student achievement was a result of specialized instructional delivery methods and related services (Neupane, 2014). The customization and individualization of learning for a vast spectrum of student abilities is the new contract between teacher and student (Collins & Halverson, 2009). The increased capability of software and computer integration allows greater individualization and customization of educational opportunities for students than ever before (Collins & Halverson, 2009); however, schools continue to regulate the amount of time spent by student-users on the internet due to limited broadband width (Ross, 2015). Some schools average 200 users and receive the same amount of connectivity speed as the average single-American household (Ross, 2015). One side-effect of limited broadband width and access to technology for students who reside in unconnected rural communities is low academic and vocational expectations (Bayse, 2014). Education is at a crisis point when 70% of students are graduating with basic technological and communication skills rather than 21st-century learning skills needed for the workplace (ISTE, 2014).

Educators need professional development to learn the basics of technology, and more importantly, how to use technology in their classrooms (Johnston, 2014). Professional development for educators is essential for technology integration to be effective as an instructional tool (Hanover Research, 2014). Technology in the classroom is a limited resource if teachers do not understand how to use technology or the pedagogy involved in incorporating technology effectively for greater student engagement (Pittler, Hubbell, & Kuhn, 2012). Professionals in the educational community support the integration of technology into the regular classroom, coupled with professional development, as a possible correlation component to higher student achievement (Pittler et al., 2012). Supporting teachers when technology is integrated in the classroom is essential and should be well-planned and in place in advance of the equipment (Johnston, 2014). Funding for professional development as it relates to technology integration and student achievement in similar-sized school districts with limited resources should be scrutinized (Bain, 2015).

Theoretical Framework

The constructivist theory is the process in which learners construct a new idea from prior experiences added to new information to form an entirely new schema (Chaipichit, Jantharajit, & Chookhampaeng, 2015). The constructivist theory is the framework within which this study was built to determine if increasing money spent on specific technological enhancements creates an environment in which students construct new learning schemas that increase achievement. The framework for changing classroom culture by integrating technology is created through an interactive relationship between technology and stakeholders (Wade, Rasmussen, & Fox-Turnbull, 2013).

Early sociocultural theories in the field of education focus around the ideology of Lev Vygotsky, whose overall theoretical framework is that social interaction plays a fundamental role in the development of cognition (Scott & Palincsar, 2013). The ideology behind constructivist theory suggests all knowledge and learning is constructed based on prior experiences gained through a variety of learning modalities (Bain, 2015). Learning is thought to occur through collaboration, negotiation, and interaction among students (Scott & Palincsar, 2013). Pedagogic models used today include reflection and exchange, production and investigation, scaffolding and storyboarding, as well as facilitation and content (Scott & Palincsar, 2013).

Technology integration is transforming education as teachers and students have numerous ways to collaborate and integrate prior knowledge while seeking a new understanding of the world around them (McKenzie, 2017). Increased student achievement will occur when industry leaders within education and those outside of education realize the single-most impactful factor is to increase teacher education as it relates to technology integration (Murthy, Iyer, & Warriem, 2015). One's reality is made up of all the sensory experiences one has gained throughout life, beginning at birth (Bain, 2015). Integrating key concepts and ideas is central to the learning process for students and teachers (Bellanca & Brandt, 2010). Students do not come to the classroom as blank slates, but rather with a wealth of prior knowledge to synthesize with new information

(Coughlan, 2015). Constructivism is defined as active learning the brain creates as opposed to passively received learning (Vygotsky, 1978). Teachers steeped in the tradition of constructivism constantly encourage students to utilize active learning techniques (Coughlan, 2015).

A constructivist classroom is one in which students have more choices in styles of learning and where students can play a more active, engaged role in their own learning (Pittler et al., 2012). When technology is integrated into classroom instruction, the classroom culture moves from a teacher-dominated lecture environment to one of student-centered learning (Pittler et al., 2012). However, simply adding technology to the classroom does not create a 21st-century learning environment for students (Tucker, 2012). Teachers who are hesitant to incorporate new technology may be more receptive to providing a student-centered constructivist learning environment if specific and targeted professional development regarding technology integration is provided (Peterson, 2016). Appropriate professional development offered simultaneously with the introduction of integrated technology may enable educators to adapt from a teacher-led approach to a student-centered constructivist learning environment (Peterson, 2016).

Educators are better able to teach through a variety of instructional options due to integration of technology in the learning environment (Murthy et al., 2015; Peterson, 2016). Integrated technology in the classroom has been found to motivate students who are accustomed to using technology in everyday life (Murthy et al., 2015; Peterson, 2016). Training teachers and engaging students requires making sense of the learning paradigm, activating prior knowledge of the learning paradigm, and applying increasingly critical technology skills to the learning paradigm (Bellanca & Brandt, 2010). Effective professional development in any model requires change in process, and that process will take time and constant support for each learner to integrate the change in a meaningful way (Murthy et al., 2015; Peterson, 2016).

Statement of the Problem

A mutually shared vision for education and the learning environment must be created by teachers and students in which collaboration, critical thinking, creativity, and communication become part of the everyday language of professional development for teachers and learning opportunities for students (Blair, 2012). To date, few secondary meta-analyses of existing studies have shown more than a modest increase in student achievement based on the use of or lack of use of technology in the classroom (Johnston, 2014). It is important to investigate whether the infusion of technology in the classroom is a fad or is an effective use of limited budgetary resources (Hanover Research, 2014). In addition, technology infrastructure must be in place to fully integrate technology and 21st-century learning (Bayse, 2014).

Educational environments and student learning have the potential to be transformed by integrating instructional technologies in a modern, 21st-century world (Sundeen & Sundeen, 2013). Teachers who utilize technology-rich, learner-centered environments find more effective ways to use technology in the classroom, resulting in increased student achievement (Hanover Research, 2014). For most small schools, infrastructure poses one of the biggest financial challenges (Bayse, 2014). To ensure students have hardware in their hands, schools must move away from relying on computer labs as the main point of contact for students and move toward everyone having access to multiple software programs and individual devices (Blair, 2012).

Students perceive the use of technology as separate from learning academic content because of the lack of fusion of the two activities (Witte et al., 2015). Lack of connection between what students use in class and what they use outside of class creates a digital divide (Witte et al., 2015). Learners in the 21st century must master literacy and numeracy skills by integrating the four Cs—collaboration, critical thinking, communication, and creativity—to be successful beyond high school (Blair, 2012). For students to transition successfully into college or the workplace, the K-12 learning environment must be filled with technology-rich software and hardware options and the opportunity to integrate collaboration, critical thinking, communication, and creativity successfully (Blair, 2012).

People and businesses continue to increase the use of technology hardware and software, which in turn has changed the work culture to one of greater collaboration (Green, 2015). In less than 20 years, the business world has transformed education by changing what and how technology integration has been situated within the work environment (Edwards, 2012). Students can work from anywhere, anytime, and in multiple modalities to demonstrate their learning (Edwards, 2012). Today's students are encouraged to be responsible for needed changes in their educational learning environments both individually and within collaborative teams (Green, 2015). Learning environments and workspaces should reflect and promote collaboration, creativity, and critical thinking (Green, 2015).

Technologically savvy students from the classrooms of today become the innovative entrepreneurs of tomorrow, and with the mobility of technology, students have discovered they can learn and work from anywhere with anyone (Green, 2015). A major impediment for many schools is the lack of knowledge and resources to train employed educators from traditional classroom delivery methods into more integrated technology-driven lessons (Norris & Soloway, 2014). Over time, the results of continuing studies will provide the hallmarks of increased student achievement as it relates to technology, so long as teachers increase, practice, and implement improved knowledge of technology-blended learning in the classroom (Johnston, 2014).

Professional development should provide educators the opportunity to delve into new pedagogical advancements, software, hardware, and devices to effectively adapt teaching styles to increase student learning and achievement using technology (United States Department of Education [USDOE], 2012). Teachers who participate in professional development programs that include coaching and mentoring, where risk-taking is encouraged, are more likely to integrate technology-centered lessons and projects than teachers who are not participating in such professional development programs (Bergmann & Sams, 2012). The teacher is no longer only the purveyor of information, but acts as a mentor for students who are performing hands-on learning in the classroom setting (Bergmann & Sams, 2012).

It is equally as important for educators to learn why they are integrating technology and how technology increases student achievement in the classroom as it is for educators to understand how the technology devices work (Hanover Research, 2014). Identifying the amount of technology available in classrooms when compared to student achievement is vital information for administrators and is a strong indicator of the success of students in the 21st-century workplace (Blair, 2012). It is imperative to determine if technology in the classroom is having an impact on student achievement (Blair, 2012).

Purpose of the Study

The educational hierarchy responsible for technology purchases in schools have spent billions of dollars for infrastructure and devices, only to have disappointing student achievement outcomes to date (Harris, Al-Bataineh, & Al-Bataineh, 2016). Educators have fought to introduce and use new devices and software in their classrooms only to result in unfulfilled expectations of student achievement gains (Harris et al., 2016). It is essential students be provided with the environment and knowledge base to facilitate their own learning regarding technology (Coyne, Potter, & Hollas, 2013). School districts have added technology under the assumption it will increase student achievement but have found little to no impact when direct instruction based on paper-and-pencil pedagogy is still the mainstay in the classroom (Norris & Soloway, 2014). Too often educational institutions operate in a silo-type environment when making technology purchases instead of utilizing a more holistic purchasing approach (Harris et al., 2016). Even as the cost to purchase and implement technology and software within primary and secondary schools continues to decrease, the cost can still be too great in many small rural and parochial educational settings (Harris et al., 2016).

Effective teachers have a greater impact on student achievement than any other school-based factor (Levenson, Baehr, Smith, & Sullivan, 2014). Effective teachers can impact student learning by decreasing the importance of non-school factors and can elevate academic growth in students (Levenson et al., 2014). Instructional strategies in technology will serve as a catalyst to student achievement and engagement with content in the 21st-century classroom (Lumpkin, Achen, & Dodd, 2015). Students coming to the classroom now are not concerned about if they will use technology but how it will be implemented and utilized (Lumpkin et al., 2015). Just because the availability and offerings have increased for student use, the introduction of technology and software alone does not guarantee a dramatic change in student achievement (Harris et al., 2016). Stakeholders must overcome a full range of physical and mental barriers, from the lack of infrastructure to the human challenge of changing long-held pedagogical beliefs (Harris et al., 2016).

Research questions and hypotheses. The following research questions guided the study:

1. What is the correlation between student achievement at the third, fifth, and eighth-grade levels and the amount of money spent on technology hardware?

$H1_0$: There is no statistically significant positive correlation between student achievement and the amount of money spent on technology hardware.

$H1_a$: There is a statistically significant positive correlation between student achievement and the amount of money spent on technology hardware.

2. What is the correlation between student achievement at the third, fifth, and eighth-grade levels and the amount of money spent on technology software?

$H2_o$: There is no statistically significant positive correlation between student achievement and the amount of money spent on technology software.

$H2_a$: There is a statistically significant positive correlation between student achievement and the amount of money spent on technology software.

3. What is the correlation between student achievement at the third, fifth, and eighth-grade levels and the amount of money spent on technology-related teacher professional development?

$H3_o$: There is no statistically significant positive correlation between student achievement and the amount of money spent on technology-related teacher professional development.

$H3_a$: There is a statistically significant positive correlation between student achievement and the amount of money spent on technology-related teacher professional development.

Definition of Key Terms

For the purposes of this study, the following terms are defined:

Diocese. The diocese is a district under the jurisdiction of a Bishop (*Merriam-Webster's Online Dictionary*, 2017). A diocese is a Catholic organization covering a large geographic area comprised of Parish churches and schools overseen by a Bishop (L. Witt, personal communication, May 13, 2014).

International Society for Technology in Education (ISTE). The International Society for Technology in Education (ISTE) is a collective body of people whose members strive to increase technology instructional time, pedagogy, and efficacy in the classroom (ISTE, 2014).

Iowa Test of Basic Skills (ITBS). The Iowa Test of Basic Skills (ITBS) is a nationally standardized achievement test for K-12 students (The Critical Thinking Co., 2017). The ITBS is a standardized, nationally norm-referenced test used by many states to assess the progress of students in various subject areas and at various grade levels (L. Witt, personal communication, May 13, 2014).

Limitations and Assumptions

Limitations. The following limitations were identified in this study:

1. This quantitative study focused on Catholic elementary schools in one diocese in the Midwest consisting of 23 K-8 elementary schools.

2. The instrument was created by the author of the study. A survey was sent to current administrators in the 23 K-8 buildings of the diocese. The response rate was 100%. Survey responses collected resulted in one portion of the quantitative data.

3. The Iowa Test of Basic Skills was used to determine academic success and student achievement in grades three, five, and eight. The data used were from the school years 2011-2012, 2012-2013, and 2013-2014 and finalized the quantitative piece of the study. The ITBS was given the first week of October for each school year defined.

4. This study focused on student achievement via academic test scores and not the social justice or religious mission of the church.

Assumptions. The following assumptions were accepted:

1. The responses of the participants were offered honestly and without bias.

2. The findings of this study could translate to any small K-8 school district regardless if it is privately funded or publicly funded (L. Witt, personal communication, May 13, 2014).

3. The number of students, cost of tuition, and overall budgets within the Catholic elementary schools were not accounted for in this study.

Summary

Technology integration continues to be the focal point of educational mandates and reform from federal and state governments, and funding for these mandates continues to be a concern for local school boards (Bayse, 2014). The goal of putting technology into the hands of teachers and students demands facilitating technology-rich environments that allow students to be better prepared for college or the workforce (Herold, 2016b). Furthermore, increasing technology-rich learning environments may increase academic achievement among all learners regardless of socioeconomic background, which in turn will better prepare students for the future (Herold, 2016b).

In Chapter One, the study and main points were outlined including background information, the theoretical framework of the study, a statement of the problem, the significance of the study, and limitations and assumptions of the study. A review of literature in Chapter Two contains information on overall budget constraints, technological hardware, technological software, and technology-based professional development for teachers. Views of technology integration, perceived issues regarding professional development, and promising strategies that can be utilized with proper technological hardware and software are also reviewed in Chapter Two. The methods and procedures applied in this study are described in Chapter Three. Presentation of data and an analysis of findings are detailed in Chapter Four. In Chapter Five, the conclusions and recommendations for further research are addressed.

Chapter Two: Review of Literature

Education is changing at an exponential rate; information is readily available anywhere at any time on most any device (Morris, 2014). Students and educators have access to more information in real time than at any other time in history (McKenzie, 2017). The challenge for educators today is changing from the role of simply transferring information to students to an environment in which students become the creators, synthesizers, critics, and overall managers of their own learning in the quest to solve real-world problems (Morris, 2014). The traditional barriers to information in real time no longer restrain educators from the ability to differentiate instruction and meet the needs of varied learners (McKenzie, 2017). Technology-enhanced learning can incorporate a variety of learning styles; online learning, blended learning, and other classroom learning environments can engage students with technology (Kehrwald & McCallum, 2015). Technological integration is as necessary today as pencil and paper were to students 20 years ago (Carver, 2016). Students of today will be the business owners and employees of new industries and employment opportunities that have not even been invented yet (Marx, 2015).

For students in classrooms today to effectively collaborate, integrate, and synthesize information, they must leverage the use of technology in the constructivist classroom (Beriswill, Bracey, Sherman-Morris, Huang, & Lee, 2016). By allowing students to utilize technology in the classroom, the potential for achievement, organizational skills, and overall attendance may increase (Carver, 2016). Additionally, the constructivist classroom teacher must shift from large-group to small-group instruction, increase collaboration among students, and allow students to have more autonomy and individualized instruction (Daccord, 2013).

The race to keep up with technology may never be won by school districts; schools will never have enough money to buy the latest technology, especially not in large quantities (Bellanca & Brandt, 2010). Unfortunately, as of 2010, education institutions in the United States had appropriated less than 1.6% of their total $9.2-billion-dollar budget for technology (Harris et al., 2016). However, schools can learn to maximize how they use current technology through careful selection of software, hardware, and professional development (Bellanca & Brandt, 2010).

The point of technology integration into the classroom is to increase student achievement and overall quality of learning (Ozerbas & Erdogan, 2016). Adding technology in the classroom is becoming more cost effective for schools; however, without re-structuring and aligning the curriculum and offering professional development, the purchase alone will do little to improve student achievement (Lukaš, 2014). Standardized tests constrain the boundaries within which computers can change learning in schools (Collins & Halverson, 2009). Buying technology for the sake of having it in the classroom does not appear to improve student achievement or standardized test scores (Zhing & Henion, 2016).

Strong teacher buy-in, appropriate technical support, targeted professional development, and curriculum alignment appear to be worth the investment long term for increased student achievement (Zhing & Henion, 2016). Students who graduate from a technology-rich classroom should be able to do more than just use devices; they should be able to evaluate and synthesize information in a manner that will allow for problem-solving and creative-thinking adults (Lukaš, 2014). The academic basics, such as reading and math, may be the same as 50 years ago, but the delivery of content and engagement of students and teachers should look vastly different (Blair, 2012).

Educators must be able to transform teaching styles from lecture models to models that promote knowledge construction and discovery through various instructional strategies in order to better accommodate the learning styles of students (Herold, 2016b). Challenging factors facing educators include the increased diversity of student learning needs in an ever-changing technological environment combined with the challenge of integrating technology into the classroom through instructional strategies (Dede, 2014). Another critical hindrance of technology integration into the classroom is the way devices and software have been used in the classroom (Harris et al., 2016). Too often devices are machines only used to automate or replace existing practices, much like the Scan-Tron machines or copiers of yesterday (Harris et al., 2016).

Educational environments are now two decades into the 21st century, and educators are still lacking in professional development that goes beyond how to use devices (Harris et al., 2016). Instead, professional development should focus on how to integrate and change the teaching and learning of any subject by way of software and devices (Harris et al., 2016). Educators need professional development to learn the basics of technology, and more importantly, how to effectively use technology in the classroom (Johnston, 2014). The overarching goal in education today should be to bolster teacher confidence while integrating technology pedagogy and content knowledge by increasing technology-rich and constructivist professional development programs (Matherson, Wilson, & Wright, 2014). The difference between leading and lagging nations becomes apparent when students are educated in the areas of competitiveness, ingenuity, mental agility, and continuous improvement (Johnston, 2014).

Furthermore, knowledge and information grow and change exponentially (Bellanca & Brandt, 2010). Seemingly the textbook still dictates the curriculum for students, not only in what they learn but how they learn it (Blake, 2010). Unfortunately, this inability to turn away from the textbook as the source of curriculum leaves students deprived of an extraordinary wealth of digital content and resources that could deepen the student achievement and engagement so many classrooms are missing (Harris et al., 2016). This rapid change advances the need for students to know basic content knowledge and to have the ability to develop skills and apply those skills to transform any piece of information put in front of them into useful and creative endeavors (Bellanca & Brandt, 2010).

Theoretical Framework

The constructivist theory is the framework on which this study was built to determine if money spent on specific technological enhancements such as software, hardware, and professional development creates an environment in which student achievement increases. With the onset of a new millennium came a technological revolution (Knoll, 2014). The use of technology combined with ever-present access to information have forever changed the learning environment (Farnsworth, 2017). No longer will a few instructional strategies work in isolation to increase student achievement; in fact, technology negates the role of the teacher as the source of all learning and information (Farnsworth, 2017).

The world is diverse, globalized, complex, and media-saturated (Knoll, 2014). One of the greatest outcomes of the technology revolution in the classroom is an increase in student engagement (Collins & Halverson, 2009). As learning moves out of traditional buildings and classrooms, the rise of hybrid learning environments will become evident both in education and in the workplace (Collins & Halverson, 2009). As people enter the workforce of today, employees must be innovative and global-centered to compete (Eyal, 2012).

To fully understand how individuals learn, one must look first at sociocultural theories and how they relate to education (Campbell, MacPherson, & Sawkins, 2014). Lev Vygotsky is considered the father of constructivism and promoted the ideology human cognition develops within an interactive framework and within social situations that include varied learners (Campbell et al., 2014). Sociocultural theories begin with the foundation knowledge is constructed socially via interaction, expectations, and behaviors all shared in a social environment (Campbell et al., 2014; Vygotsky, 1978). To view through the lens of cultural norms, a person constructs his or her knowledge based on social cues like signs, symbols, language, and materials that eventually become the fabric for all learning (Dewey, 1998). According to Vygotsky's Law of Development, a learner absorbs information first on a social interactive plane and then on an individual basis, which allows for learning to occur on both the social plane and the psychological plane (Campbell et al., 2014; John-Steiner & Mahn, 1996).

Limited professional development regarding technology and technology-related instructional strategies has proved to be a major barrier for most school districts (Coyne et al., 2013). Many educators in practice today do not utilize technology easily or with great skill; instead, technology integration is viewed as the reason for negative change in the current classroom rather than the robust avenue for endless learning possibilities (Lukaš, 2014). The average age of an educator in the United States as of 2012 was 42.4 years, which may increase the need for integrated, sustainable professional development as it relates to technology integration in the classrooms of today (USDOE, 2012; Witte et al., 2015).

Educators have long debated the value of opportunities afforded by technological devices and advancements used to enhance and elevate student-centric collaborative learning environments steeped in the ideology of the constructivist approach to learning (Howland, Jonassen, & Marra, 2012). Some educators debate the overall value of the technology device as anything more than an improved typewriter, while others suggest the internet, technology integration, and devices could in some cases replace the licensed educator (Howland et al., 2012). In many cases, barriers to teacher implementation of technology in the classroom include devices, software, and in some districts, infrastructure (Carver, 2016). The ideology behind constructivist theory suggests all knowledge and learning is constructed based on prior experiences gained through a variety of learning modalities (Bain, 2015). Teachers must approach learning new strategies as any student would in a constructivist classroom (Carver, 2016).

Technology has been readily available in some cases and still teachers lack the knowledge to integrate the technology or strategies into the classroom (Pilgrim, Bledsoe, & Reilly, 2012). The world is digital, and educators should be at the forefront of this increasingly mobile learning style to better prepare students (Herold, 2015). For technology integration to be successful, educators must perceive value is being added to what they already do in the classroom (Berrett, Murphy, & Sullivan, 2012). Technology should be viewed not as an end in itself, but rather as a tool (Dede, 2014). The goal of integrating technology into the classroom is not simply to add a few devices but to empower teachers to utilize instructional strategies that change the way knowledge is delivered and received (Dede, 2014). Educators should not stand in front of the room talking at students, but should instead circulate and talk with students for achievement to increase (Bergmann & Sams, 2012).

At the most basic level, when there is no clear and definitive technology plan, individual users make decisions that lead to ineffective use of devices (Morris, 2014). The lack of coordinated and in-depth professional development combined with feelings of isolation despite the opportunity to consult with a knowledgeable technology staff member often lead educators to return to traditional lecture methods of teaching (Witte et al., 2015). Overall, classroom teachers lack opportunities to share ideas and knowledge of best practices, which leads to frustration and overall burnout with regard to technology integration in the classroom (Ersoy & Bozkurt, 2015).

To grow strong and forward-thinking educators, professional development must be funded and the funding must include an investment in technology (Blaine, 2014). Education technology models must connect solo practitioners with classrooms that are technologically connected (Bayse, 2014). Digitally connected teachers who have ongoing access to data and information can allow students to ascertain what is real, relevant, and useful to increase achievement (Bayse, 2014). A major barrier for instructional designers regarding streamlined and interactive professional development based on a constructivist learning model is how to best reach and support educators as they attempt to acclimate to a fast-paced and ever-changing world of technology hardware, software, and professional development (Lin, Huang, & Chen, 2014).

For schools to implement new technology-rich infrastructures, effective strategies and professional development must be consistent, ongoing, and to scale (Dede, 2014). The most successful schools that have implemented transformative models for the 21st century have not simply automated the traditional model of teaching, but instead have used technology to enhance new and more innovative types of learning (Dede, 2014). Active participation using technology has allowed students to learn skills to raise their test scores (Demski, 2012). Due to the overwhelming cost of implementing and sustaining technology, including infrastructure, software, hardware, and professional development, schools must find ways to offset costs by improving effectiveness and efficiency among staff (Dede, 2014).

Student engagement is vital to the overall success of digital conversion (Edwards, 2012). Professional development is also imperative to the success of the conversion (Edwards, 2012). The pressure on administrators, school boards, and curriculum specialists to offer high-quality and sustainable professional development has never been so great (Beriswill et al., 2016). Episodic and ineffective professional development should be replaced by professional learning communities in which collaborative, connected, and continuous opportunities blend with in-person conferences and online experiences (Thomas, 2015). Professional development is paramount to the overall success of digital conversion and is tightly linked to student success (Edwards, 2012). Teachers are more likely to change their instructional practices, integrate content knowledge, and assimilate new initiatives when professional development is directly linked to daily classroom experiences (Rout & Behera, 2014).

Constructivist learning theories are applicable to adult learners (Rout & Behera, 2014). When teachers must take their learning deeper or develop new models of instruction, the expectation is learning must be grounded and connected to daily experiences (Rout & Behera, 2014). Professional development grounded in constructivist theory must be sustained, ongoing, supported, and connected to reflection and experimentation by the learner (Rout & Behera, 2014). Building a climate and culture that allows educators to try new technological advances and fail is crucial for positive and sustainable outcomes (Edwards, 2012).

Future of Education

Transformative learning is a product of technology integration in the 21st century classroom, not just because of the devices available but because educators use technology effectively in the practice of teaching (USDOE, 2016). Increasingly, stakeholders agree the high-quality teacher is vitally important to student achievement (Harris et al., 2016). The global marketplace demands specific skillsets from citizens entering the workforce, and learning environments should reflect those skills in order for U.S. citizens to remain competitive (USDOE, 2016).

Students demand both overtly and subtly technology-rich learning environments, because learner characteristics have changed (Dede, 2014). For centuries, personalized learning has been the gold standard in education, which is why affluent families hire tutors, move to wealthier neighborhoods, or even employ educators for their own children (Harris et al., 2016). Technology integration worldwide now allows the best and brightest teachers to work with students from all socioeconomic backgrounds around the world given the infrastructure is available to connect (Harris et al., 2016). Leveraging what students already use during any given day and integrating the ease of channeling information aligns with organized learning in Science, Technology, Engineering, and Math (STEM)-rich environments (White & Martin, 2012).

In an ever-increasing global marketplace, it is imperative students succeed academically by way of 21st-century learning skills not only from print but across multimodal sources (Li, Snow, & White, 2015). Learning is moving out of the classroom with the onset of easy access and engaging technology applications and devices (Collins & Halverson, 2009). The future of technology in education is not as much about the device but about access and the cloud (Britland, 2013). Infrastructure and teacher buy-in are paramount to students accessing, using, and creating in the classroom of tomorrow, today (Britland, 2013).

Education must be viewed by the masses through a new lens for students to be successful in the 21st-century marketplace (Collins & Halverson, 2009). The current body of research indicates the overall climate and culture of a building is consistently a strong marker of and predictor of positive integration regarding technology integration in the classroom (Eyal, 2012). Schools are missing a unique opportunity to capture learning because device size, cost, or applications are being used as the driving factor in how schools determine what technology will be integrated (White & Martin, 2012). Students demonstrate effective ways to communicate, translate, and move or integrate information into meaningful patterns, and schools must ascertain how students learn and use those modalities instead of inventing new ones (White & Martin, 2012).

Restructuring education effectively can best be accomplished with a powerful tool called technology (Dede, 2014). Blended learning allows for direct instruction and technology-related learning zones that provide students with individualized opportunities, collaboration, creative thinking, and informal learning (USDOE, 2016). Effective integration of technology must reach far beyond basic computer class and basic instruction in software programs and must involve reaching across all curriculum to increase depth of learning and student achievement (Díaz, Nussbaum, Ñopo, Maldonado-Carreño, & Corredor, 2015).

An important decision regarding technology integration is not so much about the type of device purchased but rather about the methods of instruction, pedagogy, and vision addressed by educators (Daccord, 2013). Developing new competencies for technology integration should allow for meaningful, collaborative and productive endeavors that will build strong digital citizens (USDOE, 2016). New technologies are woven through the very fabric of life in all facets except schools (Tomlinson, 2013). However, when teachers view technology not as an extra piece of hardware to get in the way but as a gift through which they can connect students with the world in which they live, it is transformational (Tomlinson, 2013).

Improving Pedagogy

The center of the change process in education must be professional learning (Francois, 2014). High-quality professional development is a necessity if there is to be real change in how educators share information in the classroom (Díaz et al., 2015). To bring teachers to a higher level of understanding in terms of technology integration, there must be a concrete framework for understanding (Francois, 2014). To effectively challenge the status quo of classroom teachers, teachers must learn new pedagogy and be willing to unlearn the methods they have been using for years (Dede, 2014). Teachers need technology-driven support that is targeted and specific in regard to more than just integration (Johnston, 2014). School districts must have a strategy for technology integration executed so educators and students increase overall engagement and achievement (Mbugua, Kiboss, & Tanui, 2015). A technology-rich classroom provides the opportunity for traditional instruction combined with digital enhancements and student-centered learning (Horn & Staker, 2015).

Professional development has been described as a systematic effort to change teachers' methods in the classroom with an expected improvement in student achievement (Díaz et al., 2015). A key piece to technology integration in schools is differentiated professional development for educators (Wagner, 2013). Professional development must be offered to better meet the needs of various learning styles of educators just as teachers meet the learning needs of students (Wagner, 2013). Successful ventures are identified by the foundational cornerstone of collaboration; the profession of teaching should not be different (Edwards, 2012).

Educators must have tools that engage, support, and measure effectiveness of individual learning for change to occur (Francois, 2014). The ability to access everything anywhere is the educational learning environment of the future (Britland, 2013). Digital devices improve rapidly, and the ability to access information from anywhere is the key to successful student achievement and learning (Britland, 2013).

The current reformation in schools across the world highlights the need to move to a student-centered teaching practice along with the integrated use of technology in the classroom (ISTE, 2014). Learning environments, formerly known as schools, will look vastly different as hybrids of traditional brick-and-mortar cohorts of students will meld with online cohorts of students who may live anywhere in the world (Britland, 2013). Today's generation cannot remember a time technology did not surround them in everyday life; the way they learn has been impacted by the availability of technology (Beriswill et al., 2016). Current world economic environments suggest humans live in a conceptual age because of differences in student learning; today's youth must be prepared far beyond the basics of reading, writing, and math (Pink, 2005). Students today must be challenged in a creative and collaborative manner (Pink, 2005). Collaboration is now the way in which most companies expect their employees to work (Beriswill et al., 2016).

School learning environments need to embody the ideology students learn differently today than they did even 50 years ago (Beriswill et al., 2016). Schools will need an intense and robust internet connection and little else, simply because devices will be the norm and everyone will have them (Britland, 2013). The point at which schools become one-device-to-one-student will allow teachers to integrate technology more fully as a means of instruction for basic and advanced skills (Britland, 2013). Furthermore, due to the advancement of technology, the classroom of tomorrow has become the classroom of today because learning can be conducted anywhere, anytime, by anyone (Britland, 2013).

The 21st-century Catholic student skillset can be viewed in categories: Learning and Innovation Skills; Information, Media, and Technology Skills; and Life and Career Skills (Willers, 2015). Learning and Innovation Skills provide a map for students to perform, live, and work in an increasingly complex world (Willers, 2015). Creativity, critical thinking, communication, and collaboration skills will set Catholic students apart from their counterparts (Willers, 2015). Catholic schools and their students must be able to adapt skillsets to a rapidly changing environment in which students must reflect critical thinking skills relating to information, media, and technology (Willers, 2015). Lastly, Catholic schools must find a way to provide opportunities to develop, practice, and translate learned and innate skills in order to produce 21st-century competitive students (Willers, 2015).

Technology Trends

The increased use of integrated technology in school environments helps educators depend less on time and space as a means of educating students (Marzano & Simms, 2013; Mirriahi, Alonzo, & Fox, 2016). The abundance of technology and accessibility in classrooms around the world allows a student's education to reach beyond the four walls of the traditional classroom (Murray, 2015). Increasingly students will be delivering work and responses in real time via streaming on multiple devices (Murray, 2015).

Students and parents have a certain expectation in education that what is happening technologically in their everyday lives should be reflected in their learning environments (Skiba, 2016). The trend appears to be shifting to deeper and more meaningful learning experiences which promote student-centered learning using critical thinking and collaboration instead of surface learning, which is more suited to multiple choice and memorization of facts (Skiba, 2016). Mobile computing is another area in which educators are making inroads into the 21st-century learning environment by allowing students, the natural users of today, to interface and have access to a wide range of multi-media technologies (Hennig, 2016). A natural user has augmented realities by using touch screens, integrated devices, and devices that recognize speech (Hennig, 2016).

Makerspaces are on the rise as another option for technology integration that combine critical thinking, constructivist learning, and invention in a student-centered learning environment (Armes, 2016). Adaptive learning technologies and 3-D printing are additional software and hardware purchases that look promising for students and teachers (Armes, 2016). The ability to access and the knowledge of how to access technology will be the key to student learning (Britland, 2013). The infrastructure of schools and communities will be crucial in helping students take learning into the modern world (Britland, 2013). The emphasis in education is blended learning, problem-based learning, or project-based learning, in which students look at a problem from start to finish and are required to analyze, solve, and implement solutions through technology or presentations (Skiba, 2016).

New technologies allow for differentiated instruction online, in the classroom, or through a blend of both learning environments (Holland & Holland, 2014). Social networking and gamification have allowed a new market of learners to emerge in education (Skiba, 2016). Mobile technology tools allow for greater collaboration and innovation and provide learners the opportunity to make global connections that allow for a broader perspective of the world (Holland & Holland, 2014). Blended learning continues to be an effective instructional tool as demonstrated by the following four learning models: (1) effective, purposeful use of technology; (2) small group interaction; (3) data-driven instruction; (4) high-quality, well-aligned digital content; and (5) active, engaged students and staff (Tucker, 2012). Educators must find ways to engage 21st-century learners with rich multimedia by aligning the content message to the curriculum (Holland & Holland, 2014). Many have argued it is not the medium of transferring information that determines how effectively students learn, but it is how the medium is used that determines true transformation in student achievement and learning (De Bruyckere, Kirschner, & Hulshof, 2016).

The future of technology integration for learners will require companies to determine how people behave, think, and learn across the disciplines in order to align devices with the curriculum (Asino, 2015). Educational learning environments will need to allow for the culture of any given student to be part of the practice of learning in order to best determine how to construct the classroom through multiple modalities of technological learning (Asino, 2015). Technology on its own will grow exponentially, but true integration of software and hardware will require infused investment from professional development budgets if change is going to occur in the 21st-century classroom (De Bruyckere et al., 2016).

Summary

Educators trained in the tradition of constructivism constantly encourage students to utilize active learning techniques (Coughlan, 2015). Schools must provide students with greater access to the internet at higher speeds, along with the ability to discern sources and credibility, so students will be sharper, wiser, and better-equipped for life in 21st-century society and beyond (J. Herrell, personal communication, September 15, 2015). Educators who lack understanding of how instructional technology works or of how to choose the right device to increase student engagement limit the possibility of increased student achievement (Herold, 2015). Catholic schools are at a stage in which Catholic teachers can still include technology within the classroom without losing the personal relationship so important between teacher and student (J. Herrell, personal communication, September 15, 2015). Catholic schools have long been the alternative for public education, and yet as the 22nd century approaches, they have not truly distanced themselves from their counterparts in regard to the use or overuse of technology in the classroom (J. Herrell, personal communication, September 15, 2015).

Increased technology and integration alone will not sustain or set Catholic students apart as much as the relationship between teacher and student combined with multiple learning modalities infused within the daily learning environment (Willers, 2015). In the constructivist teacher's classroom, students are viewed as active participants in the learning process and prefer to engage in meaningful collaboration with the teacher, fellow students, and the world at large (Carver, 2016). Students and staff must all come to the educational learning environment ready to communicate, collaborate, and think critically (Dede, 2014).

Administrators, teachers, and parents will have to think creatively about engagement of the physical environment for learners (Willers, 2015). Stakeholders will have to re-imagine physical space in order to accommodate personal learning as well as problem-based learning (Carver, 2016). Digital citizenship will be the new model of citizenship and how students and staff will encounter the technological world of the 21st century and the continued globalization of the world (De Bruyckere et al., 2016).

The pedagogical framework of the future will engage students in self-directed learning with student-centered learning as the new educational empowerment (Carver, 2016). Administrators and staff will be required to think creatively when planning and implementing new instructional strategies, curriculum alignment, and physical space for the 21st-century learner (Hew & Tan, 2016). Administrators will take on new roles in the area of professional development by becoming coaches for embedded and ongoing development of teachers (Knoll, 2014).

Augmented and virtual reality will be the norm for students, and computational thinking, coding, and robotics will become mainstream curriculum as opposed to the add-on model currently being implemented in many learning environments across the country (Carver, 2016). Personalized learning for staff professional development and for the classroom student will be the new norm, while leadership will be shared more openly and evenly among staff due to technology tools (Hew & Tan, 2016).

Professional development trends provide another opportunity to unbundle education as it has always been known, moving away from fixed courses and times to more competency-based learning environments (Willers, 2015). Personalized learning for the teacher will mirror that of the student in the classroom (Carver, 2016). This type of personalized learning will allow all students to cater to their own learning styles, pace, and experiences in order to create the constructs for new schemas of learning (Hew & Tan, 2016). Education for all staff will needed to be targeted, specific, and continuous for the effects to be transcendent of current credentials and degrees (Dede, 2014).

Administrators and teachers should not expect students to simply “acquire” knowledge in the traditional model; instead, educators must identify what connects experiences, learning modalities, and achievement outcomes in order to effectively communicate individualized learning for students (Willers, 2015). Analytics and data will provide in-depth information to the teacher in a 21st-century classroom (Carver, 2016). In order for administrators and staff to interpret and implement meaningful changes for students, professional development will need to include support and software for data interpretation (Skiba, 2016).

The decentralization of leadership in education is transforming what professional development looks like in the 21st century (Skiba, 2016). The authority of learning is beginning to rest among a wide range of educators within a single building and among multiple people within a district or diocese (De Bruyckere et al., 2016). The new role for 21st-century teachers is to create rich learning environments in such a way that students will construct new knowledge based on prior experiences via technology integration (Carver, 2016).

In Chapter Three, the problem and purpose of this study are restated, and the research questions and hypotheses that guided data collection and analysis are reviewed. A comprehensive rationale for and description of the methodology employed in the study is provided in Chapter Three. Furthermore, a description of the population and sample studied, data collection methods, and data analysis procedures used in this study are detailed.

In Chapter Four, the results from this quantitative study with regard to the amount of technology hardware, software, and professional development as compared to student achievement scores in grades three, five, and eight over a three-year period are presented and discussed. The problem and purpose of the study as well as a summary of the instrumentation and data collection process are reviewed. In addition, the findings from each research question are presented and explained.

In Chapter Five, the study is concluded with a summary of the research and data analysis. Recommendations are made for future funding possibilities and for future research based on the results of the study. Suggestions for modifications to this study for additional future research are made to explore professional development opportunities, alternative testing, and future funding regarding technology.

Chapter Three: Methodology

This study was designed to help administrators, educators, and families determine how best to utilize limited funding when purchasing technology to increase student achievement. The literature focused on three main points relating to technology including hardware, software, and technology-related professional development for teachers. The use of technology is ubiquitous in the educational system and essentially within all instructional classrooms in public and private schools within the United States (USDOE, 2012). In this chapter, the problem addressed in this study is restated with a review of the research questions and hypotheses that guided data collection and analysis. Overall this chapter focuses on the methodology undertaken and rationale used in the study. Additionally, descriptions of the population and the systematic sampling utilized in the gathering of data are presented. This quantitative study included analysis of survey results and student test scores. Linear regression analysis including a Pearson product-moment correlation coefficient was used to determine statistical significance.

Problem and Purpose Overview

The purpose of this study was to examine the correlation, if any, between student achievement and the amount of money spent on technology hardware, technology software, and technology-related teacher professional development. There have been very few studies conducted about Catholic schools in which achievement scores were compared and analyzed for significant correlation to the amount of money spent on technology hardware, software, and professional development (L. Witt, personal communication, May 13, 2014). To address the purpose of this study, the norm-referenced ITBS scores for all third, fifth, and eighth-grade classes across a diocese in the

Midwest were compared to the administrator-reported amount of money spent on technology hardware, technology software, and technology-related professional development to determine if there was a significant positive correlation. The study was focused on school years 2011-2012, 2012-2013, and 2013-2014.

After receiving permission to conduct the study from the Bishop (see Appendix A), a letter of introduction was written to the building principals of 23 elementary schools in the diocese (see Appendix B). A second letter to the superintendent of the diocese was written (see Appendix C) requesting student scores for all third, fifth, and eighth graders of these same 23 elementary schools in the diocese. After obtaining informed consent from all parties (see Appendix D), a survey was sent to all building principals regarding spending habits for individual schools (see Appendix E). Only scores from the third, fifth, and eighth-grade classes were used for the purposes of this study. The findings of this study could be used by other private or parochial schools in addition to most any small public school district of similar population and size.

Research questions and hypotheses. The following research questions guided the study:

1. What is the correlation between student achievement at the third, fifth, and eighth-grade levels and the amount of money spent on technology hardware?

$H1_o$: There is no statistically significant positive correlation between student achievement and the amount of money spent on technology hardware.

$H1_a$: There is a statistically significant positive correlation between student achievement and the amount of money spent on technology hardware.

2. What is the correlation between student achievement at the third, fifth, and eighth-grade levels and the amount of money spent on technology software?

$H2_o$: There is no statistically significant positive correlation between student achievement and the amount of money spent on technology software.

$H2_a$: There is a statistically significant positive correlation between student achievement and the amount of money spent on technology software.

3. What is the correlation between student achievement at the third, fifth, and eighth-grade levels and the amount of money spent on technology-related teacher professional development?

$H3_o$: There is no statistically significant positive correlation between student achievement and the amount of money spent on technology-related teacher professional development.

$H3_a$: There is a statistically significant positive correlation between student achievement and the amount of money spent on technology-related teacher professional development.

Research Design

This study was conducted using quantitative methodology, which is effective to illuminate either an increase or decrease in student achievement scores as related to the amount of money spent on technology (Bluman, 2014; Creswell, 2013). The survey instrument was designed by the researcher with information drawn from *An Educator's Guide to Evaluating the Use of Technology in Schools and Classrooms* (Quinones, Kirshstein, & Loy, 1998). A quantitative assessment tool, the ITBS with norm-referenced achievement scores, was used to measure student achievement (Creswell, 2013). The quantitative tool utilized to gather data from the administrators was a survey whereby the answers were numerical. The survey results were gathered online using the software platform Survey Monkey.

The survey for administrators included all 23 schools and 23 administrators from the diocese equating to 100% participation. All participants completed the survey on a voluntary basis, and no one was compensated for participation. The ITBS scores were provided to the researcher by the diocese superintendent. All names were redacted and alphanumeric codes were given to each of the 23 elementary schools prior to the researcher receiving the scores to protect the identity of each school. The survey results were analyzed using the Statistical Package for the Social Sciences (SPSS) program as well as Microsoft Excel to produce graphs and charts needed to demonstrate the data in a visual manner. The data gathered and analyzed assisted in understanding the correlation or lack thereof between a school's ITBS scores and the amount of money spent on technology hardware, technology software, and technology-related professional development. The results should generalize beyond the limitations imposed by this study (Seltman, 2015).

Ethical Considerations

The quantitative data derived from test scores over three years across the diocese combined with a numerical accounting of the technology available to classroom teachers were analyzed to see if any correlation existed. Specifically, the amount of money spent on technology hardware, technology software, and technology-related professional development combined with the school's overall individual ITBS scores in grades three, five, and eight were analyzed.

The participants in the study were protected and assured confidentiality and anonymity. Safeguards were set in place throughout the data collection and analysis phases. The safeguards included the following security measures: all data and documents were secured in a locked cabinet or file under the supervision of the researcher, and all electronic files were secured using a protected password on a personal computer at a secured site; all documents and files will be destroyed three years from completion of the research project.

No identifiable statistics were gathered, such as student enrollment, free or reduced price meals percentages, or the percentages of specific subgroups of individuals collected. In addition, alphanumeric codes were used to lessen the possibility of identifying participating schools. Each school was assigned an alphanumeric code. The data were collected by the superintendent's office and given to the researcher under the alphanumeric codes. Each participant received an Informed Consent Form, which described in detail the purpose of the research, any possible risks, and the opportunity to opt out of the study at any time without negative effects.

Population and Sample

The population of this study consisted of 100% of the 23 elementary school building principals in the diocese and all student populations represented by way of building-level ITBS achievement scores in grades three, five, and eight over a three-year period. Students who took the ITBS during the three years represented in this study came from settings ranging from very small, poor rural towns to large cities with populations over 200,000. Monetarily speaking, the schools represented have total budgets ranging from $10,000 to over one million dollars for technology and professional development expenditures. The diocese studied consisted of 23 elementary K-8 buildings. Introduction letters were sent to the Bishop and principals of each of the 23 K-8 schools in the diocese. Written acceptance of the Informed Consent Form was given to the researcher by way of participation in the survey. The survey was taken and returned by the participants on December 15, 2014. The convenience sample included 23 Catholic elementary principals within one diocese in Missouri and was assumed to be representative of any Catholic K-8 elementary school in the United States; thus, the study is externally valid and may be generalized, allowing for the application of the results to a broader population (Fraenkel, Wallen, & Hyun, 2012; Seltman, 2015).

Instrumentation

The survey instrument was designed by the researcher using *An Educator's Guide to Evaluating the Use of Technology in Schools and Classrooms*, as a resource (Quinones et al., 1998). The survey consisted of 25 multiple-choice questions relating to budgets, hardware, software, professional development expenditures, and student population. This study was designed to measure the amount of money spent on technology hardware, technology software, and technology-related professional development and the possible correlation to student achievement.

Key subject participants were the 23 principals within a Catholic diocese located in Missouri consisting of 23 elementary schools. Through the administrators' survey, principals were asked specific questions relating to technology devices and technology budgets. The questions were also designed to elicit approximately how many and what kind of electronic devices were in the buildings and available for student use. Multiple-choice answers provide quantifiable data needed to run the Pearson product-moment correlation, or correlation coefficient, to recognize significant correlation (see Appendix E) (Fraenkel et al., 2012).

The survey was a cross-sectional survey conducted online via SurveyMonkey; administrators were given access instructions to take the survey online and were only allowed to answer the survey once. There were 25 questions per survey designed to gain quantitative data using a nominal scale and then tabulated using SPSS and Microsoft Excel. The three independent variables included the following: (1) The amount of money spent on technology hardware available to the classroom teacher, (2) the amount of money spent on technology software available to the classroom teacher, and (3) the amount of money spent on technology-related professional development available to the classroom teacher. The dependent variables were the ITBS core scores for third, fifth, and eighth grade within each building across the diocese over the course of three years.

The major unit studied is referred to as the analysis unit (Creswell, 2013). The analysis unit for hypothesis question one (hardware) related to survey questions five, six, and seven. The analysis unit for hypothesis question two (software) related to survey questions 17, 18, and 19. The analysis unit for hypothesis question three (professional development) related to survey questions 20, 21, and 22 (see Appendix E).

Validity is known in the sciences as the extent to which a measurement is well-founded and corresponds accurately to the real world (Altun & Yücel-Toy, 2015). Analysis with a 95% certainty regarding a correlation between student achievement and the amount of money spent on technology hardware, technology software, and technology-related professional development was conducted. Consideration was given to the amount of technology currently being utilized in the classrooms and whether that usage rate correlated to higher student achievement. The Pearson product-moment correlation, or Pearson's *r*, was used to correlate the data. The Pearson product-moment correlation coefficient is a parametric statistic assuming there is a normal distribution with interval data and hypothesizing a linear relationship exists between the independent and dependent variables (Seltman, 2015).

Data Collection

Once Institutional Review Board (IRB) approval (see Appendix F) was obtained from Lindenwood University and letters of introduction were sent to the Bishop and the Superintendent of the diocese, data collection began. The survey was designed to collect data from 23 K-8 principals regarding monies spent on technology hardware, technology software, and technology-related professional development for teachers as well as questions designed to elicit technology device options, quantity of devices deployed, and overall technology budgets relating to the school years 2011-2012, 2012-2013, and 2013-2014. The principals were sent the Informed Consent Letter containing the specific description of expectations and information to be collected in the survey. Participation in the survey indicated a principal's consent, and each of the 23 principals were given a specific amount of time to finish the survey and turn in the responses. All 23 principals returned the survey in lieu of a signature page indicating agreement with the Informed Consent Form.

The superintendent's office provided ITBS scores for grades three, five, and eight for the 2011-2012, 2012-2013, and 2013-2014 school years. At the completion of the collection of all raw data, the schools' names and identifiable markers were redacted from the paperwork and alphanumeric codes were assigned to maintain anonymity of survey results and correlated test scores. When this task was completed, the de-identified data were sent to the researcher for data analysis.

Data Analysis

A linear regression analysis was performed in conjunction with a Pearson product-moment correlation, also known as a correlation coefficient (Creswell, 2013), for each research question. For research question one, the dependent variable was student achievement scores for third, fifth, and eighth-grade levels as measured on the ITBS standardized tests, and the independent variable was the amount of money spent on hardware. For the second research question, the dependent variable was student achievement scores for third, fifth, and eighth-grade levels as measured on the ITBS, and the independent variable was the amount of money spent on software. For the third research question, the dependent variable was student achievement scores for third, fifth, and eighth-grade levels as measured on the ITBS, and the independent variable was the amount of money spent on technology-related professional development.

The relationship of the three independent variables of amount of money spent on technology hardware, amount of money spent on technology software, and amount of money spent on technology-related professional development was determined. The Pearson product-moment correlation coefficient was used to determine the strength of the correlation of the variables. The proportion of variability in the data was used to determine the extent to which the dependent variables could be explained by the independent variables.

Summary

Both public and parochial schools continue to struggle to fund technological resources (L. Witt, personal communication, May 13, 2014). Researching the types of technology used in schools, learning how technology is implemented, and discovering how technology implementation correlates to student achievement is important, because it could aid administrators in channeling limited resources only to those items that improve student learning. In Chapter Four, the results from this quantitative study correlating technology hardware, technology software, and professional development to student achievement scores in grades three, five, and eight over a three-year period are presented and discussed. A review of the problem and purpose of the study and a summary of the instrumentation and data collection process are presented. In addition, the findings from each research question are presented and explained.

In Chapter Five, the study is concluded with a summary of the research and data analysis. Recommendations are made for future funding possibilities, for ideology regarding testing as a measure of student achievement, and future research based on the results of the study. Suggestions for modifications to this study for future research are made to explore professional development opportunities, alternative testing, and future funding for technology.

Chapter Four: Analysis of Data

Technology should be a tool, not a teacher, and yet technology should be ubiquitous, necessary, and invisible as the students of today continue to become the citizens of the 21st century (Botteron, 2016). In this chapter, the results from the quantitative study are shared to help administrators, school boards, parents, and teachers determine how best to invest tuition dollars to purchase various technology resources, specifically hardware, software, and professional development. This chapter includes data provided by the survey and ITBS score analysis.

Problem and Purpose Overview

As the global nature of society continues to shrink, demands on teachers and students require fresh analysis to fully prepare students for college, careers, and citizenship (ASCD, 2016). Even as the cost of purchasing technology continues to decrease, the demands on school budgets increase (Botteron, 2016). A survey instrument was utilized in this quantitative research study to determine if technology budgets in the areas of hardware, software, or professional development increased student achievement on the ITBS among students in grades three, five, and eight.

Summary of Instrumentation and Data Collection

The 23 principals within the diocese were digitally sent a survey consisting of 25 multiple-choice questions relating to budgetary items, identification of technology devices in each building, and overall budget amounts relating to technology hardware, technology software, and technology-related professional development for staff. The 23 buildings were assigned alphanumeric codes by the diocese's superintendent's office. Once Institutional Review Board (IRB) approval was obtained from Lindenwood

University and consent was acquired from the diocese, data collection began. The population of the study consisted of 23 building principals from the 23 K-8 schools within the diocese. Once the 23 surveys were returned, data from the surveys were integrated into a spreadsheet that included the elementary school alphanumeric codes and the average core building ITBS test scores at grades three, five, and eight for the academic years 2011-2012, 2012-2013, and 2013-2014. To better quantify the monetary values for regression analysis, the responses from the survey were changed to numeric values with "1" being the lowest numeric response possible on each question and "4" being the highest numeric response possible on each question.

Respondent Demographics

The population of the study included 23 elementary principals within a diocese in southwest Missouri. The participants were selected as a convenience sample, and there was 100% participation from those selected. No K-8 buildings within the diocese were excluded, and all 23 principals participated. Consent was granted by active participation in the survey.

Reliability and Validity of Results

A test is considered valid if it measures what it is supposed to measure (Seltman, 2015). Criterion-related validation is a term used to describe a study predictive of later knowledge or a concurrent measure of knowledge (Altun & Yücel-Toy, 2015). The "power" or usefulness of test scores to predict future performance is known as predictive validity (Altun & Yücel-Toy, 2015). Power also refers to the probability the research will accurately determine if changes to the independent variable directly or indirectly caused the change in the dependent variables (Seltman, 2015).

Permutations of Statistical Analysis

There was potential correlation between student achievement at the third, fifth, and eighth-grade levels on the norm-referenced Iowa Test of Basic Skills (ITBS) from the academic years 2011-2012, 2012-2013, and 2013-2014 and the amount of money spent on technology hardware (specifically computers, i-Pads, and interactive white boards), technology software, and technology-related professional development. The monetary responses for each building were graphed against the corresponding average test scores for third grade during the year 2011-2012 (see Figure 1).

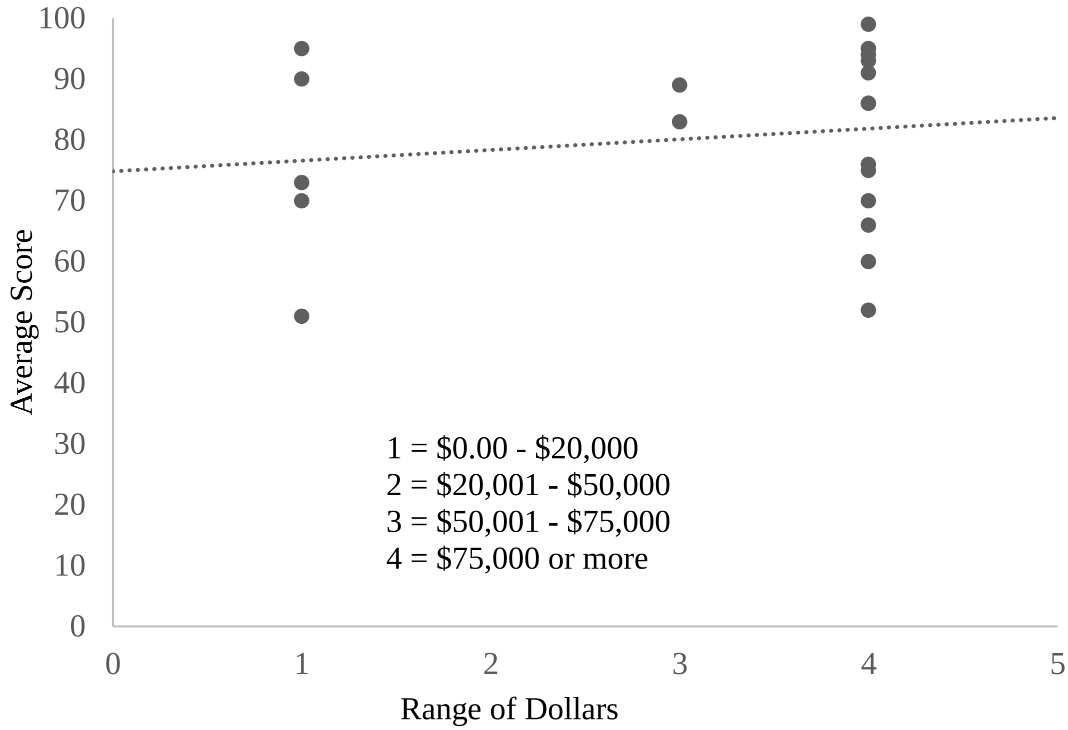

Figure 1. Scatterplot of total dollar amount of technology spending versus average third-grade test scores for 2011-2012. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = 1.7536x + 74.834$.

Next, the monetary responses for each building were graphed against average test scores for fifth graders and eighth graders during the 2011-2012 school year (see Figure 2).

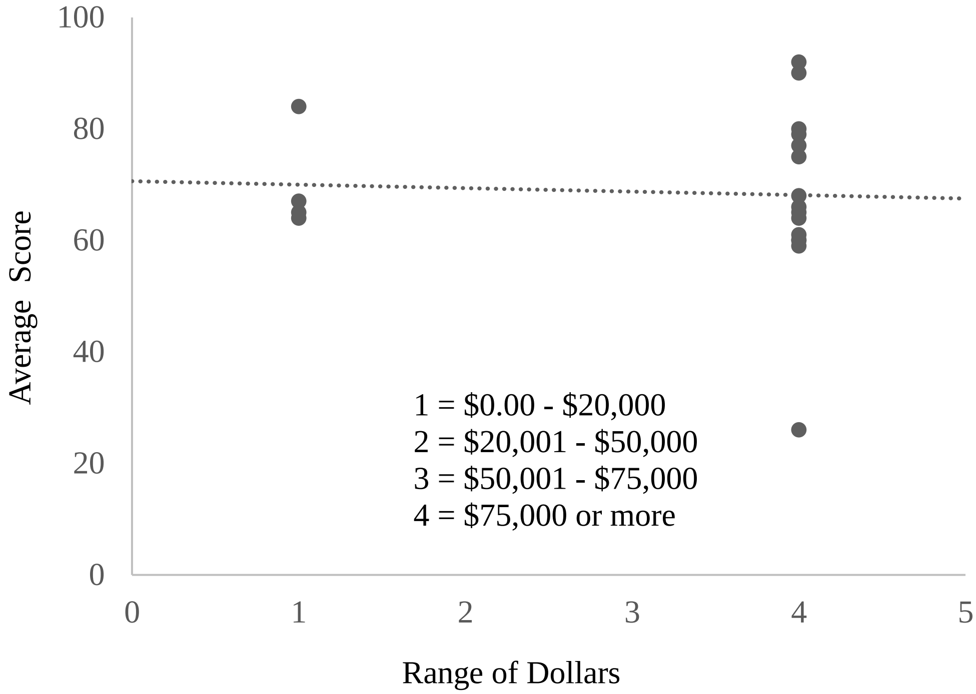

Figure 2. Scatterplot of total dollar amount of technology spending versus average fifth-grade test scores for 2011-2012. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = -0.6222x + 70.622$.

For each set of values, a graph was generated along with the line of best fit, an equation of the line, the r^2 value, and the Pearson product-moment correlation coefficient (see Figures 1 and 2). This process was repeated for "Total Dollar Amount of Spending" at grades three, five, and eight for 2012-2013 and 2013-2014 as well (see Figure 3).

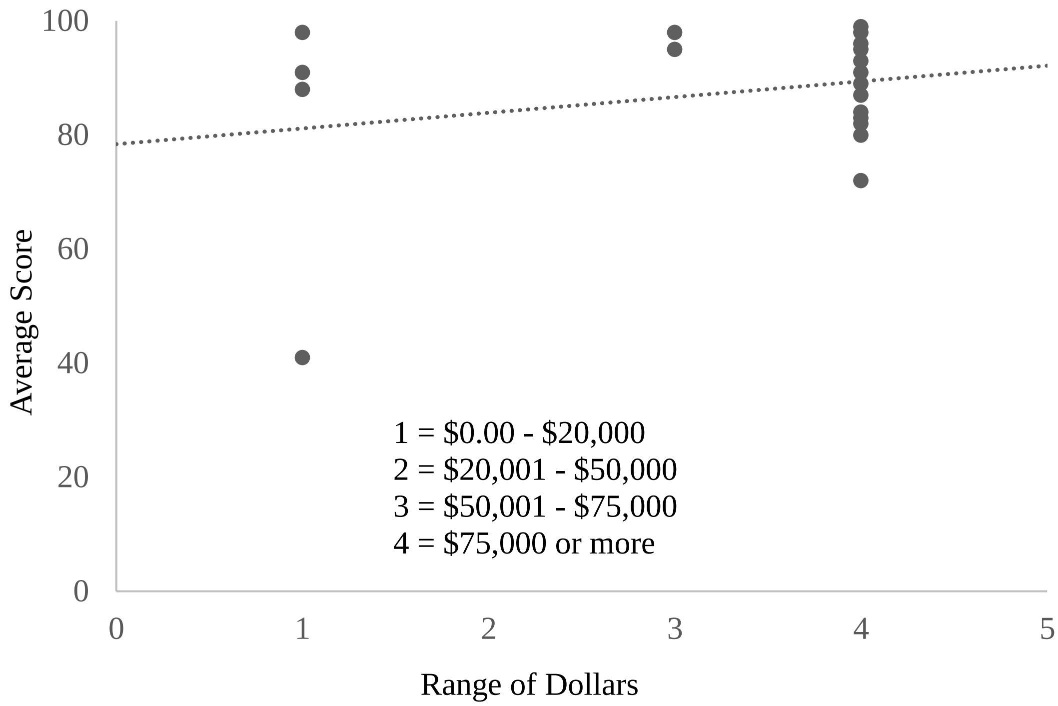

Figure 3. Scatterplot of total dollar amount of technology spending versus average eighth-grade test scores for 2011-2012. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = 2.751x + 78.392$.

This process was repeated for each of the seven major questions on the survey: 1) Total Dollar Amount of Technology Spending, 2) Dollar Amount Spent on Technology Hardware (see Figure 4), 3) Dollar Amount Spent on Personal Computers, 4) Dollar Amount Spent on Interactive White Boards, 5) Dollar Amount Spent on i-Pads, 6) Dollar Amount Spent on Software, and 7) Dollar Amount Spent on Technology Professional Development.

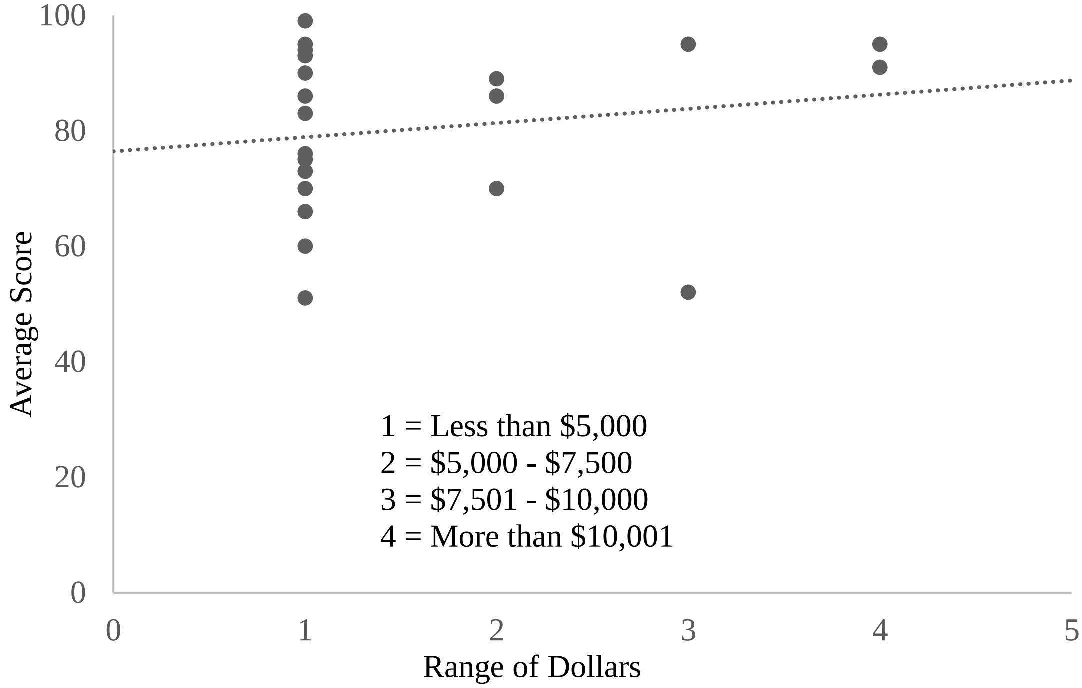

Figure 4. Scatterplot of total dollar amount spent on technological hardware versus average third-grade test scores for 2011-2012. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = 2.4545x + 76.455$.

These seven major questions were then examined at the third, fifth, and eighth grades for all academic years in question. Again, the line of best fit, equation of the line, r^2 analysis, and Pearson product-moment correlation coefficient were calculated for each of the data sets. Due to the small sample size of these data sets, data sets based on the combined mean of each building's third, fifth, and eighth-grade ITBS Core Battery means were correlated to the total dollar amount of spending in that building per year (see Figure 5). This process was repeated for the 2012-2013 and 2013-2014 school years.

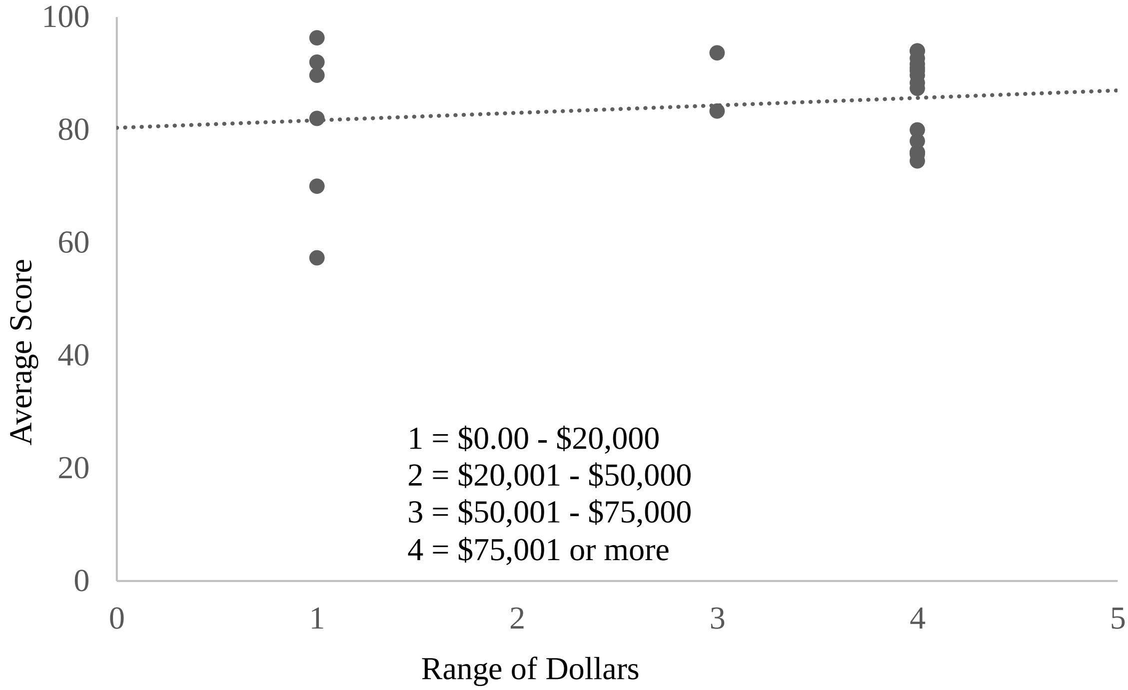

Figure 5. Scatterplot of total dollar amount of technology spending versus all average test scores for 2011-2012. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = 1.3247x + 80.36$.

To further maximize the *n* value for each individual major question under scrutiny, all third-grade test scores were combined across academic years 2011-2012, 2012-2013, and 2013-2014 (see Figure 6).

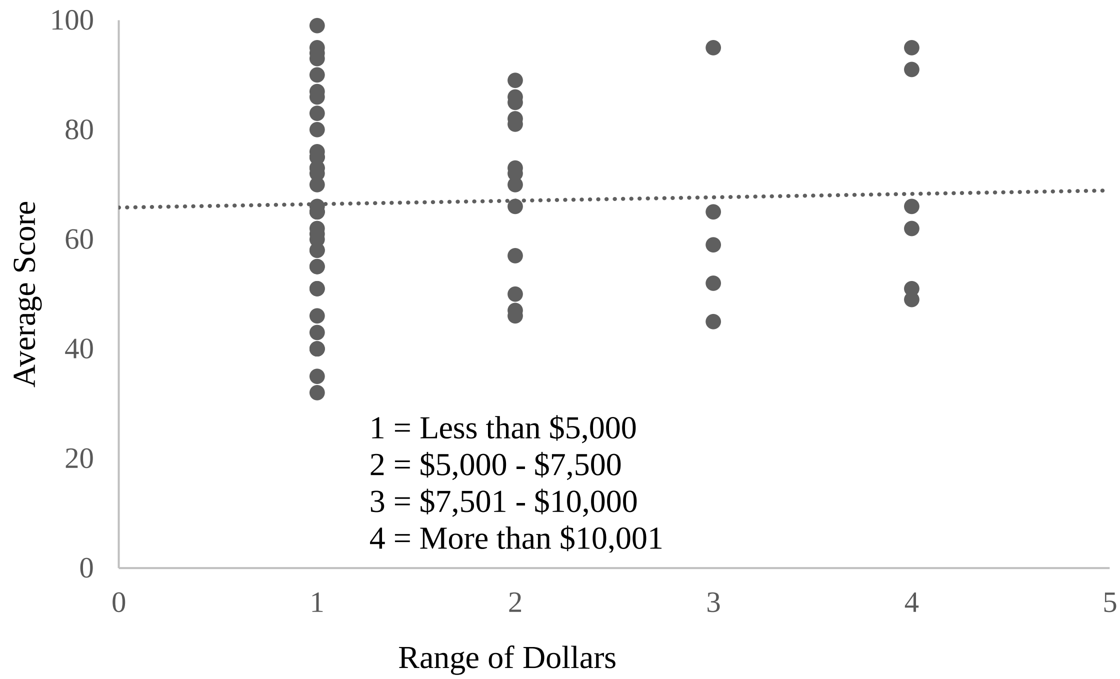

Figure 6. Scatterplot of total dollar amount spent on technological hardware versus average third-grade test scores across all academic years. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = 0.6233x + 65.810$.

Graphs were developed to understand the correlation between every third-grade test score and each of the seven major questions asked. This process was then repeated for all fifth-grade tests and all eighth-grade tests (see Figure 7).

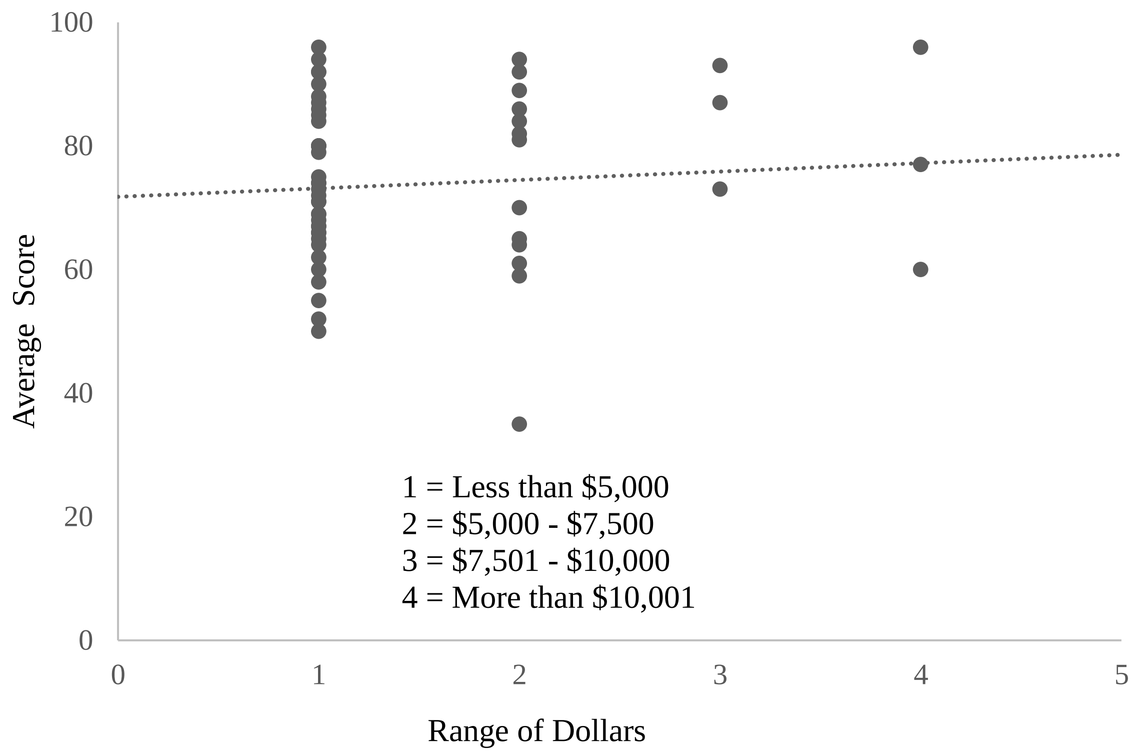

Figure 7. Scatterplot of total dollar amount spent on technological hardware versus average eighth-grade test scores across all academic years. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = 1.3601x + 71.775$.

Finally, all the scores were combined across all grade levels and all academic years to create the largest n value possible for each of the seven major questions being examined (see Figure 8).

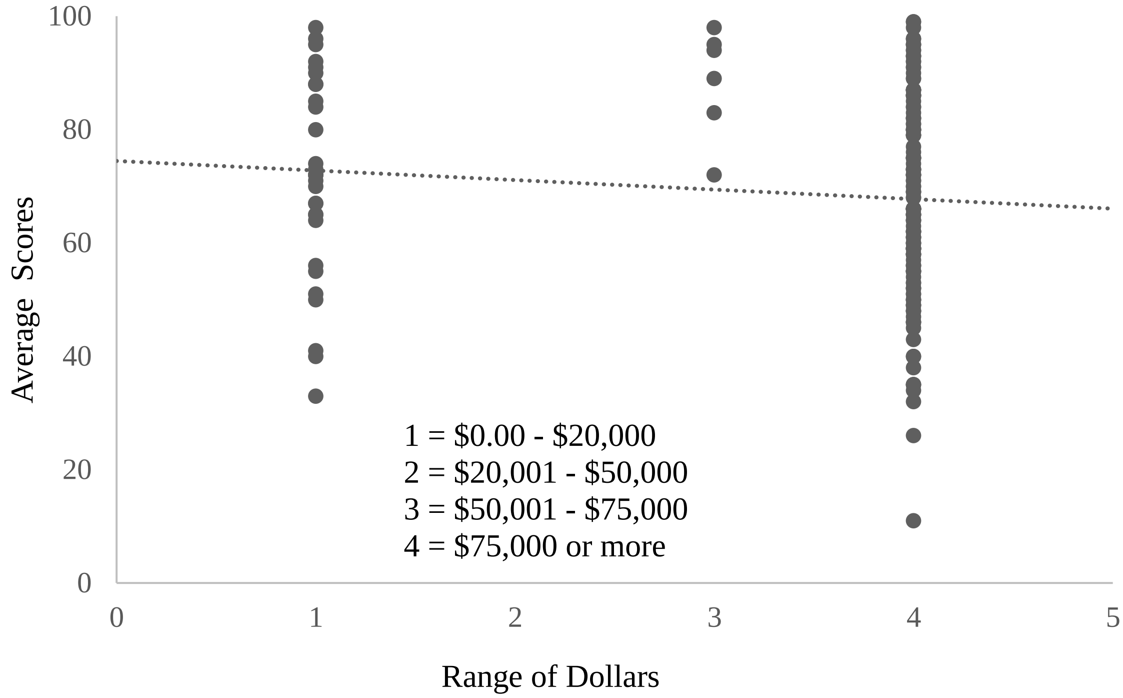

Figure 8. Scatterplot of total dollar amount spent versus average test scores across all grade levels and academic years. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = -1.6827x + 74.456$.

Data Overview: Correlation Coefficients

In all, 112 graphs and correlation coefficients were generated with the data the survey and the test scores provided. Of these, 35 had a negative correlation coefficient, meaning the more money spent in that area, the lower the test scores, with the lowest correlation coefficient for third graders in 2012-2013 against interactive white board investment (r = -0.2799) (see Figure 9).

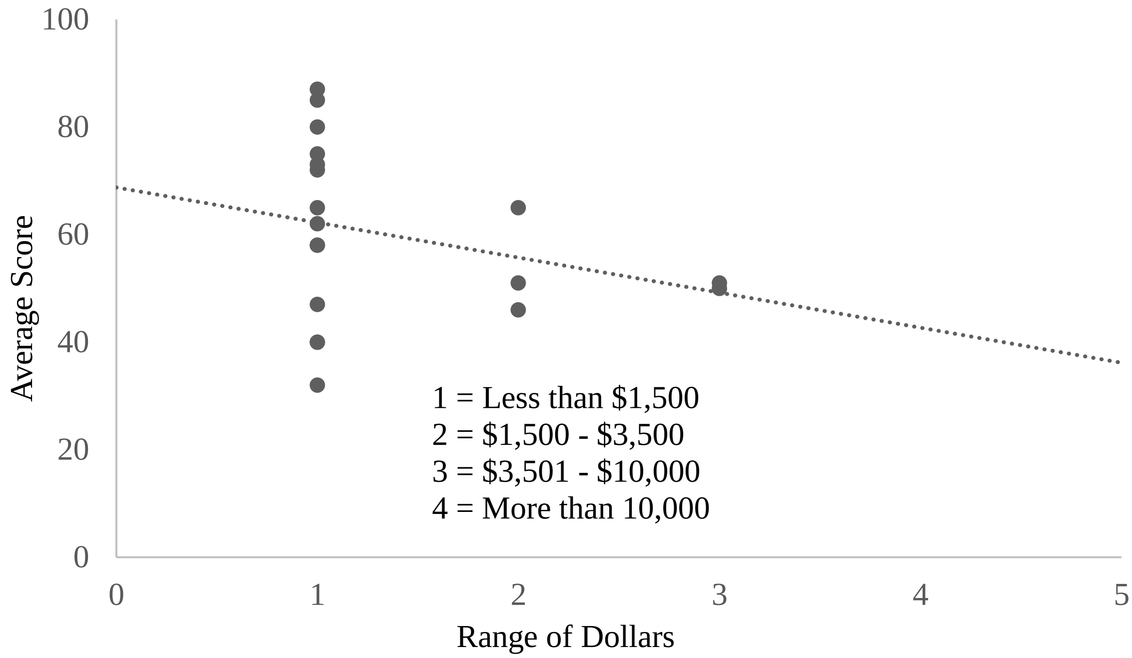

Figure 9. Scatterplot of total dollar amount spent on white boards/SMART boards versus average third-grade test scores for 2012-2013. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = -6.57188x + 68.763$.

Of the 16 graphs generated correlating the total budget of schools to student achievement, 10 had negative correlation coefficients. Of the 16 graphs generated correlating use of personal computers to student achievement, eight had negative correlation coefficients. In fact, only six correlation coefficients were near or above 0.4000 with most being significantly less. The highest correlation coefficient obtained was 0.4830, between total dollar amount spent on technological software and average test scores across all grade levels during the 2013-2014 school year (see Figure 10).

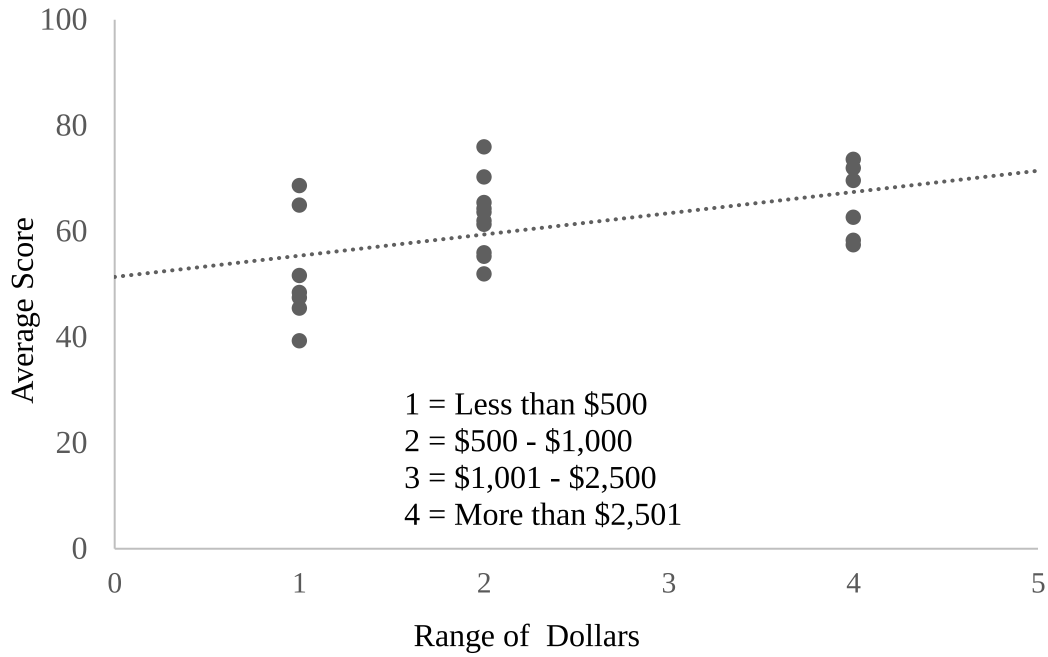

Figure 10. Scatterplot of total dollar amount spent on technology software versus average test score across all grade levels for 2013-2014. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = 4.0145x + 51.381$.

Of the six correlation coefficients hovering near or above 0.4000, two occurred in the category of i-Pad investment: fifth-grade test scores in 2012-2013 and all grades combined test scores in 2013-2014. The other four correlation coefficients near 0.4000 occurred in the area of software, with three of those occurring during the 2013-2014 academic year. The analysis of the data indicated five of the correlation coefficients in this category were negative, with the lowest being -0.1655 for third grade in 2011-2012, (see Table 1) and three negative correlation coefficients occurring in the academic year 2013-2014 (see Table 3). The highest correlation coefficient in professional development occurred in the third grade in academic year 2012-2013 with a correlation coefficient of 0.2676 (see Figure 11).

Table 1

Correlation Coefficients: Category Spending versus Grade Level and Academic Years

Academic Years	2011-12	2011-12	2011-12	Average All
Category Spending	3rd	5th	8th	All
Total Budget	0.154	0.254	-0.078	0.180
Hardware	0.171	0.260	0.343	0.291
Personal Computer	-0.014	0.174	0.057	0.024
SMART Board	0.367	0.359	0.141	0.330
i-Pads	0.330	0.253	0.224	0.278
Software	0.454	0.330	0.161	0.345
Professional Development	-0.165	0.091	0.104	0.050

Note. No correlation coefficients met the confidence interval of 95% or higher and some resulted in a negative correlation when spending amounts were compared to test scores for the years and grades studied.

Table 2

Correlation Coefficients: Category Spending versus Grade Level and Academic Years

Academic Years	2012-13	2012-13	2012-13	Average All
Category Spending	3rd	5th	8th	All
Total Budget	0.085	0.160	-0.146	-0.146
Hardware	-0.057	0.070	0.155	-0.003
Personal Computer	-0.147	0.072	-0.207	-0.010
SMART Board	-0.280	0.326	0.301	0.032
i-Pads	0.088	0.148	0.267	0.217
Software	0.101	0.106	0.032	-0.034
Professional Development	0.267	0.180	0.098	0.252

Note. No correlation coefficients met the confidence interval of 95% or higher and some resulted in a negative correlation when spending amounts were compared to test scores for the years and grades studied.

Table 3

Correlation Coefficients: Category Spending versus Grade Level and Academic Years

Academic Years	2013-14	2013-14	2013-14	Average All
Category Spending	3rd	5th	8th	All
Total Budget	-0.223	0.036	-0.053	-0.133
Hardware	-0.003	0.082	0.109	0.000
Personal Computer	0.110	-0.014	0.158	0.066
SMART Board	-0.105	-0.039	-0.038	-0.093
i-Pads	0.170	0.260	0.372	0.406
Software	0.178	0.392	0.425	0.483
Professional Development	-0.130	-0.324	0.040	-0.138

Note. No correlation coefficients met the confidence interval of 95% or higher and some resulted in a negative correlation when spending amounts were compared to test scores for the years and grades studied.

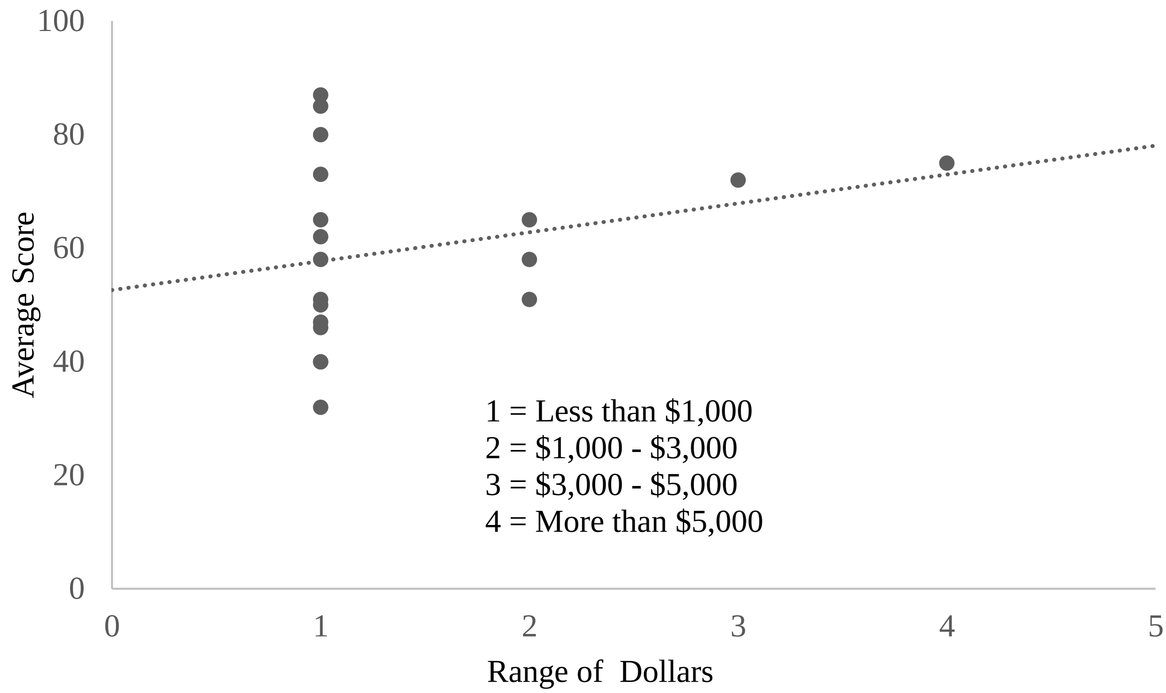

Figure 11. Scatterplot of total dollar amount spent on technology professional development versus average third-grade test scores for 2012-2013. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = 5.0875x + 52.613$.

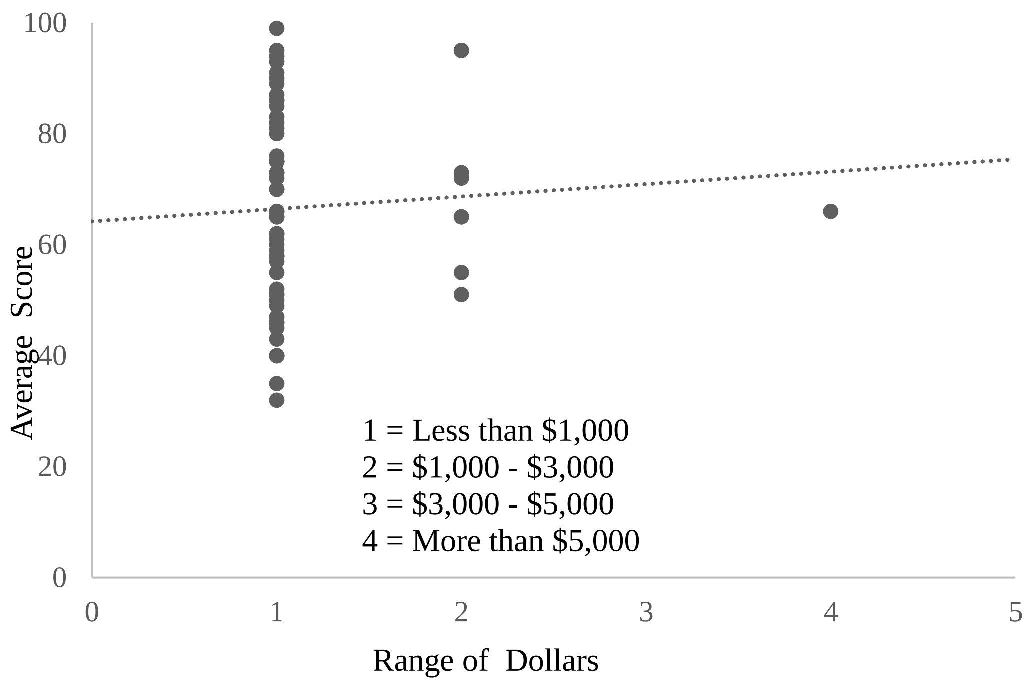

Figure 12. Scatterplot of total dollar amount spent on i-Pads versus average third-grade test scores across all academic years. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = 2.2.391x + 64.210$.

The second-highest correlation coefficient related to professional development training was for all grade levels in 2012-2013 ($r = 0.2526$). The correlation coefficient data can be presented in three graphs for comparison purposes. First, Figure 13 indicates the correlation coefficient between money spent on hardware and average building test scores across all grade levels and years. With this visual representation, the correlation between the amount of money spent on hardware and average building test scores is minimal. The data are scattered and appear to have no trend across grade levels or across years. The 2011-2012 test indicates the greatest correlation, with all grade levels indicating a positive correlation coefficient. However, the visual can be misleading, as there are no correlation coefficients above 0.3600, which is not statistically significant. The academic years 2012-2013 and 2013-2014 appear to be random in distribution across the grade levels. Furthermore, there is no trend among grade levels across the academic years. In fact, when comparing the correlation coefficients between money spent on hardware versus software versus technology-related professional development against average building test scores, the correlation coefficient values calculated for expenditures for technology hardware were the most random and the lowest in value relative to the other areas of study.

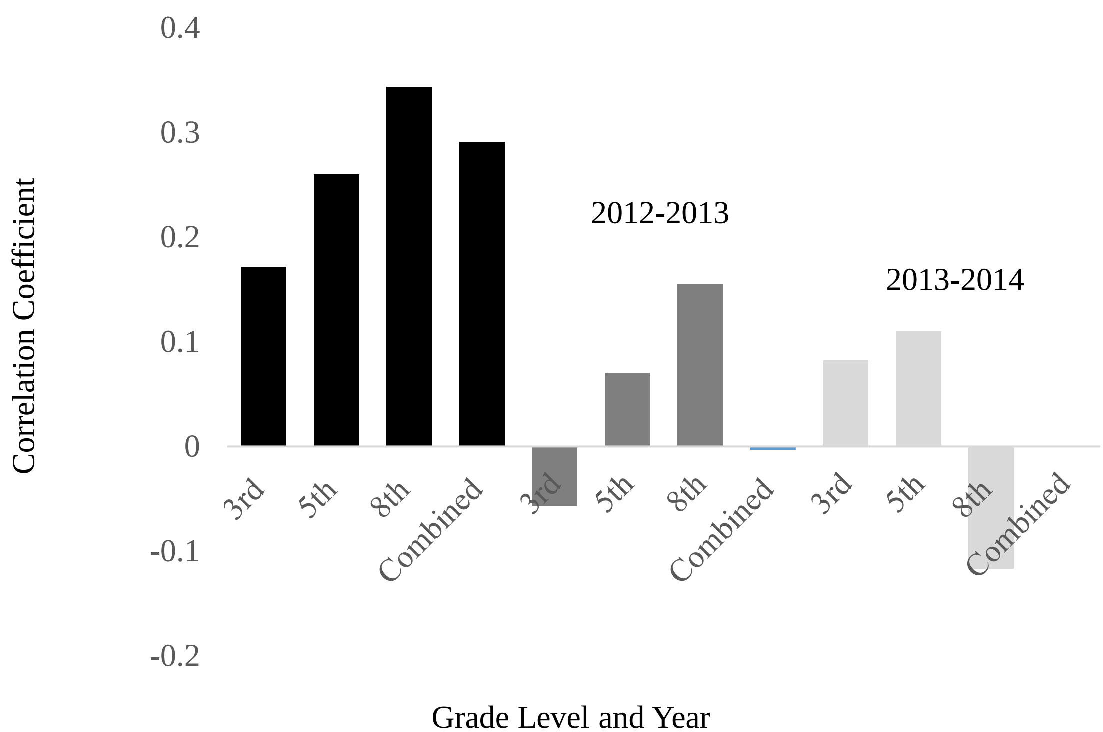

Figure 13. Bar graph of the correlation coefficients between money spent on technology hardware and average building scores across grade levels and years.

The correlation between the amount of money spent on hardware and average building test scores is minimal (see Figure 14). The data are scattered and appear to have no trend across grade levels or across years. However, the correlation coefficients have positive values. No correlation coefficients are above 0.4600, which is not statistically significant as per the standard statistical practice of 95% (Bluman, 2014) (see Figure 14). The distribution across grade levels and academic years appears to be random, and there is no trend among grade levels across the academic years. Of all the correlation coefficients studied, money spent on software had the most significant positive correlation to average building test scores relative to money spent on hardware and technology-related professional development. However, it should be noted the values were not statistically significant.

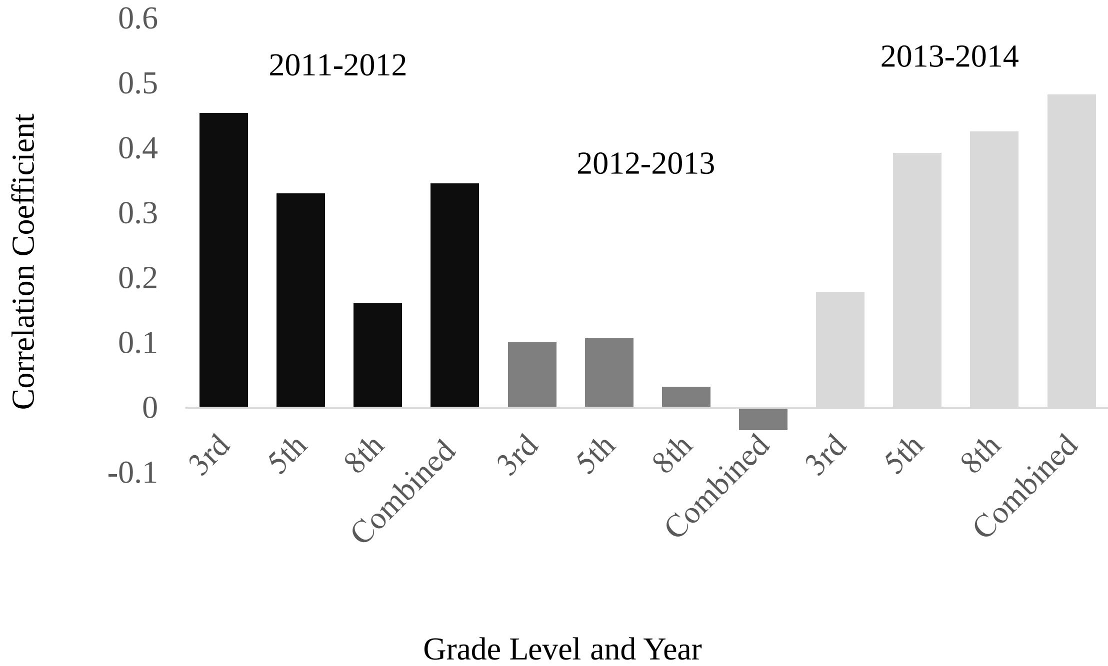

Figure 14. Bar graph of the correlation coefficients between money spent on technology software and average building test scores across grade levels and years.

The correlation coefficients for money spent on technology-related professional development and the average building test scores across the grade levels and years are shown in Figure 14. The correlation between the amount of money spent on technology-related professional development and average building test scores is minimal. The data are scattered and appear to have no trend across grade levels or academic years. The 2012-2013 test produced the greatest correlation, with all grade levels presenting a positive correlation coefficient. It should be noted there are no correlation coefficients above 0.2800, which is not statistically significant when compared to the standard of 95% (Bluman, 2014). In fact, the academic years 2011-2012 and 2013-2014 exhibit negative correlation coefficient values in some grade levels. Furthermore, there is no trend among grade levels across the academic years

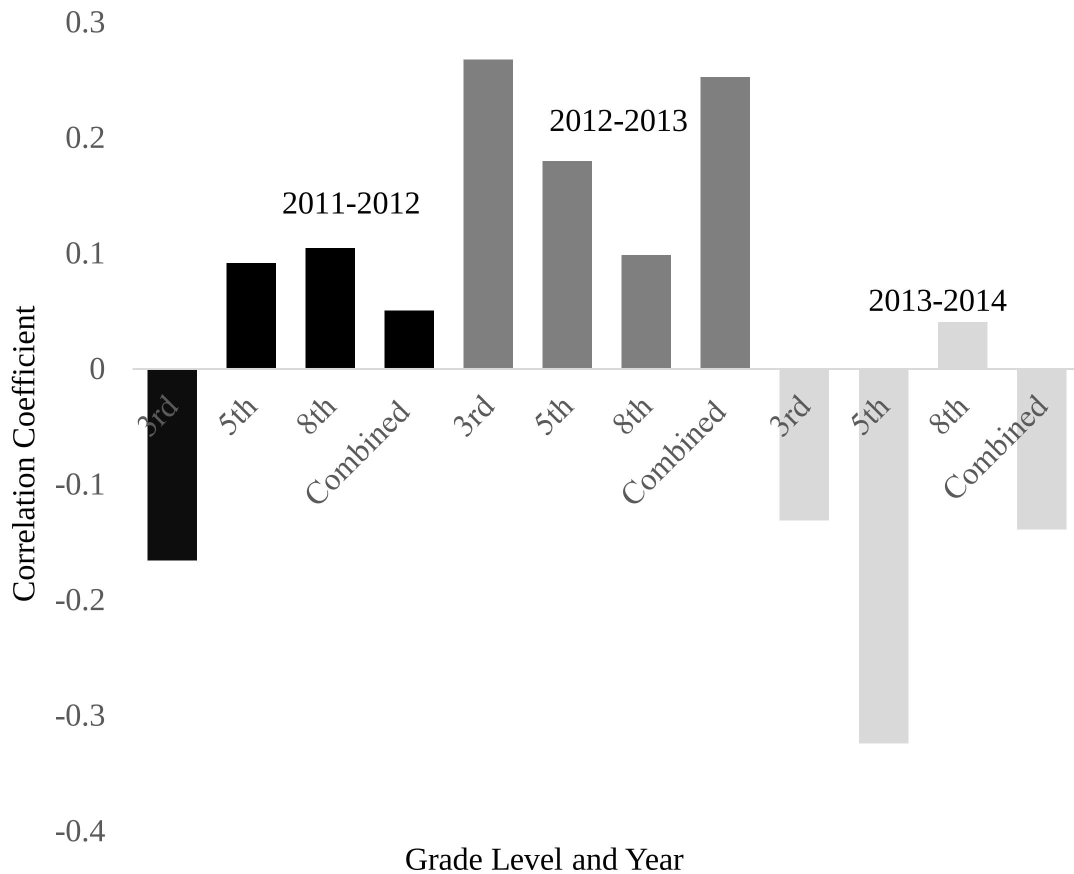

Figure 15. Bar graph of the correlation coefficients between money spent on technology professional development and average building test scores across grade levels and years.

Survey Response Distribution Errors

Of the 112 graphs and data sets generated for this research, only 38 had data points collected at each of the four possible monetary outcomes presented on the survey. This means there was uneven distribution of the data points along the graph. Fifty-six of the graphs had data points scattered among only three possible survey response values (see Figure 12). Meanwhile, 16 of the graphs had data points scattered between only two possible survey response values (see Figure 16).

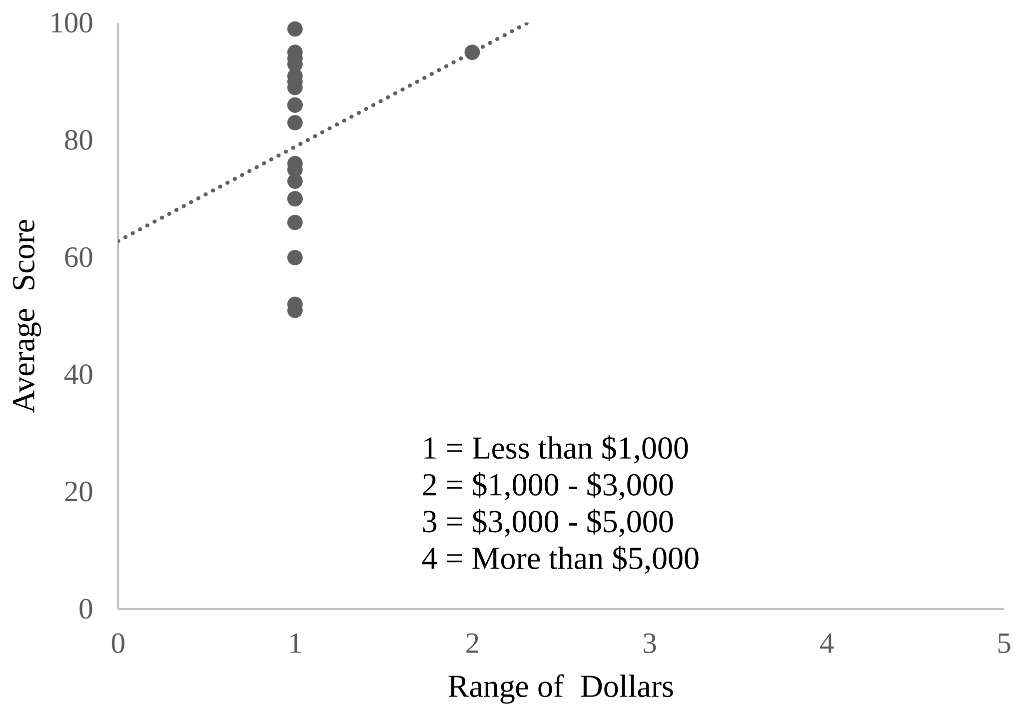

Figure 16. Scatterplot of total dollar amount spent on i-Pads versus average third-grade test scores for 2011-2012. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = 16.105x + 62.789$.

Sometimes the distribution was to one side (see Figure 16), and sometimes the distribution was split (see Figure 17). The uneven distribution of these data resulted in correlation coefficients significantly lower than the 0.9500 value desired in scientific research (Bluman, 2014).

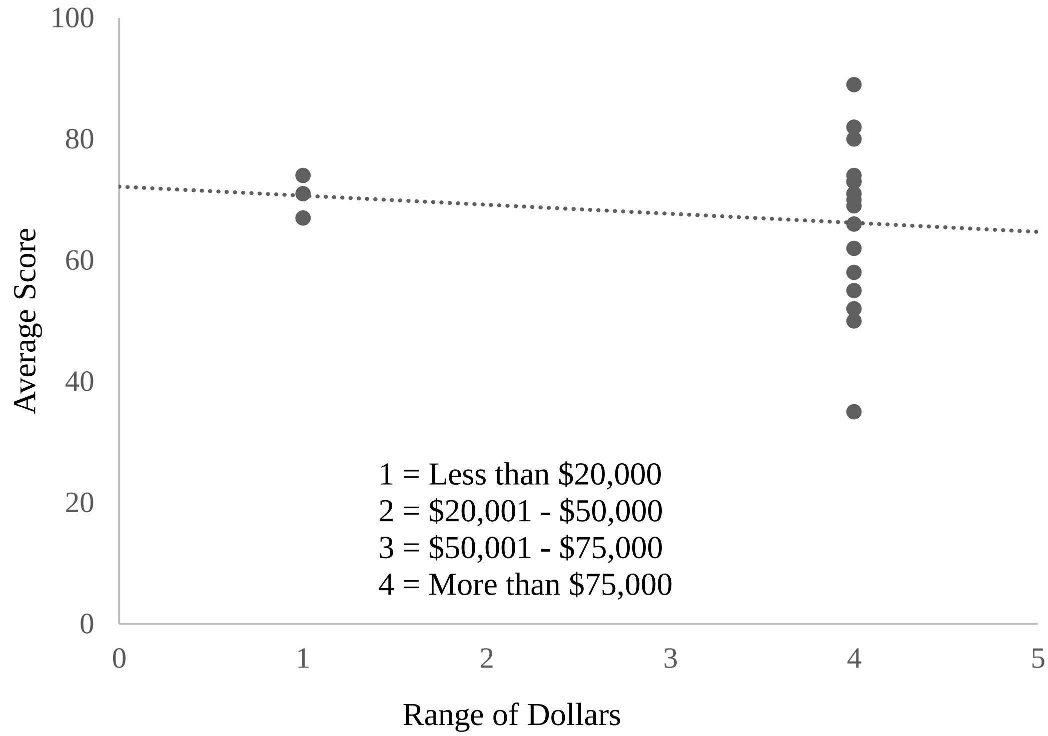

Figure 17. Scatterplot of total school technology budget versus average eighth-grade test scores for 2012-2013. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = -1.4931x + 72.160$.

Data Overview: Slope Values

In mathematics, the graph of a function is the collection of ordered pairs consisting of data collected from two variables to test the relationship that may or may not exist between the two sets of data (Blitzer, 2015). In science, engineering, technology, finance, and other areas, graphs are used for many purposes (Blitzer, 2015). In the simplest case, one variable is plotted as a function of another, typically using rectangular axes (Blitzer, 2015). There are many types of lines, curves, and shapes that can be created, but in the social sciences logarithmic, inverse, exponential, and linear relationships are the most common when sketched on a two-dimensional Cartesian plane (Blitzer, 2015). Graphing on a Cartesian plane is sometimes referred to as curve sketching (Blitzer, 2015).

The Cartesian plane is divided into four quadrants with axes labelled "*x*" and "*y*" (Blitzer, 2015). The quadrants are labelled I, II, III, and IV with quadrant I having coordinates (*x*, *y*), quadrant II having coordinates (-*x*, *y*), quadrant III having coordinates (-*x*, -*y*), and quadrant IV having coordinates (-*x* -*y*) (Blitzer, 2015). In mathematics, all four quadrants are used (Blitzer, 2015). Typically, in social sciences, only quadrant I is used, but occasionally I and IV (Blitzer, 2015). The independent variable is graphed on the *x*-axis and dependent variable on the *y*-axis (Blitzer, 2015). In this study, the amount of money spent on any given variable was the independent variable the principals could control. This information was ascertained from the surveys. The average building ITBS scores were the dependent variables.

Data points are scattered across a graph, and the investigator can determine if a logarithmic, inverse, exponential, or linear relationship exists between the scatterplot points (Blitzer, 2015). The investigator then determines the line or curve of best fit and calculates the equation associated with the shape (Blitzer, 2015). For linear relationships, the general form of the equation is $y = mx + b$ where "*m*" is the slope of the line and "*b*" is the *y*-intercept, the value of *y* when "*x*" is zero (Blitzer, 2015). After creating 112 different scatterplots, it was determined the relationship between each combination of the variables was linear. Therefore, the slope of the line ("*m*") would indicate the strength of the dependence of test scores on money spent. In addition, the *y*-intercept (or "*b*" value) would indicate what the average building test scores would have been if there was absolutely no treatment (Blitzer, 2015).

Table 4

Slope Values Across Grade Levels and Academic Years

Specific Data Grouping	Lowest Slope Value	Highest Slope Value	Average Slope Value
2011-2012 Tests Combined	-0.36223 PD$-3	16.105 IP$-3	3.3719
2012-2013 Tests Combined	-6.5188 SB$-3	12.386 IP$-5	0.2486
2013-2014 Tests Combined	-3.2719 T$A-3	7.2083 IP$-8	1.1012
Third-Grade Tests All Academic Years	-1.6945 T$A-3	2.5972 SP$-3	0.4744
Fifth-Grade Tests All Academic Years	-3.2862 PC$-5	5.1632 SB$-5	1.3865
Eighth-Grade Tests All Academic Years	-2.6757 PC$-8	5.7412 IP$-8	1.2978

Note. PD$= Professional Development money spent, IP$= i-Pad money spent, T$A= Total dollar amount spent, SP$= Software money spent, PC$= Personal Computer money spent; 3= Third Grade, 5= Fifth Grade, 8= Eight Grade. A positive slope indicates more money spent on an area correlated with increased average building test scores. A negative slope indicates more money spent on an area correlated with a decrease in average building test scores. The greater the slope value is from zero, the stronger the indication.

Theoretically, a positive slope value on any given graph indicates the more money spent in an area, the higher the test scores will be (see Table 4) (Blitzer, 2015). The greatest positive slope value was found to be in association with i-Pad usage; however, because most of the graphs had only two data points utilized on the x-axis, these data were considered outliers (Blitzer, 2015). Therefore, the highest slope values with all four data sets along the *x*-axis were found in the areas of software, third grade, 2011-2012 (m = 6.0960) (see Figure 18); training, third grade, 2012-2013 (m = 5.0875); software, fifth grade, 2011-2012 (m = 4.3083); hardware, fifth grade, 2011-2012 (m = 3.2932); and software, all grades combined, 2011-2012 (m = 3.1519) (see Table 3).

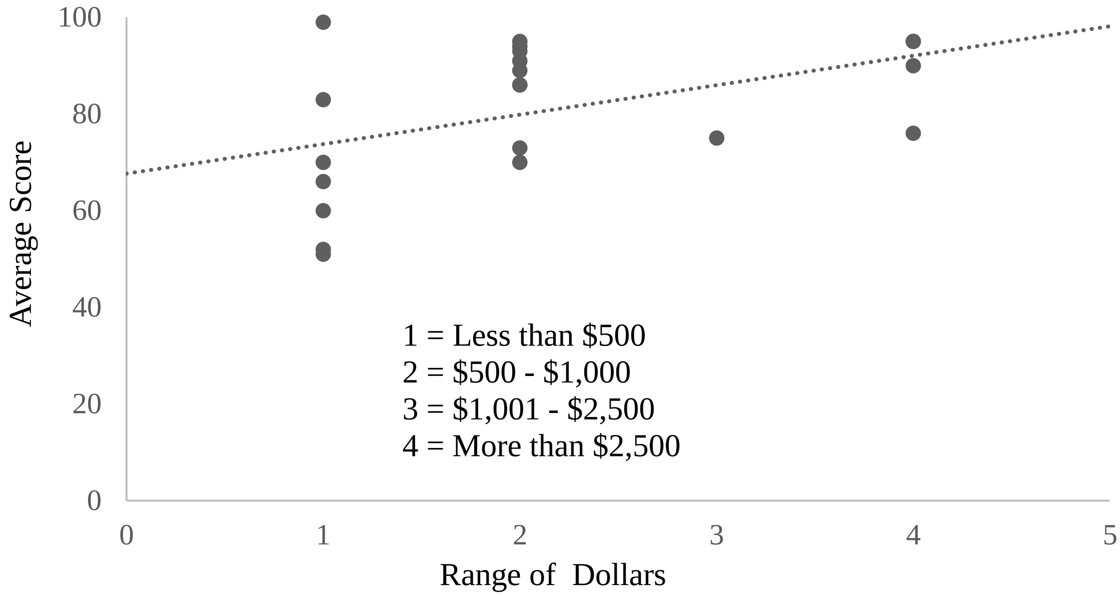

Figure 18. Scatterplot of total dollar amount spent on technology software versus average third-grade test scores for 2011-2012. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = 6.096x + 67.656$.

Table 5

Slope Values According to Question with Combined Grade Levels and Academic Years

Budget Item	Average Slope Value Across All Grade Levels and All Academic Years
Total Budget Spent on Technology	-1.6827
Hardware	0.9937
Personal Computers	-2.7285
White Boards / SMART Boards	3.0774
i-Pads	4.1093
Software	2.3217
Professional Development	-0.1831

Note. Slope values per question with combined grade levels and academic years. A positive slope indicates more money spent on an area correlated with increased average building test scores. A negative slope indicates more money spent on an area correlated with a decrease in average building test scores. The greater the slope value is from zero, the stronger the indication.

Of the 112 permutations of data comparisons performed, 77 had positive slope value, indicating an increase in money spent also increased the test scores in 68.75% of the data sets. However, this included graphs of data not distributed across all four potential survey responses. Of the 38 permutations of data that had distributions across all four possible *x*-values, 22 had positive slope values.

Data Overview: Y-Intercept Values

Theoretically, the *y*-intercept values represent what the average building test scores would have been if no money was spent on each of the items studied in the survey administered to the 23 building principals according to the linear model established for each data set (see Table 6). According to the data, overall software purchases as well as i-Pad purchases are associated the most frequently with low test scores. This means, according to the linear relationship, software purchases and i-Pad purchases actually had the least effect on increasing ITBS scores. The highest graphical *y*-intercept values were associated with total dollars spent, white board / SMART board purchases, and personal computer purchases. This means without the use of these dollars, some of the student groups would have achieved average scores between 68.763 and 88.834 in some buildings. Overall, average test scores with no treatment at all would have been between 58.478 and 79.760 depending on the sub-grouping of students examined (by academic year with combined grade levels or by individual grade levels with combined academic years).

Table 6

Y-Intercept Values Across Grade Levels and Academic Years

Specific Data Groups	Lowest Y-Value	Highest Y-Value	Average Y-Value
2011-2012 Test Scores Combined	67.678 SP$- 3	88.834 T$A- 8	79.760
2012-2013 Test Scores Combined	43.561 IP$-5	68.763 SB$- 5	58.478
2013-2014 Test Scores Combined	43.128 SP$- 5	71.772 T$A- 3	59.130
Third-Grade Test Scores 2012, 2013, 2014	61.079 SP$- 3	72.825 T$A- 3	66.52
Fifth-Grade Test Scores 2012, 2013, 2014	58.357 SB$- 5	71.593 PC$- 5	63.873
Eighth-Grade Test Scores 2012, 2013, 2014	67.073 IP$- 8	80.115 T$A- 8	72.580

Note. SP$ = Software Purchases; IP$ = i-Pad Purchases; T$A = Total Dollar Amount Spent; SB$ = SMART Board/White Board Purchases; PC$ = Personal Computer Purchases; 3 = Third Grade; 5 = Fifth Grade; 8 = Eighth Grade. The y-intercept is theoretically what the average building test scores would be if no money had been spent in an area per the graphical mathematical model.

When all the test scores are combined across grade levels and academic years and the *y*-intercept values are examined by purchase type, the purchase of software and i-Pads had the lowest *y*-intercept values, meaning these purchases affected average test scores the most. Without the use of software and i-Pads, the average student test score across the diocese would have been 63.477 for software purchases and 63.782 for i-Pad purchases. The highest *y*-intercept values were associated with total budget and personal computer purchases. This indicates the total budget expenditure and personal computer purchases had the least effect on average test scores across the diocese; without any expenditure on technology or specifically on personal computers, students still would have averaged 74.456 and 73.397, respectively (see Table 7).

Table 7

Y-Intercept Values According to Question with Combined Grade Levels and Academic Years

Budget Item	Average Y-Intercept Value Across Grades 3, 5, 8 and Academic Years 2011-2012, 2012-2013, 2013-2014
Total Budget Spent on Technology	74.456
Hardware	67.010
Personal Computers	73.397
White Boards / SMART Boards	64.290
I-Pads	63.782
Software	63.477
Professional Development	68.879

Note. The *y*-intercept is theoretically what the average building test scores would be if no money had been spent in an area per the graphical mathematical model.

Findings from Research Question One

The first research question (Is there a statistically significant correlation between student achievement at the third, fifth, and eighth-grade levels and the amount of money spent on technology hardware?) was analyzed using the Pearson product-moment correlation coefficient, the slope of the scatterplot, and the *y*-intercept of the scatterplot taken from the linear relationship created between the average building test score at third grade, fifth grade, eighth grade, and combined grade levels against the amount of money spent on technology software across the academic years 2011-2012, 2012-2013, and 2013-2014. All the average building test scores were combined for this analysis so the greatest *n* value was analyzed, theoretically offering the most statistically accurate interpretation research of the question (Bluman, 2014).

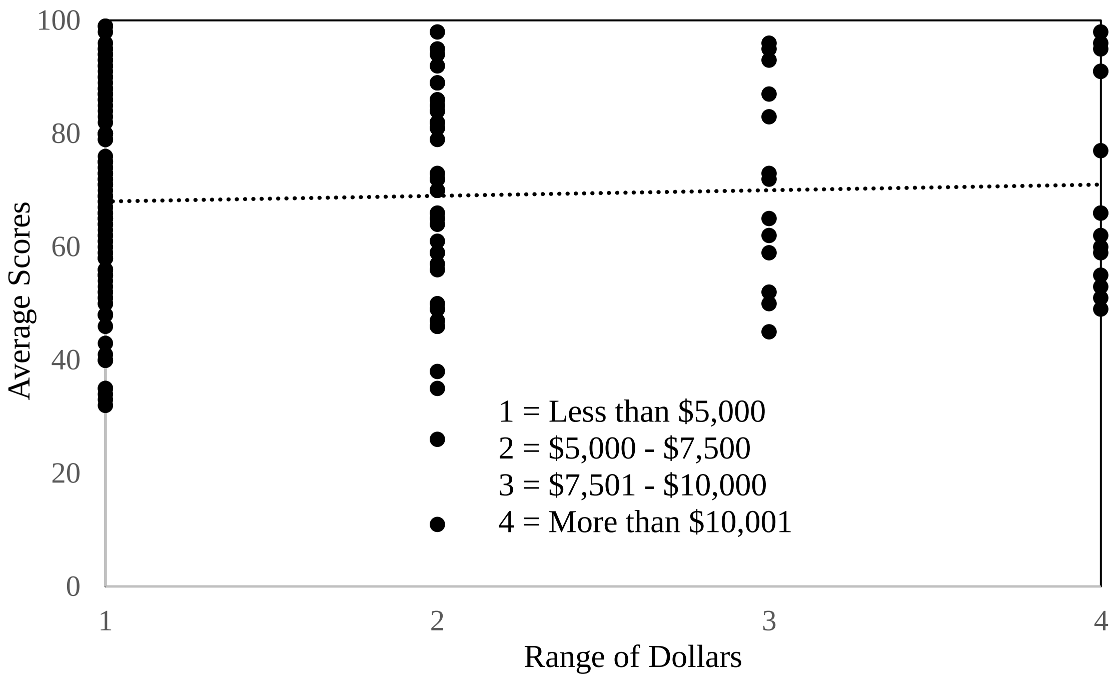

Figure 19. Scatterplot of total dollar amount spent on technology hardware versus average building test scores across all academic years and all grade levels. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = 0.9937x + 67.010$.

As shown in Figure 19, the *y*-intercept value was 67.010. This value represents what the average building test scores would have been had no treatment (no hardware purchased) been applied to the students. The slope of the line was only 0.9937, indicating for every additional $2,500 spent on technological hardware, the test scores only increased by a little under 1%. There is a great deal of scatter in the points with a correlation coefficient of only 0.052815, far below the industry standard of 0.95 (Bluman, 2014). Therefore, there was no statistically significant correlation between student achievement at the third, fifth, and eighth-grade levels despite money spent on technology hardware.

Findings from Research Question Two

The second research question (Is there a statistically significant correlation between student achievement at the third, fifth, and eighth-grade levels and the amount of money spent on technology software?) was analyzed using the Pearson product-moment correlation coefficient, the slope of the scatterplot, and the y-intercept of the scatterplot taken from the linear relationship created between the average building test scores at the third grade, fifth grade, eighth grade, and combined grade levels against the amount of money spent on technology software across the academic years 2011-2012, 2012-2013, and 2013-2014. All the average building test scores were combined for this analysis so the greatest *n* value was analyzed, theoretically offering the most statistically accurate interpretation for this research question (Bluman, 2014).

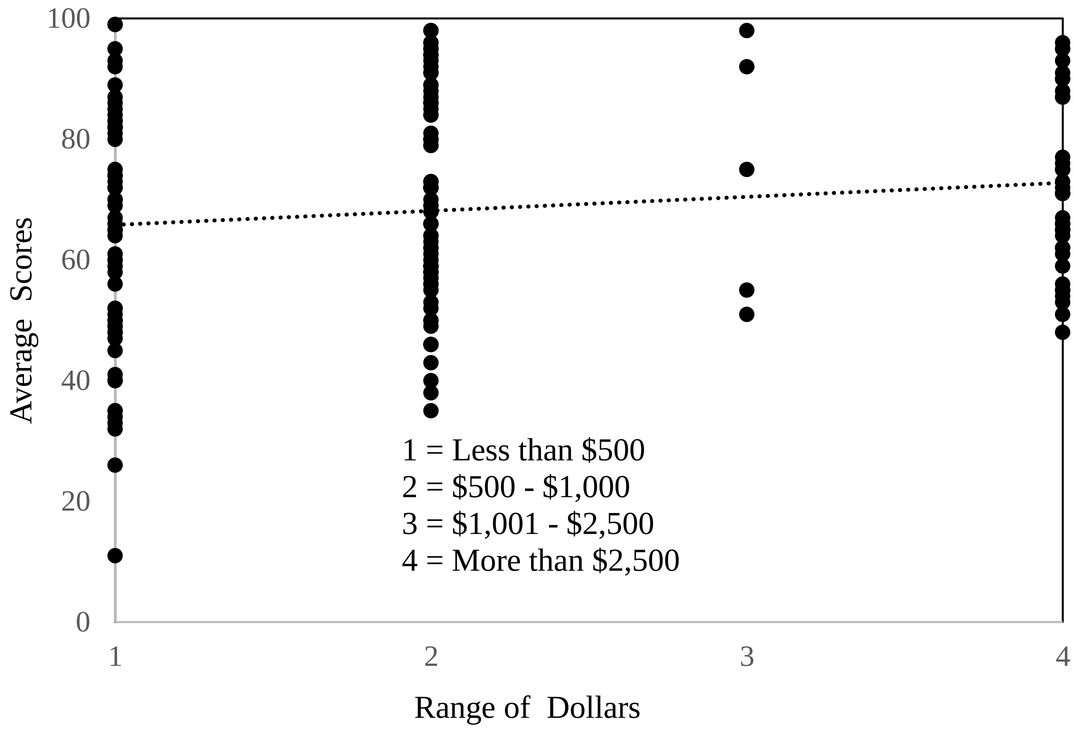

Figure 20. Scatterplot of total dollar amount spent on technology software versus average building test scores across all academic years and all grade levels. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = 2.3217x + 63.477$.

As seen in Figure 20, the *y*-intercept value was 63.477. This value represents what the average building test scores would have been had no treatment (no software purchased) been applied to the students. The slope of the line was only 2.3217, indicating for every additional $500 - $2,500 spent on technological software, the test scores only increased by a little under 2.5%. There is a great deal of scatter in the points on the graph, with a correlation coefficient of only 0.1454. Therefore, there was no statistically significant correlation between student achievement at the third, fifth, and eighth-grade levels despite money spent on technology software.

Findings from Research Question Three

The third research question (Is there a statistically significant correlation between student achievement at the third, fifth, and eighth-grade levels and the amount of money spent on technology-related teacher professional development?) was analyzed using the Pearson product-moment correlation coefficient, the slope of the scatterplot, and the *y*-intercept of the scatterplot taken from the linear relationship created between the average building test scores at the third grade, fifth grade, eighth grade, and combined grade levels against the amount of money spent on technology-related teacher professional development across the academic years 2011-2012, 2012-2013, and 2013-2014. All the average building test scores were combined for this analysis so the greatest *n* value was analyzed, theoretically offering the most statistically accurate interpretation for this research question (Bluman, 2014).

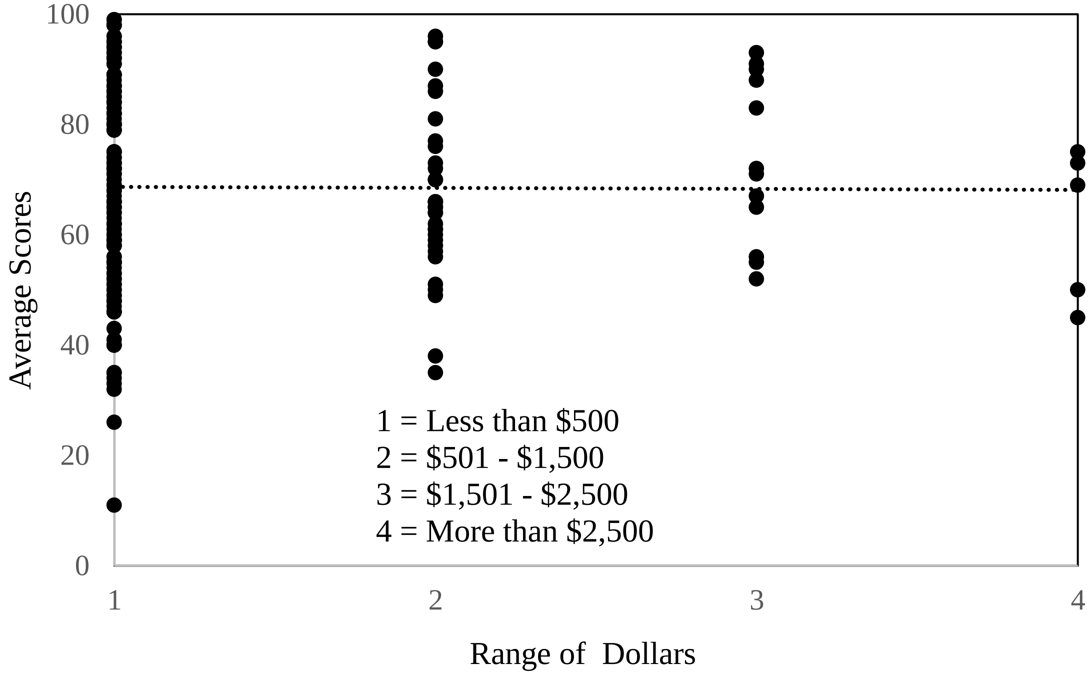

Figure 21. Scatterplot of total dollar amount spent on technology professional development versus average building test scores across all academic years and all grade levels. Solid dots represent average building test scores. The dashed line represents the trend line of the data with the equation $y = -0.1831x + 68.879$.

As seen in Figure 21, the *y*-intercept value was 68.879. This value represents what the average building test scores would have been had no treatment (no technology-related professional development) been applied to the students. The slope of the line was -0.1831, indicating for every additional $500 - $2,500 spent on technology-related professional development, the test scores decreased by a little under 0.2%. There is a great deal of scatter in the points on the graph, with a correlation coefficient of -.00763. Therefore, there was no statistically significant correlation between student achievement at the third, fifth, and eighth-grade levels despite money spent on technology-related professional development.

Summary

In many schools across the country, administrators, teachers, and parents continue to pour money and energy into providing technology in the form of hardware, software, and professional development for schools in hopes of improving student achievement (Harris et al., 2016). From the data collected and analyzed in this study, there was no statistically significant positive correlation between ITBS scores of third, fifth, and eighth-grade students and the monetary data submitted via surveys regarding technology hardware, technology software, and technology-related professional development. The confidence levels fell far below the 95% expectation set forth for the study.

The monetary responses from the surveys were analyzed against each grade level at each year. The monetary responses from the surveys were also compared against each grade level together and then against each year together to provide a more robust *n* value of test scores, compared to 23 values (corresponding to the 23 elementary schools). Overall, 112 different graphs and correlation coefficients were generated with the data from the survey and test scores provided by the schools. The analysis of the data indicated money spent on technology hardware, technology software, and technology-related professional development did not have a significant relationship to the test scores of third, fifth, or eighth graders regarding basic skills. Not a single graph of independent variable (money spent) against dependent variable (various combinations of test scores) yielded a correlation coefficient greater than 0.4000, which is far below the industry standard of 0.9500 (Bluman, 2014). In fact, some of the correlation coefficients were negative.

For each graph, the equation of the line was also calculated because the *y*-intercept is an indication of what the test scores would have been had there been no application of technology hardware, technology software, or technology-related professional development. In all cases, the baseline average building test score would have been somewhere between 50% mastery and 65% mastery at any given grade level without treatment of money spent. Overall, money spent on technology software had more positive correlations than did money spent on technology-related professional development. Money spent on technology software resulted in more positive correlation coefficients when compared to average building achievement test scores at the third, fifth, and eighth-grade levels and during any given year. These correlation coefficients tended to be higher than any of the technology-related professional development values calculated. There was minimal statistical evidence that money spent on technology improved test scores on the ITBS in grades three, five, and eight over a three-year period.

Chapter Five begins with a review of the study and an overview of the findings. The data gleaned from the findings are used to illustrate conclusions for the research as related to the three guiding questions outlined previously. These conclusions are then applied to the implications for practice as a guide for teachers and administrators as they look to the future in trying to make wise investments with regard to technology hardware, technology software, and technology-related professional development in order to yield the best possible student achievement gains. Lastly, implications for future research are suggested.

Chapter Five: Summary and Conclusions

In this chapter, the major elements of the study are reviewed. A summary of the findings explained in Chapter Four is discussed. Conclusions and implications supported by current literature are detailed. The end of the chapter is reserved for recommendations and suggestions from the researcher. In addition to the recommendations, areas of future research based upon the findings in this study are presented.

Review of the Study

Educators in the United States are facing a dilemma; they can no longer allow only a few people the luxury of technology knowledge and skills; instead, parents, teachers, and administrators must press for technology-related knowledge and skills to be the basics for students of the 21st century and beyond (Harris et al., 2016). The world is shrinking within the educational arena as everyone is interconnected through technology, and the most pressing issues of this era no longer have boundaries or borders (Carver, 2016). Being connected is no longer an option for teachers or students, as many students were born into an age that has always had “connectedness” as a standard (Witte et al., 2015).

Educators must strive to make the learning process relevant, applicable, and meaningful; fortunately, the digital age provides the ability to make learning convenient (Dede, 2014). Does the amount of technology hardware, software, or professional development implemented in schools increase student achievement? Billions of dollars are being spent to put more digital devices in the hands of students, and increasingly, educators need to be sure critical learning and global citizenship will be increased by said devices (Herold, 2016a).

It is a common misconception of educators, politicians, and parents that more money channeled to student learning will lead to higher student achievement (Green, 2015). It is also a common belief in the 21st century that students learn better with computers because computers mirror the brain's anatomical wiring (Walker, 2015). It is often believed i-Pads and computerized devices in the hands of every student in a one-to-one ratio will improve student achievement (Walker, 2015). Districts are currently spending millions of dollars to provide a device for every student in every classroom (Walker, 2015).

It is frequently assumed students learn best through fun and games delivered via software (Wright, 2016). Still others within the education community believe technology is only as good as the teachers implementing it; therefore, more money should be spent on professional development to keep teachers current on electronic devices and applications (Green, 2015). These common beliefs may be slightly false. Students most likely need exposure to computers, common technology, and various software packages because the knowledge will be needed in order to be successful in school and in the workplace of today (Green, 2015).

Most 21st-century skills build on the basic skills of reading, writing, and problem solving (Lumpkin et al., 2015). The basic skills are perhaps best acquired via the art and craft of good teaching through the interaction of children and adults, not children and electronics (Marcoux, 2015). The human brain has developed over thousands of years by passing skills from generation to generation through language, demonstration, storytelling, modeling, guided practice, independent practice, and the synergy of personal interaction (Lumpkin et al., 2015). If student achievement is going to continue to be assessed through the testing of basic skills, then the teaching must best fit the learning style required, not the use of electronics (Li et al., 2015).

Therefore, all schools, not just Catholic schools, need to carefully consider the reasons they invest in digital devices (Levenson et al., 2014). If investment in technology is so students can develop 21st-century computer application skills that may be required of them in the workforce, then the use of electronics in the classroom is applicable (Green, 2015). According to the data analyzed, this investment will not necessarily assist students in developing their ability to read, write, or problem solve as measured by the ITBS at the third, fifth, and eighth-grade levels.

A common belief among parents and educators is that technology is the vehicle through which students learn and understand the world (Prensky, 2013). In the past, keyboarding skills, computer software knowledge, and use of computer applications were taught as separate content within the schools (Levenson et al., 2014). Because of the expanded use of the internet via tablets, laptops, and cell phones, the trend in education has been to teach curriculum through the lens of technology (Wright, 2016). Perhaps educators should assess whether students already know how to manipulate user-friendly applications and should re-evaluate how learning might best be channeled through the software of a device (Ramsay & Terras, 2015).

There has been a drastic shift in educational learning modalities inside classrooms (Prensky, 2013). Teachers are encouraged, sometimes mandated, to use one-to-one computing where all learning acquisition and transmission of ideas and information is completed through the internet and technological devices (Norris & Soloway, 2014; Yuan-Hsuan et al., 2013). To facilitate this type of learning, some districts are spending millions of dollars on laptop computers, i-Pads, desktops computers, and hot spots for student personal use and home internet access (Wright, 2016). Districts are spending even more money on software for use on these devices (Blair, 2012; Ross, 2015). But the question remains, is it worth it? Are students acquiring the basic skills of reading, writing, and arithmetic any better because of these changes? Is computer application the proper avenue for learning foundational curriculum, or is computer technology usage now a basic skill to be learned itself (Sundeen & Sundeen, 2013)?

Currently, the trend is to believe computer application is the proper modality for learning foundational curriculum (Wright, 2016). Thus, districts are spending millions of dollars to train teachers to shift their pedagogical practice to thematic units and project-based learning where multiple curricular areas are integrated together (Tucker, 2012). This system typically requires students to acquire, work, learn, produce, and present in a group setting under the belief students need to develop soft skills of collaboration and cooperation (Green, 2015; Herold, 2016a). It is understood these soft skills are missing in the workforce and therefore must be developed by educators (Bellanca & Brandt, 2010). But in doing so, is the anxiety of individual accountability for learning of basic curriculum lost? Does “fun” learning with computer applications allow students to acquire more knowledge or use that knowledge with higher-level critical thinking skills?

The current culture requiring technological devices in the hands of all students is creating concern in poverty-stricken districts where educators fear their students will have less access to these 21st-century skills (Green, 2015; Herold, 2016a). This will not only make the learning of basic skills more difficult for low-income students, but will also handicap their potential employment when competing for jobs against students who have much more technology experience (Green, 2015; Herold, 2016a). The belief is that a technology-rich classroom will engage students and therefore increase the desire to learn and achieve (Collins & Halverson, 2009). It is important to investigate whether the infusion of technology in the classroom is a fad or an effective use of limited budgetary resources with regard to increasing student achievement (Hanover Research, 2014). This concept is the focus of the research of this study. In short, it is imperative for districts to determine if technology in the classroom is having an impact on student achievement (Blair, 2012).

In this case, student achievement was measured by building test scores at the third, fifth, and eighth-grade levels on the nationally norm-referenced Iowa Test of Basic Skills (ITBS) in correlation with administrator-reported expenditures for technology hardware, technology software, and technology-related professional development. The study focused on school years 2011-2012, 2012-2013, and 2013-2014. Student scores were provided by the superintendent of 23 Catholic elementary schools in a diocese in the Midwest. The findings of this study could be used by other private or parochial schools in addition to most any small public school district of similar population or size.

The survey instrument was designed by the researcher with questions drawn from a document created by Quinones et al. (1998) for the American Institutes for Research. The survey was delivered through Survey Monkey, and the answers were collected and recorded under alphanumeric code by the diocese superintendent’s office. Dependent and independent variables were analyzed using a linear regression in conjunction with a Pearson’s product-moment correlation coefficient, also known as a correlation coefficient (Creswell, 2013).

Findings

In relation to the first research question, the correlation coefficient between the amount of money spent on technology hardware and average building test scores was extremely minimal when compared to the standard of 95% (Bluman, 2014). The data were scattered and appear to have no real trend, neither across grade levels nor across years. The 2011-2012 test indicated the greatest correlation coefficient with all grade levels presenting a positive correlation coefficient, but it is important to note no correlation coefficient was above $r = 0.3600$, which is not statistically significant.

The academic years 2012-2013 and 2013-2014 appear to be random in distribution across the grade levels. Two of the correlation coefficients hovering near or above $r = 0.40$ occurred in the category of i-Pad investment (fifth-grade test scores in 2012-2013 and all grades combined test scores in 2013-2014). Of the 112 graphs analyzed, 35 had a negative correlation coefficient, meaning the more money spent in that area, the lower the test scores, with the worst correlation coefficient being for third graders in 2012-2013 against interactive white board investment ($r = -0.2799$). Of the 16 graphs of data sets generated for the major questions of how the total technology budget of a school correlated to student achievement, 10 had a negative correlation coefficient. Of the 16 graphs and data sets generated for the major question of how personal computers correlated to student achievement, only six correlation coefficients were near or above $r = 0.4000$ with most of them being significantly less.

Furthermore, there is no trend among grade levels across the academic years. In fact, when comparing the correlation coefficient between money spent on hardware versus software versus technology-related professional development against average building test scores, the correlation coefficient values calculated for hardware and funding were the most random and the lowest overall relative to the other areas of study. Money spent on hardware does not statistically positively correlate to average building test scores. One conclusion is money spent on hardware does not significantly correlate to average test scores.

In relation to the second research question, the highest correlation coefficient was r = 0.4830, and it described the relationship between the investment in software and test scores across all grade levels in the academic year 2013-2014. The other four correlation coefficients near r = 0.4000 occurred around software, with three of those occurring in 2013-2014. This may indicate a software package purchase made that year across the diocese helped students minimally. A possible conclusion is money spent on software does not affect average test scores, though it correlates more strongly than spending money on hardware (see Figure 14).

In relation to the third research question, five of the correlation coefficients in the professional development category were negative, with the lowest being r = -0.1655 for third grade in 2011-2012. The three negative correlation coefficients occurred all together in the academic year 2013-2014. The second-highest correlation coefficient related to professional development training was for all grade levels in 2012-2013 (r = 0.2526). This is because the third-highest correlation coefficient for professional development also occurred in 2012-2013 for fifth-grade test scores (r = 0.1800) (see Figure 12). Still another possible conclusion is money spent on technology professional development does not affect average test scores (see Figure 15).

The Pearson *r* correlation coefficient between money spent on technology-related professional development and the average building test scores across the grade levels and years appears to be random and possesses no line of best fit. The highest correlation coefficient was only $r = 0.2800$ in 2012-2013, and some grade levels in 2011-2012 and 2013-2014 returned a negative correlation between professional development funding and student achievement. Money spent on technology-related professional development does not significantly positively correlate to average building test scores. Of the 112 graphs and data sets generated for analysis, only 38 of them had responses at each of the four possible monetary categories presented on the survey to building principals for selection. Fifty-six of the graphs had data points scattered among three of four possible survey response values, and 16 of the graphs had data points scattered between two of four possible survey response values.

The slope values of each of the graphs generated for the data sets were also examined. Theoretically, a positive slope value on any given graph would indicate the more money spent in that area, the higher the resulting test scores (Blake, 2010). The greatest positive slope value was typically found with i-Pad usage. However, because most of these graphs returned responses in only two of the four monetary categories, the responses were outliers. Therefore, the highest slope values with responses in all four monetary categories were found in the areas of software, third grade, 2011-2012 ($m = 6.0960$); training, third grade, 2012-2013 ($m = 5.0875$); software, fifth grade, 2011-2012 ($m = 4.3083$); hardware, fifth grade, 2011-2012 ($m = 3.2932$); and software, all grades combined, 2011-2012 ($m = 3.1519$).

Of the 112 permutations performed of data comparisons, 77 had positive slope values (including all data sets). Of the 38 permutations of data with distributions across all four possible monetary categories, 22 had positive slope values. This would indicate, for the most part, an increase in money spent also increased student achievement scores in 68.75% of the data sets run. However, most of the slope values were not steep enough to conclude increasing the amount of money spent increased student achievement.

Conclusions

Just as in life, balance is the key to education and the integration of technology into the classroom (Marcoux, 2015). Ultimately it is not about how many applications can be introduced or how many devices are purchased for students, but rather it is about providing students with access, opportunities, and infrastructures to allow them to build their own futures with guidance by the classroom teacher (Bender, 2012). This study was designed to help school administrators, both public and Catholic, determine how best to utilize limited funding when purchasing technology to increase student achievement. The literature focused on three main points of interest related to technology: hardware, software, and technology-related professional development for teachers. The use of technology is ubiquitous in the educational system and within all instructional classrooms in American public and private schools (USDOE, 2012).

Districts continue to pour money and energy into providing technology in the form of hardware, software, and professional development to schools in hopes of improving test scores on basic skills (Bayse, 2014). After analyzing test scores from the ITBS for basic skills such as reading, writing, and mathematics as provided by the superintendent’s office at the third, fifth, and eighth-grade levels from 23 K-8 elementary schools and comparing them against the spending data provided by surveys completed by building principals, it can be concluded money spent on technology in these forms does not improve student achievement. The analysis of the data provided indicates technology is not necessarily the best vehicle by which students learn basic skills such as reading, writing, and arithmetic. These skills, measured by the ITBS, may be most appropriately acquired through multisensory modalities of visual stimulation, auditory stimulation, and kinesthetic stimulation (Gardner, 2015). It is possible technology in the short term may allow for learning through the constructivist approach but may create more long-term learning issues as the learner ages (Allsup, 2016). The issue with many classrooms today is the ideology that more technology equals better education, when this ideology ignores the very central role "encounter" between a teacher and a student plays in a Catholic classroom (J. Herrell, personal communication, September 15, 2015).

The question of what a Catholic school classroom should look like may be the most important question to be asked by educators (J. Herrell, personal communication, September 15, 2015). The real identity of any given Catholic classroom is defined by the relationship between the teacher and the student (J. Herrell, personal communication, September 15, 2015). If Christ is recognized as the first teacher, then His pedagogy model was one of "presence" (J. Herrell, personal communication, September 15, 2015). There may be something to be said for the theater of the classroom, the acquisition of knowledge and skills through the inundation of all the senses simultaneously. The idea a device may reduce the opportunity for sensory stimulation is one that should be considered when accepting technology as a way of learning. However, if technology is simply the vehicle through which learning occurs, it can bring added value to the classroom (Gardner, 2015). Gardner (2015) suggested educators should place equal attention on individuals who show gifts in the other intelligences: the artists, architects, musicians, naturalists, designers, dancers, therapists, entrepreneurs, and others who enrich the world in which we live.

Learning styles have more influence than teachers may realize (Gardner, 2015). Preferred styles guide the way students process information through the brain and therefore learn (Gardner, 2015). Learning styles also change the way students internally represent experiences, the way they recall information, and the words they choose (Gardner, 2015). This type of learning relates directly to the constructivist theory that suggests students take their learning directly from their social environment and personal experiences (Vygotsky, 1978). By involving more of the brain during learning, students remember more of what they learn (Gardner, 2015). Everyone has a mix of learning styles (Gardner, 2015). Some students may find they have a dominant style of learning, with far less use of the other styles (Abbott, 2014). Others may find they use different styles in different circumstances (Abbott, 2014). There is no right mix, nor are learning styles fixed (Abbott, 2014). One can develop ability in less-dominant styles, as well as further develop styles he or she already uses well (Abbott, 2014).

Because every minute seems packed with digital distractions, the opportunity to simply sit and stare into space considering positive possibilities is rare (Walker, 2015). It is possible the use of computers to research information and take in knowledge in a virtual two-dimensional world only stimulates students who are naturally good with words, numbers, and pictures (Walker, 2015). It is possible computers are simply replacing textbooks as an information input and as information repetition devices

(Walker, 2015). It is possible computers have digressed teaching techniques away from constructivist and social learning approaches (Green, 2015). Unless computers are used to create or construct a product for presentation to others in a cooperative learning setting in tandem with a self-reflective grading rubric, it is possible most students will never maximize their learning potential based on their personal learning styles (Herold, 2015).

The concepts of learning styles and multiple intelligences contributed to a style of lesson planning called the learning cycle (Safar & Alkhezzi, 2013). A learning cycle is a concept of how people learn from experience (Safar & Alkhezzi, 2013). A learning cycle has several stages or phases, the last of which can be followed by the first (Safar & Alkhezzi, 2013). Over time, researchers have contributed learning cycle steps to the theory of learning styles including John Dewey, Kurt Lewin, David Kolb and Ronald Frye, and Peter Honey and Alan Mumford (Safar & Alkhezzi, 2013).

The use of technology should be integrated in carefully crafted lessons, not be the lesson itself (Green, 2015). Computers, i-Pads, interactive white boards, and other hardware devices should be used to assist students through the learning processes so the knowledge and skills acquired are relevant, personal, and meaningful (Marcoux, 2015). Sitting behind a piece of technology while watching a video and then completing an assignment online is not a rigorous and relevant way to acquire the basic skills of reading, writing, and arithmetic (Green, 2015). Furthermore, the use of software products does not replace the engagement of the senses brought about through social interaction of well-developed lessons facilitated by human teachers and carried out by human classmates (Levenson et al., 2014). Technology alone is not always a replacement for good pedagogical personal experiences but rather should be viewed as a major component in education (Berkeley Center for Teaching & Learning, 2016).

Learning is the active engagement of experience, social interaction, and ongoing communication with the subject (Berkeley Center for Teaching & Learning, 2016). For full learning potential, both in acquisition of knowledge and its application, students must have metacognitive thinking modeled for them in uniquely human ways (Green, 2015). Lessons should include modeling, checking for understanding, dependent guided practice, and finally a weaning of the new skill through gradual independent practice (Hunter, 1983). The use of technology as a means of information relay may rob students of this gradual process (Herold, 2015).

Many educators believe learning is best done in an interpersonally rich environment, and the use of Kagan Cooperative Learning Structures in a classroom maximize that avenue (Kagan, 2014). By making the teacher a facilitator of learning, students then become the teachers and mentor each other through the learning process (Kagan, 2014). Cooperative learning is an educational approach which aims to organize classroom activities into academic and social learning experiences (Kagan, 2014). There is much more to cooperative learning than merely arranging students into groups, such as structured positive interdependence in the learning environment (Kagan, 2014).

Students must work in groups to complete tasks collectively toward academic goals and unlike individual learning, which can be competitive in nature, students learning cooperatively can capitalize on one another's resources and skills (asking one another for information, evaluating one another's ideas, monitoring one another's work, etc.) (Kagan, 2014). Furthermore, the teacher's role changes from giving information to facilitating students' learning (Allsup, 2016). Successful cooperative learning tasks are described as intellectually demanding, creative, open-ended, and involving higher-order thinking tasks (McKenzie, 2012). Students in cooperative learning settings, compared to those in individualistic or competitive learning settings, achieve more, reason more, gain higher self-esteem, like classmates and the learning tasks more, and have more perceived social support (Gardner, 2015).

Technology must be used to reinforce learning in a social context, not eliminate it (Allsup, 2016). Learning must be collaborative, cooperative, and cohesive to be shifted from short-term memory to long-term memory based on the latest brain-based learning philosophies (Prensky, 2013). Brain-based learning was founded on the concept of neuroplasticity, the model neural connections in the brain change, remap, and reorganize themselves when people learn new concepts, have new experiences, or practice certain skills over time (Jensen, 2013). Scientists determined, for example, the brain can perform several activities at once; the same information can be stored in multiple areas of the brain; learning functions can be affected by diet, exercise, stress, and other conditions; meaning is more important than information when the brain is learning something new; and certain emotional states can facilitate or impede learning (Abbott, 2014). If technology is being used to create novel experiences, give personal meaning to information, or create heightened emotional states, the use of technology to pass along basic skills of reading, writing, and arithmetic may be a waste of parent and district dollars (Levenson et al., 2014).

Edgar Dale, who presented the "Cone of Knowledge" theory, stated that after two weeks, humans will only remember 10% of what they read, 20% of what they heard, 30%

of what they saw, 50% of what they heard and saw, 70% of what they said, and 90% of what they said and did (Marzano & Simms, 2013; Wagner & Dale, 1970). The first four learning techniques are described as passive, and the last two are described as active (Marzano & Simms, 2013; Wagner & Dale, 1970). Are students simply reading computer screens or watching YouTube videos to glean information or mimic a procedure? If so, then computers are merely taking the place of textbooks, and the retention rate for information is minimal over the long term (Jabr, 2013).

If computers are being used to gather information to be assimilated into projects and presentations, that may be a better use of technology with longer-lasting effects. However, if the gathering, assimilating, and presenting occurs as a solitary endeavor, it is likely students are not experiencing the learning benefit of a synergistic cooperative human collaborative process (Jensen, 2013; Kagan, 2014). How technology is utilized within the pedagogical process needs to be carefully considered before purchases are made by public and parochial schools.

Care must also be used when creating learning environments to assure projects and presentations are not simply rearranged words, facts, and pictures in PowerPoint form (Dede, 2014). Learning must make permanent changes in the synapses of the brain as the brain re-wires so information is retained or a skill is learned (Berkeley Center for Teaching & Learning, 2016). Often students remember the emotional appeal, the fun, or the action of creating a project, but they do not actually learn or retain the information the project was intended to teach (Blake, 2010). Educators must be careful they are constantly assessing what students are learning through formative and summative assessments and not just by monitoring what students are doing through action-based rubrics (Blake, 2010).

To blend cooperative learning techniques with technology implementation, many schools are training teachers to incorporate project-based learning structures (Lumpkin et al., 2015). By using real-world scenarios, challenges, and problems, students gain useful knowledge and skills that increase during their designated project periods (Lumpkin et al., 2015). The goal of using complex questions or problems is to develop and enhance student learning by encouraging critical thinking, problem solving, teamwork, and self-management (Marcoux, 2015). The project's proposed question drives students to make their own decisions, perform their own research, and review their own and fellow students' process and projects (Knoll, 2014). The combination of collaboration, reflection, and individual decision-making gives the students an applicable scenario to real-world situations they will face as they mature (Dede, 2014). Instead of a pre-determined project or assignment, students can witness the issues or concerns in their community, discover one they find particularly interesting, and brainstorm ways to address or solve the problem (Knoll, 2014).

School becomes much more engaging through the active participation in projects focused on real-world issues rather than passively attending classes. Furthermore, project-based learning provides content and skills students can actively apply in future life events and situations (Portz, 2014). Teachers have the chance to engage with students on a higher personal level by discovering student interests and concerns and then performing important, high-quality work alongside them (Czerkawski & Lyman, 2015). Project-based learning does not allow teachers to make sure students learn all the material that may be evaluated on state-mandated tests (Czerkawski & Lyman, 2015). This technique has been particularly criticized in mathematics, physics, chemistry, and other process-driven learning where drill and practice appear to be necessary for long-term brain "muscle memory" or application of a calculation technique (Portz, 2014, p. 12).

Again, project-based learning may just use technology as a textbook and presentation tool (McKenzie, 2012). Have computer presentations simply replaced poster paper, paper foldables, worksheets, pamphlets, and display boards? If so, then is technology simply rearranging information on the reading, writing, and arithmetic levels students have already achieved as opposed to increasing these skills? Can technology improve these skills, and if so, is it through drill-and-practice software or through application of projects? Or is the use of technology a skill in and of itself?

Perhaps the synapses of the brain are most receptive to the synergy that exists between mentor and mentee in the passing of knowledge and skills. For learning to occur, permanent changes must be made to the neural junctions of the brain that permanently rewire it (Jensen, 2013). Perhaps the brain is most sensitive to information passed from human to human. Similarly, it is possible the human brain is most sensitive to learning from other humans and not from machines, though they also can provide the same knowledge (Jensen, 2013).

So where does technology fit into the curriculum? The ability to use hardware and software is a skill that must be perpetuated in and of itself as technological tools continue to progress (Levenson et al., 2014). The notion student brains are "wired" to better learn through computers appears to be false (Neupane, 2014). Students learn best through personal interaction with other students, from gifted teachers, and in small and intimate environments with constructed products created through higher-order application thinking skills (Marcoux, 2015).

Implications for Practice

Based on the findings in this study, increases in technology software, technology hardware, and technology-related professional development do not have a significant positive correlation to student achievement. As stated in Chapter One, it is important for technology integration in the classroom to increase student-led learning instead of teacher-led instruction (Pittler et al., 2012). Vygotsky's overall theoretical framework states social interaction and prior knowledge play a fundamental role in the development of cognition or learning (Scott & Palincsar, 2013). Technology in any form is merely a tool for learning (Edwards, 2012). Increasing the amount of money spent on technology hardware, software, or professional development does not automatically increase student achievement (Coughlan, 2015).

Technology in the classroom is not inherently good, bad, or neutral so much as it is different than previous generations have experienced (Prensky, 2013). Educators and citizens must make technology knowledge and skills accessible to all people. The world is shrinking in the educational arena, as humankind and machine are interconnected (Prensky, 2013). The most pressing issues no longer have boundaries or borders (Prensky, 2013). Being connected is no longer an option for teachers, because students were born into an age that has "connectedness" as a standard (Prensky, 2013). Educators must continue to strive to make the learning process relevant, applicable, and meaningful; the digital age provides educators with the ability to make learning convenient (Morris, 2014). To do this requires answering some tough questions. Does the amount of technology hardware, software, or professional development increase student achievement? Billions of dollars are being spent to put more digital devices in the hands of students, and there is a need to be sure critical learning and global citizenship will increase through the implementation of technology (The Hechinger Report, 2015).

It is a common misconception of educators, politicians, and parents the more money provided to students, the more students will achieve (The Hechinger Report, 2015). It is often believed i-Pads and computerized devices in the hands of every student in a one-to-one ratio will improve student achievement (Tucker, 2012). It is frequently assumed students learn best through fun and games provided through software (White & Martin, 2012). If learning is fun, then students will desire more knowledge and desire to come to school (Tucker, 2012). It is often believed in the education community technology is only as good as the teachers who know how to use it; therefore, more money should be spent on professional development to keep teachers current on electronic devices, technological instructions, and their applications (Walker, 2015).

However, the results presented in Chapter Four indicate these common beliefs may be slightly false. Students need exposure to computers, common technology, and various software packages because the ability to utilize technology will be necessary for success in the workplace of today (Lumpkin et al., 2015). These basic skills are perhaps best acquired through the art and craft of good teaching through the interaction of children and adults, not children and electronics. If student achievement is going to continue to be assessed through assessment of basic skills, then teaching must fit the learning style required, and that may not be using electronics. Schools should consider several factors when purchasing technology or spending dollars on professional development such as purpose of the technology, outcomes expected, and long-term impact sought by staff and students (Marx, 2015). To be good stewards of money allowed, school boards and administrators cannot simply purchase technology-based devices just to say they have them, especially in schools with limited resources (Bayse, 2014). Administrators should seek out similarly sized schools and find out what is working. They should speak with businesses and maintain their knowledge base of cutting-edge trends in the international markets. High on the needs list should be ongoing professional learning, and experimentation must take place within the school climate and culture regarding staff professional learning (Carver, 2016).

Technology in its totality is just a tool. Students and staff must be able to collaborate, problem solve, and think about how technology can be used to increase achievement (Britland, 2013). All schools, not only Catholic schools, need to carefully consider the reasons they invest in technology hardware, technology software, and technology-related professional development. If the technology investment is for students to develop 21st-century computer application skills that may be required of them in the workforce, then the use of hardware, software, and teacher professional development is applicable. The amount of money spent on hardware, software, or professional development as it relates to technology does not appear to influence an increase in student achievement as measured by ITBS test scores at the third, fifth, or eighth-grade levels.

Recommendations for Future Research

There are areas of this study that could be modified for future research to decrease the impact of the limitations and to make the unknowns less intrusive. First, future studies might include the same convenience sample of administrators with 100% participation considering the same grade levels or the same group of students over at least five years using ITBS scores compared against the amount of monies spent on technology hardware, technology software, and technology-related professional development. This study could eliminate missing years when the ITBS was not given and compare the same group of students over several years rather than multiple groups over three years.

Future researchers could investigate the individual test scores of students rather than total building averages, to hone in on dollars spent and specific outcomes. This could allow the diocese to see any trends or positive correlations when comparing the same set of students over the course of several years. An additional consideration would be to offer more budget response categories to give more in-depth data points on the graphs. There were four possible monetary category responses for principals to select on the survey, again causing chunking of data rather than a detailed distribution for analysis.

The overall average building scores did not differentiate between those schools with 10 students in a grade level or those schools in which the grade level population was 30. The overall average building scores for grades three, five, and eight over the course of three years were used, and this may have skewed the data or at the very least may not have given a robust picture of true equalized comparisons among schools. This meant there were only 23 data points represented by the 23 elementary schools, and each average test score was given the same statistical weight regardless of how many actual tests that value represented. This gave small schools the same statistical weight as large schools. Additionally, only 23 buildings were surveyed, which meant each graph only had 23 data points unless various categories were combined. Also, the buildings provided average test scores, which meant some of these values may have represented one test while others represented 100 tests. If all the individual student test scores were graphed and analyzed according to how much money was spent per school, this would dramatically increase the sample size and therefore increase the robustness of the data. For this study, the results would have increased the data points to over 1,000 student test scores per year across the three grade levels.

A more important consideration would be to increase the number of survey response categories for building principals, giving smaller increments of money and therefore a greater variation of independent variable data in the analysis. However, it must be noted the best-case scenario would be to have the actual dollar amount spent so a more statistically correct scatterplot could be created with regard to the independent variable. This might be considerably more time-consuming for the 23 building principals who received no remuneration for their services. When using a convenience sample, the investment of more time and energy may decrease the number of participating principals and therefore limit the study.

Still another possible future consideration would be comparing the classes and schools that spend the most on technology hardware, technology software, and technology-related professional development against those schools that spend very little regardless of the lack of money or the desire to stick to a strict constructivist educational pedagogy. Few long-term studies have been conducted regarding student achievement as it relates to student scores and the amount of monies spent on technology hardware, software, and professional development. Simply put, it would be valuable to compare schools that simply cannot afford to purchase technology or schools that choose not to purchase technology based on the principles of learning against those schools that spend a large portion of their budgets on technology hardware, software, and professional development as a means of integrating technology into the classroom at varied levels and intensity. A future study and consideration of those components would allow educators and stakeholders to consider technology as another tool.

An additional study could include examination of the possible correlation between student test scores and household affluence. These data could be difficult to collect, as it would require parental involvement and the disclosure of personal income levels for analysis. Examination of the possible correlation between schools with higher overall budgets and higher student enrollment with student achievement would be of interest. Because there is value in cooperative learning in a sensory-rich environment, there could be some added value in having 10 to 20 students per classroom simply for diversity of ideas and contribution to projects versus having classrooms with fewer than 10 students.

A study of the influence of the age of the teacher and level of ability using technology in the classroom would be interesting. Are more mature teachers less likely to effectively implement technological hardware and software than younger teachers who may be digital natives? When a building spends money on hardware and software, it may not necessarily mean it is being used effectively. Teachers could be polled to determine their comfort levels in the use of hardware and software. Finally, teachers could be surveyed to determine how many minutes each day students spend learning basic skills through technology and could be interviewed to determine the way they implement such teaching and learning strategies.

Summary

Stakeholders in education must endeavor to consider unintended consequences when purchasing and implementing technology hardware, technology software, and professional learning regarding technology integration strategies for the classroom. There has been a drastic shift in educational pedagogy such that teachers are strongly encouraged to be completely paperless in their classrooms, using technology for knowledge acquisition, processing, and regurgitation (Yuan-Hsuan et al., 2013). Districts feel compelled to spend millions of dollars to implement one-to-one computing and to put some sort of technological device in the hands of every student with the belief the only way students will be ready for the challenges of the future workplace is if they are always immersed in technology (Ross, 2015).

This study was designed to discover if the use of technology assisted students in acquiring the basic skills of reading, writing, and mathematics. In total, 112 scatterplot graphs and correlation coefficients were generated with the data collected from the survey and the building test scores provided. In addition to the Pearson product-moment correlation coefficient, the slope of the line and the y-intercept of each line were evaluated. The analysis of the data indicated technology is not a better vehicle for the acquisition of the basic skills of reading, writing, and mathematics. To be successful in the 21st-century workforce, students need to acquire the ability to use technological devices (Prensky, 2013). It was concluded technological skills must be added to the list of basic skills this generation of learners should be required to master for future success. The ability to use technology is a necessary basic skill but not a means for acquiring other basic skills.

This study was designed to help administrators, educators, and parents determine the best way to utilize limited funds when purchasing technology for improving student achievement in the form of basic skill acquisition. Based on this study, stakeholders should be aware of the limitations of student usage and application of technology in the classroom. Stakeholders should also be aware the amount of money spent on technology hardware, software, and professional development does not necessarily equate to a positive correlation to student achievement nor as a long-term solution to learning and instruction.

Ensuring each student has a device in hand at all times should not become the standard to which schools are held accountable. Students should have significant access to technology hardware and software for use in project-based learning, cooperative learning, researching, and presenting, but computing hardware is only one tool for learning. The amount of money spent on technology hardware, software, or technology-related professional development does not appear to increase student achievement to a positive correlation standard as measured in this study.

Appendix A

Letter Requesting Permission for Study to Bishop

December 3, 2013

Dear Bishop [redacted],

As I am nearing the final stages of my dissertation proposal, I am writing to ask for your blessing to submit/send the survey out to all administrators and teachers in [redacted] diocese. My thesis is looking at "Student Achievement vs Technology in the Catholic classroom; Correlation or Added Bonus."

I am looking for correlation between student achievement using the ITBS scores for 2011-2012, 2012-2013, and 2013-2014 across the diocese and the amount of technology hardware, software, and professional development within each elementary building. I will be using only 3rd, 5th, and 8th grades. Not only will this survey help in my fulfillment for my doctorate in education, but my hope is that we might find ways as a diocese to increase student achievement by adding technology and professional development to all our schools.

I have spoken with [redacted] and gained his approval to conduct the research as it will only be sent to adults. No children will be involved. The IRB (Institutional Review Board) must approve my application first. Everything is through Lindenwood University in St. Charles, MO, and my hope is to graduate in May. As I am quickly approaching the last deadline for this year, I pray that all will go well and I won't have to wait another year.

Please let me know if you have any questions or concerns. I look forward to hearing from you and will be happy to share the results with Mr. [redacted] and yourself if you desire. I realize you are very busy, but I wanted you to be aware that a survey would be going out to [redacted]. Thank you again for your support as I further my education and experience.

Yours,

Cheryl L Hall, EdS
Principal St Elizabeth Ann Seton Elementary
Springfield, MO

Appendix B

Letter of Introduction to Study for Building Principals

December 26, 2013

Dear Building Principal,

I am sending you this letter asking for your help in completing research for my Doctorate in Education through Lindenwood University in St Charles, MO. My research is focused on the 23 elementary school within [redacted] diocese. Specifically, I will be looking for a correlation between three years of ITBS scores and the amount of technology hardware, software, and professional development you have within each of your buildings.

The scores will come directly from superintendent [redacted], and I am asking for your participation in filling out a survey specific to your own school. It mostly deals with budgets, purchasing, and offerings of technology hardware, software, and professional development for the current school year and the past two. Your specific school information will not be shared by name, nor will any other identifying information. Each school will be coded by letter and mixed so that there is no way to know from which school the scores or budgeting information came.

While there is no compensation, I hope the result will help all of us as we endeavor to increase our student achievement and overall educational experience within [redacted] diocese. Thank you in advance for your help and willingness to fill the survey out and share your information with me. If you have any questions, please feel free to contact me. My cell phone number is [redacted] and my email is [redacted]

Sincerely,

Cheryl L Hall EdS
St Elizabeth Ann Seton Principal
Springfield, MO 65807

Appendix C

Letter to Superintendent of Schools Requesting Student Achievement Data

August 6th, 2013

Dear Mr. [redacted],

I am in the final stages of my dissertation proposal and am officially requesting ITBS scores for the 23 elementary schools within the [redacted] Diocese for the years 2011-2012, 2012-2013, and 2013-2014. I am especially interested in grades 3, 5, and 8 only. I will send introductory letters to all administrators as they will be the professionals participating in the online survey.

Thank you for your consideration and enthusiasm in assisting me in this endeavor as I continue my journey.

Yours,

Cheryl L Hall, EdS
Principal, St Elizabeth Ann Seton School
Springfield, MO

Appendix D

Informed Consent Letter

Lindenwood University
School of Education
209 S. Kingshighway
St. Charles, Missouri 63301

Informed Consent for Participation in Research Activities

Student Achievement vs Technology in the Catholic Classroom; Correlation or Added Bonus

Principal Investigator: Cheryl L. Hall

Telephone: [redacted] E-mail: [redacted]

Participant ___________________________ Contact info ___________________________

1. You are invited to participate in a research study conducted by Cheryl L. Hall under the guidance of Dr. Kathy Grover. The purpose of this research is to examine the correlation between student achievement and the amount of money spent on technology and teacher professional development surrounding that technology.

2. a) Your participation will involve:

Scores from the norm-referenced Iowa Tests of Basic Skills Test (ITBS) for all third, fifth, and eighth-grade classes across the [redacted] Diocese will be utilized. These scores will be compared against the administrator-reported amount of money spent on technology and technology professional development to determine if there is a direct relationship to the level of student achievement.

You are being asked to answer a relatively short survey regarding the money spent at your building site over the course of the last three years on technology software, technology hardware, and technology professional development.

b) The amount of time involved in your participation will be approximately 1 - 2 hours, depending on how readily available the budgetary information is to you. You will receive a thank you for your time and a copy of the research upon completion, which you may use as a resource when planning your technology budget in the future.

Approximately 23 subjects (principals) will be involved in this research by taking the survey. These 23 principals are responsible for approximately 300 teachers and approximately 2,000 students, though the teachers and students are not directly involved in the acquisition of information.

3. There are no anticipated risks associated with this research.

4. There are no direct benefits for you participating in this study. However, your participation will contribute to the knowledge about budgetary allotments toward technology and its impact on student achievement, which may be helpful to you as a building principal.

5. Your participation is voluntary and you may choose not to participate in this research study or to withdraw your consent at any time. You may choose not to answer any questions that you do not want to answer. You will NOT be penalized in any way should you choose not to participate or to withdraw.

6. We will do everything we can to protect your privacy. As part of this effort, your identity will not be revealed in any publication or presentation that may result from this study and the information collected will remain in the possession of the investigator in a safe location.

7. If you have any questions or concerns regarding this study, or if any problems arise, you may call the Investigator, Cheryl L. Hall, at [redacted] or the Supervising

Faculty, Dr. Kathy Grover, at [redacted]. You may also ask questions of or state concerns regarding your participation to the Lindenwood Institutional Review Board (IRB) through contacting Dr. Jann Weitzel, Vice President for Academic Affairs, at 636-949-4846.

I have read this consent form and have been given the opportunity to ask questions. I will also be given a copy of this consent form for my records. I consent to my participation in the research described above.

Participant's Signature Date	Participant's Printed Name
Signature of Principal Investigator Date	Investigator Printed Name

Appendix E

Survey to Building Principals via Survey Monkey

1. What was the total school budget (without donations, grants, or in-kind gifts) in 2011-2012?

    a. <$20,000 b. $20,001 - $50,000

    c. $50,001 - $75,000 d. >$75,001

2. What total dollar amount (without donations, grants, or in-kind gifts) did you spend on technological **hardware** (e.g., personal computers, Interactive Boards, i-Pads, Elmos, cables, repair, printers, etc.) in 2011-2012?

    a. <$5,000 b. $5,000 - $7,500

    c. $7,501 - $10,000 d. >$10,001

3. What dollar amount (without donations, grants, or in-kind gifts) did you spend specifically on **personal computers** in 2011-2012?

    a. <$1,000 b. $1,001 - $3,000

    c. $3,001 - $10,000 d. >$10,001

4. What dollar amount (without donations, grants, or in-kind gifts) did you spend specifically on Interactive Boards / SMART Boards in 2011-2012?

    a. <$1,500 b. $1,501 - $3,500

    c. $3,501 - $10,000 d. >$10,001

5. What dollar amount (without donations, grants, or in-kind gifts) did you spend specifically on i-Pads in 2011-2012?

    a. <$1,000 b. $1,001 - $3,000

    c. $3,001 - $5,000 d. >$5,001

6. What dollar amount (without donations, grants, or in-kind gifts) did you spend specifically on Elmos in 2011-2012?

a. <$500 c. $501 - $1,500

c. $1,501 - $2,500 d. >$2,500

7. What <u>total</u> dollar amount (without donations, grants, or in-kind gifts) did you spend on technological **software** in 2011-2012?

a. <$500 b. $501 - $1,000

c. $1,001 - $2,500 d. >$2,501

8. What total dollar amount (without donations, grants, or in-kind gifts) did you spend on technology **professional development** training (e.g., RPDC, Conventions, On-line Tutorials, In-House Guest Trainers, etc.) in 2011-2012? (Note: This does not include staff salaries if you had training during the contract day.)

a. <$500 b. $501 - $1,500

c. $1,501 - $2,500 d. >$2,501

9. As of the end of the school year in 2011-2012, how many personal computers did your building have including teacher and student computers?

a. <10 PCs b. 11 - 30 PCs

c. 31 - 60 PCs d. >61 PCs

10. As of the end of the school year in 2011-2012, what was your student population?

a. <100 Students b. 101 - 200 Students

c. 201 - 300 Students d. >301 Students

11. What was the total school budget (without donations, grants, or in-kind gifts) in 2012-2013?

a. <$20,000 b. $20,001 - $50,000

c. $50,001 - $75,000 d. >$75,001

12. What <u>total</u> dollar amount (without donations, grants, or in-kind gifts) did you spend on technological **hardware** (e.g., personal computers, Interactive Boards, i-Pads, Elmos, cables, repair, printers, etc.) in 2012-2013?

a. <$5,000 b. $5,000 - $7,500

c. $7,501 - $10,000 d. >$10,001

13. What dollar amount (without donations, grants, or in-kind gifts) did you spend specifically on **personal computers** in 2012-2013?

a. <$1,000 b. $1,001 - $3,000

c. $3,001 - $10,000 d. >$10,001

14. What dollar amount (without donations, grants, or in-kind gifts) did you spend specifically on Interactive Boards / SMART Boards in 2012-2013?

a. <$1,500 b. $1,501 - $3,500

c. $3,501 - $10,000 d. >$10,001

15. What dollar amount (without donations, grants, or in-kind gifts) did you spend specifically on i-Pads in 2012-2013?

a. <$1,000 b. $1,001 - $3,000

c. $3,001 - $5,000 d. >$5,001

16. What dollar amount (without donations, grants, or in-kind gifts) did you spend specifically on Elmos in 2012-2013?

a. <$500 c. $501 - $1,500

c. $1,501 - $2,500 d. >$2,500

17. What total dollar amount (without donations, grants, or in-kind gifts) did you spend on technological **software** in 2012-2013?

a. <$500 b. $501 - $1,000

c. $1,001 - $2,500 d. >$2,501

18. What total dollar amount (without donations, grants, or in-kind gifts) did you spend on technology **professional development** training (e.g., RPDC, Conventions, On-line Tutorials, In-House Guest Trainers, etc.) in 2012-2013? (Note: This does not include staff salaries if you had training during the contract day.)

a. <$500 b. $501 - $1,500

c. $1,501 - $2,500 d. >$2,501

19. As of the end of the school year in 2012-2013, how many personal computers did your building have including teacher and student computers?

a. <10 PCs b. 11 - 30 PCs

c. 31 - 60 PCs d. >61 PCs

20. As of the end of the school year in 2012-2013, what was your student population?

a. <100 Students b. 101 - 200 Students

c. 201 - 300 Students d. >301 Students

21. What is the total school budget (without donations, grants, or in-kind gifts) in 2013-2014?

a. <$20,000 b. $20,001 - $50,000

c. $50,001 - $75,000 d. >$75,001

22. What total dollar amount (without donations, grants, or in-kind gifts) did you spend or are you planning to spend on technological **hardware** (e.g., personal computers, Interactive Boards, i-Pads, Elmos, cables, repair, printers, etc.) in 2013-2014?

a. <$5,000 b. $5,000 - $7,500

c. $7,501 - $10,000 d. >$10,001

23. What dollar amount (without donations, grants, or in-kind gifts) did you or will you spend specifically on **personal computers** in 2013-2014?

a. <$1,000 b. $1,001 - $3,000

c. $3,001 - $10,000 d. >$10,001

24. What dollar amount (without donations, grants, or in-kind gifts) did you or will you spend specifically on Interactive Boards / SMART Boards in 2013-2014?

a. <$1,500 b. $1,501 - $3,500

c. $3,501 - $10,000 d. >$10,001

25. What dollar amount (without donations, grants, or in-kind gifts) did you or will you spend specifically on i-Pads in 2013-2014?

a. <$1,000 b. $1,001 - $3,000

c. $3,001 - $5,000 d. >$5,001

26. What dollar amount (without donations, grants, or in-kind gifts) did you or will you spend specifically on Elmos in 2013-2014?

a. <$500 c. $501 - $1,500

c. $1,501 - $2,500 d. >$2,500

27. What total dollar amount (without donations, grants, or in-kind gifts) did you or will you spend on technological **software** in 2013-2014?

a. <$500 b. $501 - $1,000

c. $1,001 - $2,500 d. >$2,501

28. What total dollar amount (without donations, grants, or in-kind gifts) did you or will you spend on technology **professional development** training (e.g., RPDC, Conventions, On-line Tutorials, In-House Guest Trainers, etc.) in 2013-2014? (Note: This does not include staff salaries if you had training during the contract day.)

a. <$500 b. $501 - $1,500

c. $1,501 - $2,500 d. >$2,501

29. As of the end of 2013-2014, how many personal computers did your building have including teacher and student computers?

a. <10 PCs b. 11 - 30 PCs

c. 31 - 60 PCs d. >61 PCs

30. As of the end of 2013-2014, what was your student population?

a. <100 Students b. 101 - 200 Students

c. 201 - 300 Students d. >301 Students

Appendix F

Institutional Review Board Approval

LINDENWOOD

LINDENWOOD UNIVERSITY ST. CHARLES, MISSOURI

DATE:	May 20, 2015
TO:	Cheryl Hall, EdD
FROM:	Lindenwood University Institutional Review Board
STUDY TITLE:	[563565-1] A Comparison of Student Achievement and Technology Budgets in the Catholic Classroom
IRB REFERENCE #:	
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
APPROVAL DATE:	May 20, 2015
EXPIRATION DATE:	May 20, 2016
REVIEW TYPE:	Expedited Review

Thank you for your submission of New Project materials for this research project. Lindenwood University Institutional Review Board has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to the IRB.
This project has been determined to be a minimal risk project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the completion/amendment form for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of May 20, 2016.
Please note that all research records must be retained for a minimum of three years.

If you have any questions, please contact Katherine Herrell at (636)627-2555 or kherrell@lindenwood.edu. Please include your study title and reference number in all correspondence with this office.
If you have any questions, please send them to IRB@lindenwood.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Lindenwood University Institutional Review Board's records.

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Vita

Cheryl L. Boze Hall is the principal at St. Elizabeth Ann Seton School in Springfield, Missouri. She holds a Bachelor's Degree in Communication with a Legal Studies minor. Mrs. Hall also holds a Master's Degree in Elementary Education and a Master's Degree in Educational Administration from Missouri State University in Springfield, Missouri. In addition, Mrs. Hall holds a Specialist's Degree from Lindenwood University in St Charles, Missouri. She is a lifelong learner and has an incredible passion for educating the whole child: spiritually, academically, and physically. Before becoming a principal, Mrs. Hall taught secondary English at Parkview High School in Springfield, Missouri.

Prior to Mrs. Hall's education career, she was a florist and managed the floral departments for a grocery chain in Missouri. Mrs. Hall belongs to a variety of professional education organizations and is active in her local community and church. When she is not working or going to school, she enjoys time with her husband and six children: Hannah, Ian, Daniel, Mary Grace, George, and Ralph. Mrs. Hall continues her floral career as a creative outlet and enjoys hanging out with her own children and those within her school.