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Integration of Technology into the Classroom Environment: A Study of Student Perceptions as Related to Skill Attainment

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Integration of Technology into the Classroom Environment:

A Study of Student Perceptions as Related to Skill Attainment

by

Richard M. Sullivan

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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.

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Signature: Richard M. Sullivan Date: April 30 2015

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Abstract

The purpose of this study was to contribute to available literature by ascertaining student perceptions of benefits of student access to technology as correlated to students' standardized test scores. Students and teachers were surveyed for perceptions of technology benefits. Survey results were analyzed and Pearson product-moment correlation coefficients were calculated comparing student perceptions to standardized Missouri Assessment Program (MAP) grade-level assessment results. As described in specific detail in this paper, it was found student standardized MAP testing data were positively correlated to the introduction of technology-integrated instruction in the classroom setting. Student perceptions indicated a more positive linear association to the support of technology in the content area of mathematics than communication arts. Teacher perceptions of technology integration into the classroom indicated the influx of technology into classroom instruction benefitted lesson preparation and availability of supporting materials.

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Chapter One: Introduction

Countless amounts of time and resources have been devoted in recent decades to the integration of technology into the classroom. While public perception is typically acceptable and encouraging of increasing technology access for students, there is continued debate as to the effectiveness of most technology integration efforts (Martinez & McGrath, 2014). Not enough research has been completed as to the effectiveness of technology integration as it relates to improved student learning in the classroom setting (Graham, Borup, & Smith, 2012; Jackson, 2013). School districts have allocated money and labor to rewrite curriculums; job targets have been written for lack of teacher effort; hours of professional development have been required; and the earth's environment has been deteriorated with landfills of used equipment all for the sake of technology integration, (Hammonds, Matherson, Wilson, & Wright, 2013; Pellegrino & Quellmalz, 2010).

Background of the Study

The purpose of the study was to examine perceptual student data of technology use in the classroom to standardized Missouri Assessment Program (MAP) grade-level test results to determine the linear correlation. Additionally, the study involved examination of teacher perceptions of technology integration into the educational environment. Major points reviewed in preparation for conducting this study relevant to technology integration into the classroom included the following:

(1) A historical review of technology in multiple settings.

(2) Educational leadership theory as pertaining to technology integration.

(3) Pre-service teacher perceptions of technology integration.

(4) Pre-service teachers' self-efficacy regarding technology integration as instructors.

(5) Systems change regarding technology.

(6) Teacher development research.

(7) Technology integration methodology, and

(8) Teacher perceptions of technology integration.

Patterns of barriers and supports relevant to successful technology integration to the classroom setting were identified.

Conceptual Framework

This study explored the perceived benefits versus actual effectiveness of technology integration into the educational setting from student and instructor points of view. The conceptual framework for this study was digital inclusion can ensure individuals have access to digital technologies to narrow the educational gap caused by socioeconomic, language, age, ability, or other factors between individual for whom technology is readily available and those for whom it is not (Real, Bertot, & Jaeger, 2014). Variance in access among groups of students, specifically students from rural areas, may result in additional negative consequences from theoretical and practical gaps in learning (Real, Bertot, & Jaeger, 2014).

Statement of the Problem

Today, classrooms in the United States look largely as they did over 30 years after the U.S. Department of Education report, *A Nation at Risk* (Christensen, 2008). Although there has been much effort to equip students with computers, the teaching and learning processes are very similar to what they have been over the last 50 years

(Christensen, 2008). How do we transform teacher, technology-integrated instruction to most effectively address the educational needs of 21st Century students?

The primary investigator for this study is a superintendent in a rural district which introduced technology hardware and software to instructors and students prior to offering a curricular implementation plan for instructional integration. To better understand the current reality of the effectiveness of instructional integration, the primary investigator compared student standardized test scale scores before and after technology implementation to teacher and student perceptions of the impact of technology in the classroom in order to determine the effect of integration efforts in regard to hardware, software, professional development programs, and student learning.

Purpose of the Study

The purpose of the research was to gain a better understanding of the impact of technology in a third through seventh-grade classroom setting and the effects on student performance and subject-matter comprehension, as measured by MAP scores and correlated through perceptual survey data. The research was designed to examine perceptual data in order to compare student and teacher perceptions relating to technology-integration. Student perceptual data were compared to student standardized MAP data to determine the correlation of linear fit between technology-enhanced learning environments versus actual academic impact, as measured by the state-wide Missouri MAP test.

Research questions and hypotheses. This causal-comparative study involved comparison of standardized test scores of fifth, sixth, and seventh-grade students enrolled in a rural, low-socioeconomic K-12 school district to student and teacher perceptions of the effectiveness of technology integration as a tool for increased student learning.

The following research questions guided the study:

1. What is the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Mathematics (MA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014)?

$H1_0$: There is no correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Mathematics (MA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014).

2. What is the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Communication Arts (CA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014)?

$H2_0$: There is no correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Communication Arts (CA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014).

3. What is the correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP MA test in spring 2014?

$H3_0$: There is no correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP MA test in spring 2014.

4. What is the correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP CA test in spring 2014?

$H4_0$: There is no correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP CA test in spring 2014.

5. What are the perceptions of teacher respondents regarding technology integration in one rural, low-socioeconomic K-12 school district?

Definition of Key Terms

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

Current student. For the purposes of this study, a current student is defined as one who was enrolled at the study site for the 2014-2015 school year. The student also must have been enrolled in the same study site for the school years of 2012-2013 and 2013-2014. This enrollment timeframe allowed the primary investigator access to sequential data for statistical analysis.

Missouri assessment program (MAP). The Missouri Department of Elementary and Secondary Education (MODESE) Missouri Assessment Program (MAP assessments are given to all Missouri students grades three through high school.

Technology-enhanced instruction. Technology-enhanced instruction is an educational setting in which the students are afforded access to technology devices to support learning in the classroom. In this setting, the teacher becomes much more a facilitator of knowledge and guided inquiry, rather than a lecturer disseminating knowledge at large (Shand, Winstead, & Kottler, 2012).

Traditional teaching methods. Traditional teaching methods encompass an educational setting in which the teacher lectures and utilizes mostly chalkboards, whiteboards, multimedia projectors, and traditional textbooks to deliver information to students (O'Neil, 1995).

Limitations and Assumptions

The following limitations were identified in this study:

Sample demographics. A potential limitation of this study is the demographics of the studied area. Potential participants were recruited from a population of 210 student respondents from grades five, six, and seven for the 2014-2015 school year. The teacher surveys were given to the teachers of students of the district in grades three through seven. The students and teachers were recruited from a rural, low-socioeconomic K-12 school district.

Instrument. Two surveys were developed by the primary investigator to ascertain basic perceptions of the gained benefits students and teachers felt by having technology available for classroom use. The brief survey was targeted for all upper elementary and middle school-aged students at the K-12 school district for the study. The survey was piloted among colleagues with age/grade-level experience and revised for clarity and brevity.

The additional instrumentation from which data were drawn included the MAP grade-level assessments for English Language Arts (ELA) and Math (MA). According to a 2010 MAP Alignment Forms Validation Study: Technical Report (Taylor et al., 2010), the MODESE contracted with Human Resources Research Organization (HumRRO) and with Dr. Norman Webb as subcontractor to serve as external independent alignment entities. Taylor et al. (2010) stated, "While some researchers argue a minimum of six items is arbitrary, an assessment should include a sufficient number of items for accurate assessment of what students know to produce valid scores" (p. 52). The following process was used to align the Missouri Assessment Program (MAP) tests:

> The Missouri Department of Elementary and Secondary Education (DESE) requested an external independent alignment study of the Missouri Assessment Program (MAP) for Communication Arts-Reading and Writing, Mathematics, and Science. Specifically, the study evaluated the alignment of the MAP test forms (Grades 3 through 8 in Communication Arts and Math and Grades 5 and 8 in Science) to the Missouri Grade-Level Expectations1. Missouri uses the MAP test in the federal and state accountability programs. (p. v)

Assumptions. It is the assumption of the researcher all participant responses were offered honestly and without bias.

Summary

The study of effective technology integration is an under-represented area in research literature. This study reflects the demographics of many small, rural educational systems, which carefully balance the expenditures of day-to-day operations with the desire to move districts forward in regard to programs and technologies offered to students. Further, the primary investigator sought to gain insight into teacher and student perceptions of the benefits of technology available for student use and to identify if the potential perceived benefits actually relate to a positive gain in student learning, as evidenced by standardized MAP testing results.

In Chapter Two, the review of literature includes an explanation of the conceptual framework and discussions on historical technology integration, educational leadership, and pre-service teacher perceptions of self-efficacy. Also discussed are systems change regarding technology, effective methods of technology integration, and teachers' perceptions of technology integration. The methodology is described in Chapter Three, and in Chapter Four, the analysis of data is explained. Findings, conclusions, and recommendations for future research are contained in Chapter Five.

Chapter Two: Review of Literature

The overarching problem of the study is the lack of data relevant to teacher and student perceptions and the educational impact of technology in the classroom setting (Jackson, 2013). The purpose of this review of literature and subsequent study was to compare student perceptual data with student scores on state-level standardized assessments to gauge the effectiveness of technology integration efforts in one rural, low-socioeconomic K-12 school district. Further, the study involved the descriptive examination of teacher perspectives of classroom technology integration. The literature review which follows begins with a look back into historical technology integration.

Technology has always had a place in education, yet the swift evolution of existing technologies makes it difficult to remain relevant for any given length of time. What is now considered current may be antiquated within a year (Betrus, 2012). Educational leadership must address the concerns of successful technology integration into the classroom. With proper leadership, opportunities may be opened for increased learning and expansion of technology in the educational setting; however, leadership sets the tone for expansion, and misguided leadership may eliminate opportunity (Craft, 2012).

Pre-service teacher perceptions of self-efficacy are often grounded in lack of classroom experience. A pre-service teacher may have a distinct advantage when relating to students, as the student teacher's education has most likely included e-books, which have transformed the modern definition of a book (Kasman, Valenza, & Stephens, 2012). In the review of literature, systems change regarding technology is addressed. One of the most meaningful advantages to digital learning may be the collaborative potential of modern communication's ability to share not only voice, but text and images, allowing a complete concept to be shared globally (Fortin, 2010). An important component to effective technology integration is to ensure context and meaning are retained when using technology (Schweder & Wissick, 2011). When utilized correctly, effective technology lessons have the potential to engage students and bring the lessons to life (Shand et al., 2012). Teacher perceptions of technology integration are reviewed in this chapter. It was revealed, without proper professional development and focused leadership, technology may be seen as only a way to manage student databases and to organize information (Benson, Anderson, & Ooms, 2011).

In the review of literature for this study, technology integration history may inform research toward underlying factors regarding technology integration success in the classroom (Gonzales, 1997). An examination of leadership focus and commitment, as well as the level of professional development afforded staff, are variables which influence the integration of new ideas (Hughes, 2013). A deeper analysis is required to fully understand technology integration rather than using only one set of data from a classroom on a given day (Gonzales, 1997). This study was aimed to add to literature of the effectiveness of technology integration into the classroom setting.

Conceptual Framework

Recent comparative data on high school graduates show that many American students are not well prepared in fields of science, technology, engineering, and mathematics, and there is a persistent achievement gap according to the socioeconomic backgrounds of students (Blank, 2013). Part of the deficit may be attributed to a lack of access to high quality instructional materials and internet access for some of American's most rural children (Mardis, 2013). Mardis (2013) stated, “A fifth of U.S. children live in rural areas with limited access to the informal learning opportunities available to their metropolitan counterparts” (Mardis, 2013, p. 387).

Public perception is typically encouraging of increased technology access for students yet debate continues as to the effectiveness of most technology integration efforts (Martinez & McGrath, 2014). The conceptual framework for this study was digital inclusion can ensure individuals have access to digital technologies to narrow the educational gap caused by socioeconomic, language, age, ability, or other factors between individuals for whom technology is readily available and those for whom it is not (Real, Bertot, & Jaeger, 2014). The primary investigator examined the impact of the introduction of technologies into rural district which introduced technology hardware and software to instructors and students prior to offering a curricular implementation plan for instructional integration.

Historical Technology Integration

The historical perspective of technology integration is much older an idea than once postulated. Technology, as defined by Merriam-Webster (n.d.), refers to knowledge or a tool of innovation which enables mankind to complete any given task. Therefore, technology integration, today, through the use of microprocessors, is comparable to the methods used by the Mayans to build their temples (Pollard, 2011) or to draw hieroglyphics (Pezzati, 2012).

Technology integration began long before what would be considered today to even qualify as technology. Simple machines such as the wheel and a block-and-tackle, both defined by Dictionary.com (n.d.), would have undoubtedly been as much or more useful in the past than in today's society. What society currently thinks of as technology, when compared to computer-related devices and development, gained momentum during the Space Race (O'Brien & Sears, 2011) and Cold War Era, including a potential change in educational climate (Hoffman, 2013). The space program's need for multiple mathematical computations to be correctly and repetitively calculated led mankind in a new direction of computer application. The desire for more complex calculation may be the basis for one's initial use of technology, simply being able to do what one already can do, but faster (Dede, as cited in O'Neil, 1995).

The influx of technology into the learning environment has taken different forms. In the early 1980s, it was commonplace to find a computer in the library prohibited without authorized permission by students. Contrast this to what is seen today on many campuses where students bring their own devices to interact with teachers through electronic means instead of on paper. The digitization of a traditional chalkboard cannot be the limit of applying current technologies into the educational setting (Dede, as cited in O'Neil, 1995). Over the last few decades, however, this has been largely the case. If the reader is to reflect on his or her own classroom experiences with technology, it is likely most have been relegated largely to an electronic version of a chalkboard lesson. In order to relate to a student in a millennial classroom, "Today's teachers are expected to use modern digital technology to optimize pedagogical effects" (Yeung, Taylor, Hui, Lam-Chiang, & Low, 2012, para. 1). One of the reasons modern classrooms utilize technological devices is to enhance the educational process through student motivation (Ozel, Yetkiner, & Capraro, 2008). While the students may have been more engaged with the electronic presentation of material, many lessons could largely have been conducted on a chalkboard. Part of this dilemma is due to the lack of adequate teacher training.

The lack of adequate instructor training for technology rollouts has had a negative impact upon the success of many programs. What teachers believe technology is supposed to do for teachers and students and what really should happen during the instructional process are often not realized in the classroom. There are times when the actual teaching processes do not change with any significance (Polly & Hannafin, 2010). Teachers need training on how to use technological devices for the instructional process. Teachers often have access to computer labs without having workshops on how to use the labs (Mason, 2007). Even if educators have technology available, it is not woven into the teaching process (Ozel et al., 2008). Also, many innovations have largely been driven by the marketing plans of companies (Gonzales, 1997). The process of having teachers use devices and programs long before implementing them in an instructional setting makes sense from the standpoint of having the greatest positive effect on the instructional process. Dede (as cited in O'Neil, 1995) found the political ramifications are not so positive, as communities and boards of education often feel students should be accessing the technology devices as soon as possible.

Another dilemma for modern educators to deal with is the volume of information available to the teacher and to the student. Historically, information has been limited to teacher knowledge or textbooks and library materials on-hand. Perhaps for a big project, a book from an inter-library loan would be in order. But with technology and access to the internet, filtering the amount of information into a manageable and useful quantity has become a challenge. Generational characteristics of teachers and students have a direct effect upon the educational use of technology, as Baby Boomers, Generation X, and Millennial generations all have different expectations of technology and related applications (Werth & Werth, 2011).

All too often, teachers are expected to teach a technology tool or software use instead of subject matter. Regardless of background, teachers are expected to teach a greater volume of information, rather than acquiring training on how to infuse knowledge of teaching and subject matter through technology (Mason, 2007). There is the beginning of a shift away from training teachers on hardware and software-specific technology toward strategies of instructional effectiveness (Schaffhauser, 2009). The refresh rate of staff training for new hardware and software applications does not keep pace with the development of those technologies. The result is educators instructing students on antiquated resources (Greer, 2008). The real integration of technology into the classroom can only be achieved when the teacher has adequate instructional training and brings sound principles and practices into the classroom (Gonzales, 1997). Student projects have been found to be the most empowering and rewarding when technology use is balanced with proper technology integration (Yang, 2009).

Educational Leadership

Leadership takes many forms, some direct and some subtle. Technology advancement programs often are resisted upon initial implementation, but the changes can be successful if substantial knowledge of the technology and training is combined with effective leadership (Berrett, Murphy, & Sullivan, 2012). With the integration of technology into the classroom setting, the avenues of leadership are multi-faceted. Austin and Hunter (2013) found an expedited interest in information communication technology (ICT) funding and programming design, pushing ICT to the center of attention in some schools.

The principal of the school is traditionally thought to be one of the leading reasons for success or failure (Polizzi, 2011). To be effective, administrators and teachers need to be trained on multiple forms of technology integration from basic face-to-face research to virtual distance learning (Mann, Reardon, Becker, Shakeshaft, & Bacon, 2011). Uslu and Bumen (2012) noted unsuccessful technology integration programs may be linked to a lack of organization and support for teaching staff, which also does not foster a climate supportive of change.

To be in charge of an innovative program, such as a new technology initiative, can be intimidating. Implementation of a new program historically needs a major change in the educational approach (Killion, 2013). While national and international trends often strongly influence educational policy, each school typically approaches the strengthening of its technology programs in different ways (Austin & Hunter, 2013). The professional learning support given to staff in order for the educational delivery to be accomplished through technological means is an administrative issue (Akbulut, Odabasi, & Kuzu, 2011). Many progressive educational leaders have taken it upon themselves to stay current on technological trends and effective integration strategies (Schrum, Galizio, & Ledesma, 2011). In order for the educational leader to be prepared to engage in meaningful long-range planning, careful attention should be paid to the state and national curriculum expectations, changes, and potential funding sources to implement advancement (Duffey & Fox, 2012).

With increasing resources devoted to technology integration efforts, assessments of effectiveness have proliferated, indicating the attitude the educator is a critical component of the effectiveness of the integration of technology into the classroom setting (Uslu & Bumen, 2012). As some governmental agencies only look at short-term injections of fiscal resources to bolster programs, relatively little is often spent on the technological support to maintain initiatives once started (Austin & Hunter, 2013). The administrator needs training in fiscal responsibility. Brooks (2011) identified the general nature of many technology integration programs, which encumbered millions of dollars without a large measurable increase in learning. An administrator's perception of political changes in policy and potential funding sources, in addition to personnel management, will be increasingly important to leading successful long-range planning to meet the ever-changing climate of politics and the rapidly changing technological landscape (Persichitte, 2013).

Polizzi (2011) also suggested the principal's and educator's participation in professional development and personal technology proficiencies will largely pre-determine success or failure of the technology integration program. Mann et al. (2011) noted the benefits of scenario problem-based learning (PBL) as a means for distance learning for administrators and teachers who may not be able to attend trainings on-site. However, Killion (2013) cautioned significant mistakes can be made if districts depend on technology-delivered training as a replacement for all other forms of teacher professional development.

Problems with successful technology integration efforts identified by Berrett et al. (2012) included lack of effort from a leadership position to address the culture of schools implementing change. Further, fiscal resources for professional development are insufficient to promote the need to blend the technologies into existing classroom practice (Berrett et al., 2012). Polizzi (2011) proposed a series of five stages of the innovative process: knowledge, attitude, adoption/rejection, implementation, and lasting adoption. Killion (2013) indicated a successful technology program contains a vision and goals, standards and policies, as well as a method for practice, among other elements. The systematic methods for developing a framework for technology integration allows for individual attenuation of each step to be content or program-specific. McLeod, Bathon, and Richardson (2011) recognized three intersections of technology and leadership: (a) the tendency to teach traditional content, (b) a focus on the technology itself, and (c) lack of administrator technology implementation training.

A critical component for the leadership of a technology integration or advancement program the firm understanding of what technology can and cannot do to help teaching staff implement changes with students and to clearly explain programmatic goals (Berrett et al., 2012). Therefore, technology should be integrated into the teaching process as a tool for content or curriculum support (Polizzi, 2011). The effective technology integration leader will need to assess the ever-changing technological climate in order to promote buy-in and delivery of new technological devices and methods of student interaction to a curriculum delivery which may already be filled with requisite information and lessons designed which do not incorporate technology (Courville, 2011).

McLeod et al. (2011) found the lack of effective administrator training as the greatest negative impact with regards to successful technology integration leadership. In Killion's (2013) paper, it was suggested without proper integration of technology into a program, the misalignment may negate the positive effects expected for students. Berrett et al. (2012) identified culture of a school as a strong factor in the success of a technology integration program. Through her study, Persichitte (2013) proposed effective leadership must develop the necessary skills to make the needed decisions which may not be attainable through consensus building.

The close alignment of state and particularly national technology standards were found to be significant, when educational leaders ensured meaningful professional development was provided and local curriculum was closely aligned to expectations (Richardson, Flora, & Bathon, 2013). Polizzi (2011) found the teacher's behaviors were more dependent on competence and how often teachers used technology rather than the principal's support alone; the two seemed independent of each other. As a building or technology leader, it is critical the decision to provide staff with meaningful and long-term professional development is made, in order to improve the educational system (Duffey & Fox, 2012).

Killion (2013) found the technology-integration engagement of the teacher with students after high-quality training had a direct influence on instructional outcomes, if technology access was available after training. The common ground of mutual support was the principal's attitude toward and attendance in trainings (Polizzi, 2011). For teachers to embrace technology advancement, the applicability of the technology to the classroom setting and the support of administrators during the transition phase are essential (Berrett et al., 2012). Successful educational leaders will take into account the connectedness between meaningful professional development for administrators and teachers and communicating the needs and expectations from one to the other (Schrum et al., 2011).

The successful link found by Killion (2013) was when the process of technology integration professional development and leadership includes practice, feedback, and continuing support. If administrators treat technology integration as a value-neutral system, practitioners will have a much more difficult time devoting efforts into application to improve the educational setting (Brooks, 2011). McLeod et al. (2011) suggested training educational leaders to use technology integration to further extend the variety of tools available for educating students.

The highly effective educational technology leader will need significant continuing professional development in order to stay abreast of the changes in the field of technology for gains in student achievement to continue to be realized (Courville, 2011). The technology landscape is evolving at a very rapid pace. Technology is controlled by and of value to people, yet the successful integration of technology into the educational climate frequently meets resistance from practitioners and through misguided policies (Brooks, 2011). If educational leaders do not develop the skills necessary to advance school technology integration efforts with innovative solutions, student needs will not be met (Richardson et al., 2013).

For the highly political and competitive environment of higher education leadership preparation programs for both teachers and administrators to survive public scrutiny and promote the benefits of advancement to students, institutions will have to improve the effectiveness of their graduates (Persichitte, 2013). With increased societal demands on technology, a student of today's educational system must gain a proper technological background in order to be competitive (Brooks, 2011). For personalized learning to take place with regards to professional development of the educational leader, institutional programs must redefine the traditional methods of on-site seat-time as a stagnant component of success (Duffey & Fox, 2012). The entire field of educational leadership needs to reflect on what the students of tomorrow will need to be successful (Schrum et al., 2011), especially with state standards for leadership preparation programs.

Pre-service Teacher Perceptions of Self-Efficacy

Regardless of the name of the university and the country in which it is located, the preparatory technology training for pre-service teachers with regards to technology use and the ability to affectively engage its use in the curriculum for benefitting the learning process is a concern. Teachers are critical of the institutions which guide the pre-service teacher learning process with regards to technology integrations (Akbulut et al., 2011). Pan and Franklin (2011) identified this gap as one in need of closure. Al-Ruz and Khasawneh (2011) identified three key components of university teacher preparatory program development: (1) self-efficacy, (2) proficiency, (3) perceived usefulness (p. 78). Al-Ruz and Khasawneh (2011, p. 79) illustrated the interdependence of these components in Figure 1.

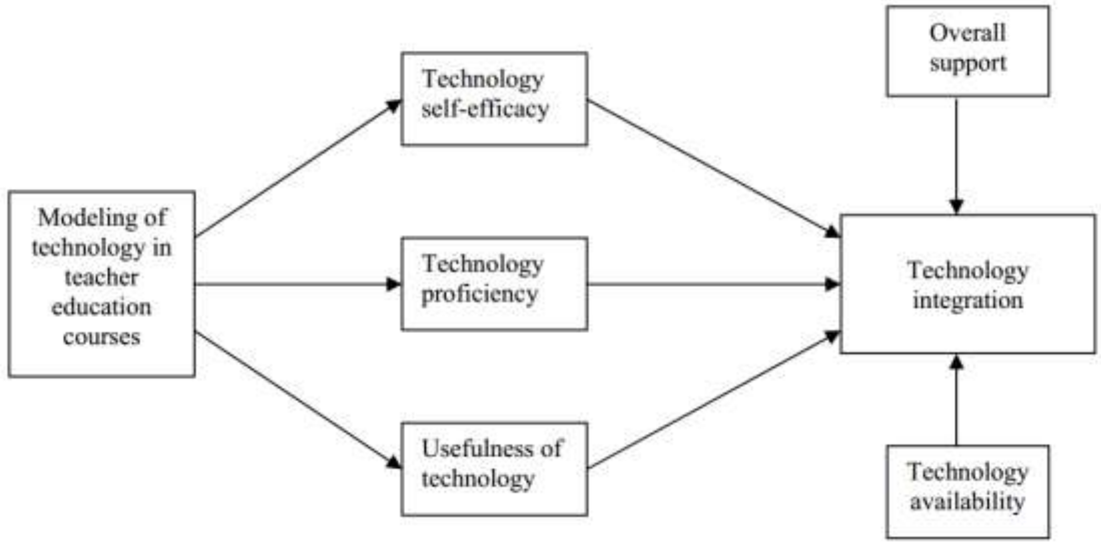

Figure 1. A model of pre-service teachers' integration of technology.

Hughes (2013) found the following four behaviors most prevalent in pre-service teacher perceptions: first was the use of technology for things directly related to teaching, second was using technology for communication and web-based activities, third were the use of software to increase efficiency or content delivery, and fourth, pre-service teachers possessed a high level of self-efficacy in various technologies which could be employed into the classroom setting. Hughes (2013) also identified the apparent stagnation of pre-service teacher preparation program experiences in universities over the last 15 years, which would allow more than sufficient time to revitalize programs to incorporate currently available technologies and associated applications to the educational setting. According to Kalota and Hung (2013), many university-level teacher preparation programs are developing methods to address the integration of technology into the classroom environment to foster better teaching and learning. Pre-service teachers have difficulty in identifying and applying appropriate educationally supportive technologies into the classroom setting (Hughes, 2013). Teachers are often given new tools to work with, yet very little formal training for application (Dede, as cited in O'Neil, 1995).

Teachers are ultimately in charge of what technology is and is not taught in the classroom. There is a running misconception pre-service teachers possess a naturally high level of self-efficacy (Aypay, Celik, Aypay, & Sever, 2012). Teachers who are well-prepared from a university with an integrated technology curriculum enter the classroom better equipped to successfully engage students for improved student achievement (Kalota & Hung, 2013). The discussion of technology integration in education has existed for years, and at the same time, has been recognized by countries around the world as a needed addition to the educational climate (Teo, 2012). While there will be continued debate over the use of technology in the classroom, it can be noted unless technology is successfully integrated into the curriculum through knowledge and support, it will not be effective (Pamuk, 2012).

To garner administrative support, Pan and Franklin (2011) found online security as an area of contention between school systems and students, which could affect the advancement of technology integration into the classroom curriculum. New teachers often lack the prerequisite technology skills for teaching students, yet the district support they receive is either non-existent or not available in advance of classroom placement (Kalota & Hung, 2013). Pamuk (2012) noted the lack of direct teaching experience or technology proficiency often results in non-efficient technology use in the classroom. Educators need a more effective technology-integration protocol, "Therefore, results suggest that modeling effective use of technology in teaching throughout the teacher education programme is necessary" (p. 435). Pan and Franklin (2011) identified web 2.0-

related materials as frequently filtered or even blocked entirely in an effort to protect students from undesirable uses or inappropriate content from the web. Teacher-preparation programs would be strengthened through the inclusion of practitioner insight (Akbulut et al., 2011).

Pre-service teachers who have either a pre-existing technological background or one developed during university study oftentimes feel restricted when trying to integrate technology into lessons (Pamuk, 2012). Restrictions to protect from real or perceived unknown e-safety concerns do not encourage teachers to integrate some potentially useful technologies into classrooms (Pan & Franklin, 2011). There should be instilled a lifelong-learner ideology into pre-service teacher preparation programs with regards to technology integration, to help ensure teachers do not fall into a pattern of only using word processing and presentation software in the classroom (Hughes, 2013).

A successful technology integration program requires more than just content knowledge and access, or the individual components will ultimately fail (Pamuk, 2012). Al-Ruz and Khasawneh (2011) found technology self-efficacy as the summative determination as to whether or not a teacher will successfully integrate technology into lessons and deliver lessons in the classroom. When given the opportunity to determine what material is to be covered with students, then ascertaining what technologies would be appropriate, teachers express technology integration is a successful part of a lesson (Graham, Borup, & Smith, 2012). Pamuk (2012) further identified the need for the development of a new form of teaching knowledge which blends content knowledge with the technology systems incorporated. To be successful, Pamuk (2012) suggested, teachers will need to examine how systems interact with one another. Acknowledgement of technology as an integral part of the learning process is evident worldwide; however, many technology integration programs to date are more focused on the technology itself, rather than the delivery of content knowledge (Graham et al., 2012).

Pan and Franklin (2011) found a significant Pearson correlation coefficient with regards to the professional development of staff having a predictive and positive relationship to web tool integration. Ham (2010) found an increase in accountability related to student outcomes versus the inputs of fiscal resources and labor put into technology-integration professional development. Kalota and Hung (2013) found many education courses designed for use of technology hardware or software, rather than how to successfully integrate the technology tools into the curriculum and the classroom environment.

Teachers need the ability to assess what content is to be covered and what technology supports would enable a better delivery of instruction (Graham et al., 2012). Al-Awidi and Alghazo in 2012 noted the United Arab Emirates University (UAEU) had installed wireless connectivity and SmartBoards to classrooms and were utilizing the program Blackboard for university courses. Al-Awidi and Alghazo (2012) indicated technology advancement was initiated in response to the desire to provide pre-service student teachers with technology experiences to take with them to the classroom, in addition to requiring a course in educational technology during the 150-credit hour program prior to the student teaching semester. Technology training must be incorporated into pre-service preparatory classes so teachers have a foundation to draw from in the classroom, reducing the likelihood of an undesirable effect upon the learning environment due to a significant lack of knowledge (Pamuk, 2012).

Al-Awidi and Alghazo (2012) found pre-service teachers to be fearful of technology problems when interacting with technology, especially when no tech support is readily available. As the generational characteristics of students change, adjustment is needed in methods used to teach a highly visual and graphics-minded group with short attention spans where work and play are increasingly intertwined (Latham & Carr, 2012). Latham and Carr (2012) expressed the need to transform from traditional teaching methodology to a riskier form of student-centered, collaborative, technology-driven teaching. Items identified may be partially attained by infusing a pre-service preparation program which incorporates online discussions and data sharing/analyses to build confidence and a working knowledge within future teachers (Al-Ruz & Khasawneh, 2011).

To help avoid frustrations, a teacher preparatory program needs carefully planned case studies to give the pre-service teacher a glimpse into what a real classroom setting will be like (Pamuk, 2012). Al-Awidi and Alghazo (2012) found a factor in successful teacher integration of technology was confidence in the educator’s own technological ability. Pre-service teachers are also likely to base some of their self-efficacy feelings on the perceptions of others, such as cooperating teachers and administrators (Al-Awidi & Alghazo, 2012). Such acknowledgement of the psychological component of self-efficacy is a contributing factor in successful teacher preparation and is extremely important in societies whose cultures strongly value social perception (Al-Awidi & Alghazo, 2012).

Many pre-service teachers feel they have a good background in the use of technology with regards to utilization, but have self-efficacy concerns when it comes to teaching with technology as an instructional tool (Pamuk, 2012). Pamuk (2012) also found pre-service teachers to be apprehensive about their abilities to teach with technology, even with adequate preparatory background, citing lack of experience as a contributing factor. Akbulut et al. (2011) found training programs for pre-service teachers with an average individual technology experience of 5.66 years to be insufficient to develop the individual to a level which may lead to successful technology integration with students in the classroom. Al-Awidi and Alghazo (2012) found surveyed respondents believed they would be successful as a result of technology-rich experiences they had while attending UAEU, and perception has previously been linked to success. Pamuk (2012) found pre-service teachers spend much more time and effort in developing a lesson through a technological format than through traditional methodologies. This finding indicates pre-service teachers become focused on the technology device or software, rather than the necessary content knowledge (Pamuk, 2012).

Lack of technology support or a supportive technology climate may prevent some pre-service teachers from utilizing the full extent of their technological integration capabilities (Teo, 2012). Findings were not related to income or technology-related experience, as verified through the cross-sectional sampling work of Akbulut et al. (2011). Teo (2012) found even though a pre-service teacher may have adequate technology training, without direction from a cooperating teacher or an administrator, they did not see a direct need to include technology in lessons. An increase in self-efficacy was found when positive feedback was provided from supervisors and cooperating teachers, and teachers felt the integration of technology aided them in helping students and ultimately made them a better teacher (Al-Awidi & Alghazo, 2012).

Since self-efficacy is a feeling rather than an action, one must assess reflective perceptions as opposed to a skills checklist (Pan & Franklin, 2011). It will be difficult for a pre-service teachers to develop new teaching methods, as they may not yet possess a true understanding of what a classroom setting is like, as well as the core content knowledge needed and technological integration skills necessary (Pamuk, 2012).

Hughes (2013) suggested the following for enhanced teacher-preparation programs: (a) access to modern, content-specific technologies; (b) meaningful technology support; (c) university faculty who are fluent in modeling software and hardware which support educational delivery systems; (d) regular professional development for college faculty to keep abreast of newly developed technologies; and (e) meaningful partnerships with schools for pre-service teachers to experience the technologies learned in university study and the practical application thereof (pp. 508-509). A solid technology background combined with a good student teaching experience can help a pre-service teacher feel more confident about self-efficacy and will increase the likelihood of technology integration, helping to bridge the divide between classroom practice and the preparatory theory learned from the university (Al-Awidi & Alghazo, 2012).

Systems Change Regarding Technology

Teachers have always had an influence upon students and self-perception; a key difference in today's classrooms is the influence of social media on the student's perception of the teacher (Carr, Zube, Dickens, Hayter, & Barterian, 2013). Howley, Wood, and Hough (2011) found the location of a school did not have a measurable effect upon technology integration, although the availability of technology and related supports did. The ever-changing student body is evident from kindergartners entering school able to use handhelds to the general student body using text messaging to communicate with family and friends (Blair, 2012). From birth, a child in today's modern society interacts with technology, either passively or actively (Germany, 2014; Ketsman, 2012). Quite a difference exists among students in regard to technology use as "11- to 14-year-olds spend 230% more time on non-school computer use than do 8- to 10-year olds" (Downes & Bishop, 2012, p. 6).

Social media may influence student perception, but there is no clear link to the perception affecting learning and information recall rates (Carr et al., 2013). This interaction has necessitated a change from the data collected during a study by Norris, Sullivan, Poirot, and Soloway (2003), who found one classroom out of seven had only one computer, leaving a multiple computer classroom as the minority. Cviko, McKenney, and Voogt (2012) indicated successful technology integration is attributed to teachers and students existing in a technology-rich environment with a positive climate and support for a technologically focused curriculum. Supports build self-efficacy, leading to more integration with students, as teachers decide to use technology rather than avoid it (Howley et al., 2011).

Indications are pre-service teachers possess more depth of knowledge in relation to technology integration than some of the current standards may reflect, as the subject of technology content knowledge is such a large and rapidly expanding pool of information (Hughes, 2013). A significant barrier to effective technology integration efforts in small, rural schools was the lack of access to dedicated technology support personnel, both in hardware/software issues and curriculum integration with students (Howley et al., 2011). Cviko et al. (2012) also found the teacher to be a key component in the successful implementation of a technology curriculum, solidifying the need for adequate supports for teachers to foster a positive technology perception to complex systems. An important part of successful technology integration is the teacher's perceived usefulness of any particular technology to the classroom setting, which can be bolstered by appropriate supports in technology devices and training (Aypay et al., 2012).

There are those who feel the push for advancement in technology access is simply a well-designed marketing plan with strong political ties to promote profit margins (Sawchuck, 2009). Anthony (2012) found institutional factors, as well as the traditionally identified teacher competency and values, to have a direct effect upon the delivery of technology integration. Blair (2012) also noted the students of a classroom today have far advanced technology skills and expectations than students did at the beginning of the 21st Century. Akbulut et al. (2011) also found men possess a more positive outlook towards technology utilization, yet females indicated a preference for a Learning Community in which to deliver technology-rich lessons, possibly explainable through social theory, rather than cognitive theory.

In contrast, many groups indicate technology in and of itself will not solve educational issues (Sawchuck, 2009). Many things such as building wiring and department curriculums were redesigned beginning in the mid-1990s to accommodate the addition of technology tool magic, which was intended to revolutionize the classroom (Robertson, 2005). Document writing and presentation software, as well as using technology to communicate, are the dominant uses of technology in the preparation and delivery of education to students (Hughes, 2013). Anthony (2012) found initial and continuous improvement plans for technology integration are a critical component of success. A lack of plans is a contributing factor to why more significant improvements may have not been seen from many technology-integration programs (Anthony, 2012).

Students sitting in today's classrooms are a group who expect quick access to information and are very social (Blair, 2012). Properly utilized, technology devices offer a means of information and communication access like none other before (Germany, 2014). The current student body needs to compress a greater amount of knowledge into the same basic classroom instructional timeframe, which has been very similar for decades (Blair, 2012). Students who are not fluent with information technologies will struggle to attain the basic skills needed to contend with modern classroom expectations (Tannis, 2013). A missing piece of research studies in literature was how student learning actually was affected by the influence of technology integration efforts (Cviko et al., 2012). To help alleviate student stress of large goal attainment, Randall, Harrison and West (2013) suggested designing an incremental recognition system to show a student progression for self-reflection.

Anthony (2012) suggested teachers should have an active part in the design of technology delivery integration lessons, opposed to an administrative mandate just to incorporate technology devices. Hughes (2013) identified a concern of the targeted nature of technology programs utilized by teachers for convenience, versus the amount of technology software available, which would deliver a stronger educational program. The research available relevant to technology integration efforts in elementary programs was identified to have at least two problematic concerns, the lack of research specifically targeting elementary programs, and the lack of depth as to integration with students to improve learning (Howley et al., 2011).

For anyone to not be fluent in technology is seen by some as a form of illiteracy (Robertson, 2005). To be successful in a K-12 environment and assuredly in post-secondary study and the modern workforce, students must attain a new level of technological fluency for which they are quite capable (Blair, 2012). A true assessment of professional development goal attainment, rather than just identifying areas of need, is important to be able to address staff concerns rather than identify and highlight areas of concern (Ham, 2010). Germany (2014) noted an often unforeseen barrier to successful technology integration is a cultural one, in which parents may not wish their children to be exposed to technology, especially the internet. Another possible barrier would be if technical assistance is typically online, which could make comprehension much more difficult for students from some cultures, due to the lack of personal interaction (Tannis, 2013).

Educational technology demands student skills are on par with those of the teacher in order for effective integrated technology curriculum to be delivered which incorporates individual creativity and critical thinking (Blair, 2012). The elementary teachers studied by Howley et al. (2011) identified advanced student technology integration occurred when students had access to current technologies, combined with preparation and a positive climate, yet administrative support was not seen as a direct influence upon student achievement. Aypay et al. (2012) identified direct links from teacher’s perceived usefulness and attitude about technology to successful technology integration with students, as well as indirect indicators such as the complexity of the technology to be used and the supports afforded teachers in the utilization and implementation of technology into lesson plans and educational delivery.

When technology planning is complementary to the teacher's integration efforts, technology integration is seen as less stressful and more effective (Anthony, 2012). An unforeseen barrier to planning and implementation may be the social context of the community or particular families within it (Germany, 2014). Howley et al. (2011) identified a concern of the elementary setting which requires elementary teachers to be cognizant of local values when integrating technology in order to effectively implement technology advancement programs. Without proper professional development, there is a notable risk of misinterpretation by teachers as to the ultimate goal of any particular curricular revision relevant to technology integration (Cviko et al., 2012).

To effectively incorporate technology into the classroom setting, Blair (2012) proposed blending the student lesson to include student-centered activities. Skills which are presented to staff during professional development activities have the greatest impact on technology integration when presented in a way inclusive of classroom implementation (Ham, 2010). This is an expansion of early technology integration theory and practice. Originally, teachers were to deliver lessons electronically, which is not sufficient for today's learner (Blair, 2012). Initial technological pushes came from a desire to appease parent and community pressure for the job market, not necessarily from a teacher-driven revision (Robertson, 2005). Aypay et al. (2012) found the easier a technology was to use, the more successful was the teacher's technology integration in the classroom environment. Clear goals of professional development and the relevance to student growth may help foster climate, as well as gathering information needed for analysis and adequate time for review of data to be allotted (Ham, 2010). How the lessons are presented will depend on the district's approach to technology integration (Anthony, 2012).

Modern classrooms will need to incorporate experimental e-learning to meet student needs (Otamendi & Doncel, 2013). To foster creative growth, the student should be given a task to engage critical thinking skills, placing the teacher as a facilitator of the classroom activity instead of a lecturer (Blair, 2012). There is a positive correlation between the frequency of technology integration and teacher self-efficacy (Ketsman, 2012). Anthony (2012) suggested the integration of technology into the lesson plan be a collaborative effort between administrative direction and teacher input to be effective. If teachers are included in relevant, high-quality professional development, Cviko et al. (2012) found teachers of any particular school develop similar ideologies about technology integration and learning.

Germany (2014) found long-term success of a technology-integration program may include many independent variables. Blair (2012) proposed the teacher should allow students creative freedom to solve the task and also use technology solutions for the presentation of student results, building on current generational social culture. Properly developed and nurtured, the social nature of the current generation may facilitate technology integration efforts through collaborative learning and even gaming (Germany, 2014). Gaming was identified as an established educational tool by Otamendi and Doncel (2013). Technology acceptance was also found by Aypay et al. (2012) to be essentially non-attainable by persons who had grown up without technology. This finding may inform an educational leader in planning appropriate professional development for staff (Aypay et al., 2012).

Through the involvement of the teaching staff, Anthony (2012) found many meaningful changes including in which grade(s) to push for technological expansion for better results, and which modifications needed to be implemented to allow curriculum to be more effectively delivered to students. Otamendi and Doncel (2013) found computer simulation an effective use of technology in delivering complex theoretical models. Blair (2012) found successful student technology integration when adequate access is available. Positive teacher perception towards student learning was impacted the most by classroom constructs which included both computer-based lessons and traditional non-computer-based activities (Cviko et al., 2012). A key to successful integration would be a shift from prior visions of what technology devices can do to one of what is an attainable fluency (Robertson, 2005).

Duran, Brunvand, Ellsworth, and Sendag (2012) found quality, effective professional development helps teachers learn or improve technology-related skills. Assessing the needs of teachers from the teacher perspective is essential to developing a targeted professional development program or series to help teachers bolster technological skills to sustain the most impact to the learning environment. Anthony (2012) indicated leadership with regards to technology integration is still emerging. Teacher efficacy with regards to the integration of technology into the classroom has not been clearly analyzed as to whether it is teacher skill set or if it is related to the actual availability of student-use technological devices, which is impeding measurable progress (Hsu, 2010).

Mitra (as cited in Blair, 2012) suggested a student-to-computer ratio of approximately 4:1 as an ideal target for technology integration. Such a ratio would allow districts to broaden their technology offerings to students, instead of targeting a 1:1 program at the outset. Emerging uses of technology in the classroom must be seen as real teaching, not just supplemental (Otamendi & Doncel, 2013). Anthony (2012) also suggested those responsible for hardware acquisition be mindful the products selected are able to withstand the environment of a classroom setting with multiple potential users.

Anthony (2012) suggested teachers have an active role in technology planning, as without insight into the classroom, a poorly developed technology plan may complicate the process, adding significant barriers to integration with students. When teachers do not use technology in regular lesson plan design, the summation is often lack of proficiency (Hsu, 2010). One barrier to technology implementation is the lack of instructional technology support personnel identified in Germany's (2014) study. Anthony's work in 2012 related an example of a technology-based science lab, of which the teacher did not feel there was sufficient hands-on experience for the students. Therefore, lack of teacher inclusion in software selection led to a technology lab and a hands-on lab being conducted on the same principle, which may not be an effective use of funds or time (Anthony, 2012). This is another example similar to Germany's (2014) finding that even with a technology-rich environment, the desired result of improving instruction may not be attained. Teachers who have not had adequate exposure to training on the technologies to be used with students face a significant barrier to integration with students as identified by Hsu (2010), equally if the teacher has not had professional development relevant to the application of specific technologies into the curriculum setting taught.

To present the same lessons using technology instead of using a traditional method will not bolster student engagement to increase learning (Ketsman, 2012). Another contributing factor to achieving desired results may be from the expectation of the teacher. If the teacher expects students to gain from technology or internet-based learning, there is a logical probability results will be more positive than if the teacher feels there will be little to no benefit from such instructional support (Norris et al., 2003). Duran et al. (2012) also identified sustained professional development can improve both teacher perception and curriculum efforts applied in the classroom, which is where there is a need to focus professional development.

Differentiating technology-rich instruction from traditional teaching models is necessary to fully exploit the potential of distance learning such as virtual classrooms (Otamendi & Doncel, 2013). Teachers utilizing technologically-based curriculum supports have current materials available for student use, rather than potentially outdated textbooks (Martinez & McGrath, 2014). Anthony (2012) found some teachers willing to incorporate technology into their lesson plans, yet admitted reservations as to the effectiveness of such activities. Due to the limited number of truly proactive classroom settings, it is necessary to thoroughly explain and show the benefits of technology integration to those who are reluctant to adopt technology programs (Ketsman, 2012). When technology is employed for communication in the classroom, students may explore higher-ordered authentic thinking skills relevant to a modern workplace, opposed to sitting in lecture (Martinez & McGrath, 2014).

An inclusive yet passive approach to technology integration may lead to the stagnation of efforts and very limited positive results (Anthony, 2012). Downes and

Bishop (2012) found teachers proclaiming the benefits of technology integration, but it required significant effort to get there. The ability of technology to allow for flexibility and multi-media experiences is a noted benefit of integration (Ketsman, 2012). Norris et al. (2003) indicated a greater propensity for middle and high school level teachers to integrate technology-related activities into their classes for the expanded benefit than the likelihood of integration by elementary teachers.

Administrators charged with the responsibility of hardware and software selection also need to keep in mind how the teaching staff will use the products with students (Anthony, 2012). Some teachers or districts may wish to make an audio or video recording of lessons to facilitate student study outside the classroom for review or for students not able to be present during class (Otamendi & Doncel, 2013). District technology use policies must be written to protect the computer systems and students from negative external forces, yet still allow the teachers and students the ability to access the external resources needed for effective instructional delivery (Anthony, 2012).

Students of today's digital age are more demanding of teachers and technology alike; students are accustomed to attaining a large volume of information almost instantly and are very social, yet may prefer to communicate through technology rather than face-to-face (Downes & Bishop, 2012). An example is student cell phone use. While many schools restrict cell phone use, these devices are a readily available means of integrating technology. In turn, the student cell phone is more likely a target of conflict rather than a solution (Germany, 2014). Disruption of the flow of communication due to policy restrictions were noted by Otamendi and Doncel (2013). Anthony (2012) revealed many parents are now frustrated with district programs or individual teaching staff members who are not proactive in the development of technology-rich lessons.

Teachers and students alike may use collaboration in order to develop and cultivate a climate of blended learning, which incorporates technology as a tool to solve problems (Martinez & McGrath, 2014). When surveyed by Otamendi and Doncel (2013), students and staff indicated a high level of satisfaction with e-learning. Teachers of today's classrooms need adequate supports in order to build self-efficacy for teaching and technology integration, which leads to enriched lessons for students (Moore-Hays, 2011).

The single strongest predictor of successful technology integration is the number of computers, with appropriate software and technical support found to also be significant (Norris et al., 2003). When proper technologies have been selected, teacher lesson preparation and delivery times are reduced, allowing more time for student engagement into the lesson (Anthony, 2012). Another positive technology integration enhancement item is "badges," which are electronic symbols of skill attainment, discussed in a study by Randall et al. (2013). Teachers have indicated a sound technology integration program increases creativity, which in turn fosters student engagement due to the ability of the student to make choices (Ketsman, 2012). In contrast to many common beliefs, teacher demographics and relevant attitudinal variables were found insignificant, specifically with regards to curriculum (Norris et al., 2003).

A quandary for administrators may be to find adequate and appropriate professional development, professional social network, and technology support for staff (Anthony, 2012). The need for students to attain advanced technological skills was identified by Partnership for 21st Century Skills (P21), a group influential in the original drafts of the college and career ready standards (Sawchuck, 2009). It was identified through Anthony's (2012) study all teachers do not teach and deliver the same way, and yet professional development is delivered without differentiation. Teachers indicated they must attend many technology conferences and share ideas in order to feel confident they are keeping up with integration (Ketsman, 2012). The general view held by many, that the influx of funding and training has not had a profound effect upon the American education system, may be as much related to consistent technology access as any other reason (Norris et al., 2003). Technology skills will have to be assessed if people are to take technology seriously (McGaw as cited in Sawchuck, 2009). TPAK (technological pedagogical content knowledge), as noted by Baran, Chuang, and Thompson (2011), helps to clearly define goals and standards for technology into the educational setting (see Figure 2).

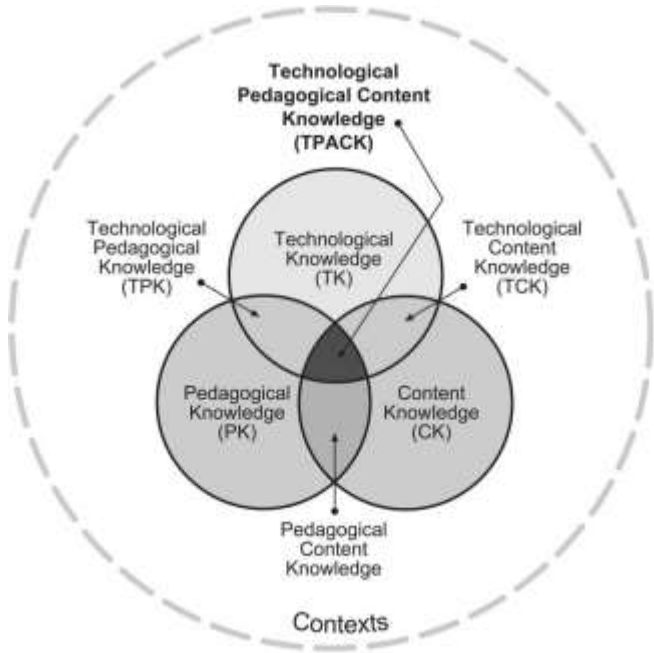

Figure 2. Technology pedagogical content knowledge (TPACK).

Anthony (2012) found teachers appreciative of receiving technology-related professional development, yet frustrated with the lack of training on how to incorporate technology-rich lessons into the classroom setting. Duran et al. (2012) posed a varied, active, student-connected professional development program with sufficient time to design and implement will be more successful. Trying to merge the complex systems available for use by educators only strengthens the need for a clear set of goals which any given educational setting is to achieve (Carr et al., 2013).

Adequate student access and support are key components to technology integration in order to increase proficiency (Norris et al., 2003). Downes and Bishop (2012) found the two main components to a successful technology integration program are: teachers willing to infuse technology into the classroom and administrators willing to commit energy and funds to procure devices and meaningful training. Anthony (2012) found the division of technology support duties, as well as the inclusion of a technology media specialist, aided in the development and successful delivery of technology-enhanced lessons. Accessibility and support proved the overall contributing factors to successful use of technology, far outweighing content area or years of teaching experience (Norris et al., 2003). Ketsman (2012) also found a potential for the benefits of technology integration, which with increased teacher use, increased student engagement. Interestingly, the findings were not dependent upon the length of time a person had been a teacher.

Effective Methods of Technology Integration

Technology integration is most effective when students are empowered to take an active role in the learning process, allowed to work collaboratively, where the teacher becomes the facilitator, and students master the educational content (Martinez & McGrath, 2014). There is a consensus technology is now an integral part of a modern classroom, necessitating teachers to have a fluent understanding of the technologies to be utilized in the instructional process (Baran et al., 2011). Even with significant efforts for the implementation of professional development for the integration of technology into the classroom, teachers may still have reservations about their self-efficacy when it comes to actually working with students (Duran et al., 2012).

Baran et al. (2011) saw a teacher's role in technology integration as drawing from the educator's multifaceted knowledge base and applying such information to the classroom setting in an authentic way. Educational accountability trends focus on student growth data. Student growth data may then be tied to district curriculum and teacher proficiency, providing yet another justification for the importance of technology infusion (Pellegrino & Quellmalz, 2010). Modeling successful technology integration strategies and the technological tools to support the integration is essential in developing and maintaining teacher self-efficacy (Al-Ruz & Khasawneh, 2011).

Research has shown 21st century students learn best when using technology as a supporting tool to develop higher-order thinking skills and gain workplace-applicable collaborative skills. Stakeholders in technology integration in the classroom benefit from planned, targeted professional development experiences (Smolin & Lawless, 2011). Student learning focused on digital technologies in context provides relevant, self-driven skill application and readily allows instructors to stay current in evolving technologies (Sethy, 2012). Terras and Ramsay (2012) identified five components as challenges for the advancement of mobile learning and technology integration: "(1) the context-dependent nature of memory, (2) cognitive resources are finite, (3) cognition is distributed and learning is situated, (4) metacognition is essential and (5) individual differences matter" (pp. 824-826).

For students to gain the greatest potential from exposure to technology, both student and teacher must have a fluent ability in the basic functions of and applications of the technologies to be used in the classroom (Davies, 2011). As seen in Figure 3, the National Education Technology Standards (NETS) for teachers point to the need for a connection among collaboration, discussion, learning, and sharing attributes if teachers are to effectively integrate technology in the classroom (Davies, 2011). A consideration for the modern educator is to keep in mind the depth of attachment millennial students have with technology. Teachers need proper training and sufficient time to plan and implement various technologies into the curriculum, or the negative effects of a poorly planned system will emerge (Teck, 2013). Many students develop connections with people met through chat rooms and online gaming and are often more comfortable communicating through a device, rather than face-to-face conversation (Turkle, 2011).

NETS•C standard	*Collaboration*	*Discussion*	*Learning*	*Sharing*
Visionary Leadership Technology Coaches inspire and participate in the development and implementation of a shared vision for the comprehensive integration of technology to promote excellence and support transformational change throughout the instructional environment.	•	•		•
Teaching, Learning, & Assessments Technology Coaches assist teachers in using technology effectively for assessing student learning, differentiating instruction, and providing rigorous, relevant, and engaging learning experiences for all students.			•	
Digital Age Learning Environments Technology coaches create and support effective digital-age learning environments to maximize the learning of all students.	•	•		•
Professional Development & Program Evaluation Technology coaches conduct needs assessments, develop technology-related professional learning programs, and evaluate the impact on instructional practice and student learning.			•	
Digital Citizenship Technology coaches model and promote digital citizenship.			•	
Content Knowledge and Professional Growth Technology coaches demonstrate professional knowledge, skills, and dispositions in content, pedagogical, and technological areas as well as adult learning and leadership and are continuously deepening their knowledge and expertise.	•		•	

Figure 3. Collaboration, discussion, learning, and sharing resources identified in the NETS.

To be highly qualified with regards to academic credentials does not indicate a teacher can effectively deliver technology-enhanced lessons to students. Information communication technologies (ICT) may come in the form of recorded mediums such as a digital video disk (DVD) or word-processing and web-based communication technologies (Raob, Al-Oshaibat, & Ong, 2012). Rather, an in-depth analysis of the lesson is needed (Davies, 2011). There is a continuing shift from traditional classroom settings to a setting which is technologically-based, with a growing and complex system of devices and software increasingly being generated by users with an open source platform (Carr et al., 2013). While previous generations of students may have deemed technology as optional, modern students have an expectation to access technology anywhere at any time (Werth & Werth, 2011).

A traditional lecturing instructor is not like to incorporate the knowledge of current teaching practices, such as integrating collaborative online discussion groups for students, despite research showing support for such teaching pedagogies (Owens, 2012). Some instructors indicate a level of mistrust as to the reliability of a technology-rich lesson, because if something goes wrong, the entire lesson and meeting period may be lost (Cifuentes, Maxwell, & Bulu, 2011). By using a series of surveys to assess teacher knowledge level, combined with technology integration modeling, teachers have been encouraged to integrate technology more successfully into the classroom setting (Baran et al., 2011).

Web-based technologies are expanding at a brisk pace, with web 2.0 technologies providing a platform for an immense amount of collaboration among students, peers, and professionals, providing the potential to dramatically increase knowledge (Terras & Ramsay, 2012). Second-generation web-based educational supports present a much greater opportunity for teachers to become facilitators of a classroom, due to the social design of many emerging technologies (Carr et al., 2013). Another possible reason for the absence of technology-rich teaching pedagogies may be teacher skill deficiency. The result is limited technology integration and an imperative call for change from a lecture-centered classroom to one with student-centered engagement (Walker et al., 2011).

Tingoy and Gulluoglu (2011) identified not only the need for current technologies to be available for student use, but to have staff trained to a high enough level to fully implement the devices and software to be utilized for instruction. The volumes of research indicating the potential for the inclusion of technology into the educational setting is steadily growing, yet the effective methods for successful integration models are limited. The limitation is due in part to lack of resources, time for adequate integration, or the absence of proven changes in teaching methodologies (Ng'ambi, 2013). As seen in Figure 4, Ng'ambi (2013) proposed a transformative pedagogical model for teaching with emerging technologies in which "context, teaching/learning assumptions and emerging technologies are like the environment in which a garden of learning is embedded" (p. 9).

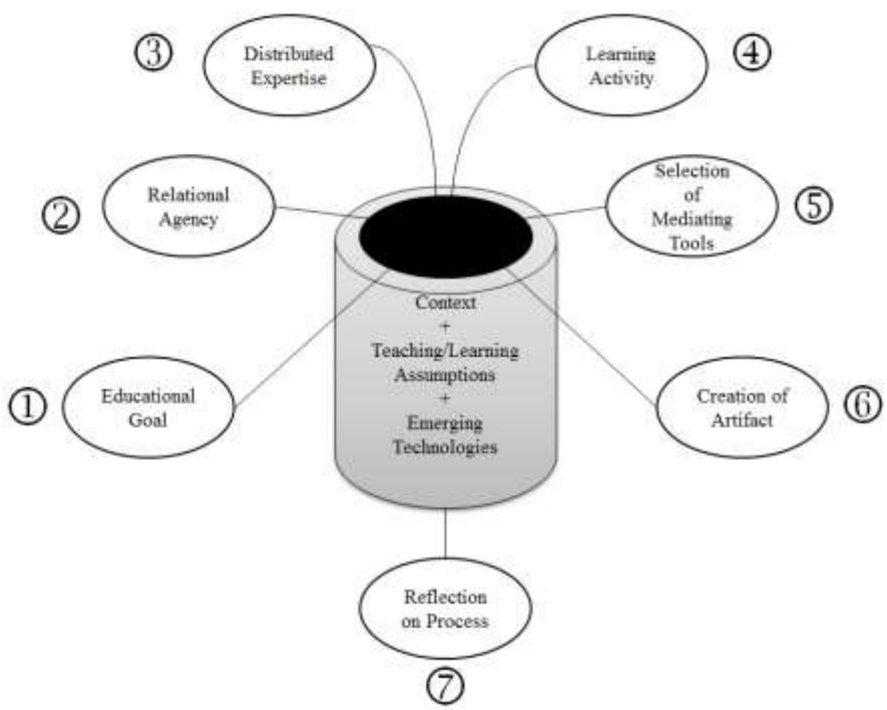

Figure 4. A transformative pedagogical model for teaching and emerging technologies.

Teachers' Perceptions of Technology Integration

Administrators and teachers have now had a long-standing role in the integration of technology into the classroom, with successful programs developing a culture which fosters continued growth (Cakiroglu, Akkan, & Guven, 2012). Modern technologies are being implemented in classrooms at all levels from preschool to higher education (Teck, 2013). Teachers sometimes struggle to implement technology into the classroom, because by supplanting existing instructional materials with online resources to increase student interest or to provide additional avenues of support, the protection of students from undesirable input becomes a more difficult challenge (Carr et al., 2013). Effective programmatic development requires the inclusion of teachers from different stages of teaching careers, sharing of curricular design, and consistent administrative support to implement new teaching ideologies with students, fostering a climate of progression (Potter & Rockinson-Szapkiw, 2012).

Many classroom teachers indicate web 2.0 activities are challenging, engaging, and rewarding (Shinsky & Stevens, 2011). Carr et al. (2013) found a majority of the teachers studied found social-based media supports such as YouTube as beneficial to classroom instruction. Teachers identified Facebook and YouTube as current social-based technologies which offer an assistive role to the classroom, whether through gaining the interest of the students, or by offering supplemental information which otherwise may not be available (Raob et al., 2012). Tingoy and Gulluoglu (2011) found student perception with regard to technology to fall into three distinct, basic categories as follows: how useful one perceives a technology to be to an individual setting, the person's confidence in utilizing any particular technology in a meaningful way, and the amount and quality of learning one encounters prior to applying a technology to a particular problem or application.

Over the course of a multi-year study, Cifuentes et al. (2011) found feelings of technological advancement were limited from the beginning to the end of the first year, but indicated a feeling of familiarity and confidence with instructional technologies after completing year two, which also supports previous studies indicating ongoing, quality professional development being key to successful technology integration. The rapid rate of technology expansion has the subsequent negative consequence of educational systems not keeping up with technologies to ensure students are fluent in applicable systems once coursework is completed (Tingoy & Gulluoglu, 2011). For technology integration to more fully impact the classroom environment, teachers must realize they are not the dispenser of all knowledge, but rather a facilitator in the technology integration process (Potter & Rockinson-Szapkiw, 2012). While for many programs accessibility is still a concern, without proper professional development to ensure teachers feel comfortable using technologies, the benefits are negated with unnecessary information and diminished learning (Mwalongo, 2011). Although cognitive learning remains a focus in the classroom, Carr et al. (2013) found a potential for the re-examination of how instructional resources are used, as educators and students alike communicate differently than prior to the emergence of web-based, socially generated communication platforms.

If there is a problem with technology integration in an educational setting, it is the responsibility of the administrator to develop solutions to remediate the concern. While technology may open multiple avenues for acquiring and disseminating information, technology alone will not improve instruction (Teck, 2013). Without a positive teacher opinion of technology competency, professional development will not improve perceptions, even though a negative attitude has no correlation to teacher knowledge (Yucel, Acun, Tarman, & Mete, 2010). It is important to personalize professional development which fosters continued support for teachers' overall feelings of self-efficacy toward technology integration into the classroom (An & Reigeluth, 2012). Moore-Hays (2011) indicated a lack of statistically measurable differences between the self-efficacy of current and pre-service teachers with regards to technology integration, yet differences seen were lack of experience as a classroom teacher and the challenge of technological change.

Ultimately, the success of any educational program is dependent on the instructor, validating the importance of teacher perception with regards to traditional classroom technology, mobile devices for learning, and web 2.0 (Uzunboylu & Ozdamli, 2011). Technologies acquired for classroom use with students oftentimes go unused due to lack of proper planning for teacher training, as teachers need to fully understand the use and potential benefit to student learning prior to the expectation of curricular integration with students (Potter & Rockinson-Szapkiw, 2012). Through the development of a technology-rich climate, digital integration is broadened as the more educators learn of new and promising technologies, the more such methods are welcomed and infused into existing educational platforms (Cakiroglu et al., 2012). Pre-service teachers indicate a positive perception of utilizing technology in the classroom, demonstrating a need for professional development to continue to encourage and support classroom technology integration strategies as they move into the classroom (Berlin & White, 2012). The work of Tingoy and Gulluoglu (2011) indicated a commonality in perception of the inseparable connection between technology and the educational setting, with a secondary finding of the need to strengthen educational technology programs in order to see benefits in the development of well-trained, skilled teachers with the capacity to pass such abilities on to students.

Murphrey, Miller, and Roberts (2009) completed a study to determine teacher perceptions of technology use, and over 88% of the teachers surveyed felt they were competent at computer usage and believed all students would benefit from technology integration. Through the work of Cakiroglu et al. (2012), the evidence indicated a positive technology climate fostered a system of repeated technological integration growth, even though different teachers grew at different rates. Potter and Rockinson-Szapkiw (2012) suggested teachers who know how to operate the available technologies, apply the technologies with students, and integrate not only the technology devices but the collegial climate to foster authentic learning, see a marked improvement in the support for technology integration. With proper support, teachers may use technology to broaden the information available to design and will bolster the lessons for students (Teck, 2013).

Summary

Modern technology is relevant to a specific timeframe. In a historical perspective, one may liken the use of modern technology to the Mayan's practice of stone carving (Pezzati, 2012). A self-efficacy evaluation of teachers and pre-service teachers alike may show each group misjudges their technology skills and capacity for instructional classroom integration to benefit the learning process (Pan & Franklin, 2011). A perceived difficulty for educational systems is to develop a teacher-training environment which encompasses a large field of information, yet is current and targeted so as to allow individual applications of technologies in various disciplines (Tingoy & Gulluoglu, 2011). Carr et al. (2013) identified the need for additional research to be conducted to assess student cognitive learning using technology to solve problems, as most prior research focused specifically on student interaction with technology devices rather than viewing technology as a tool for problem solving.

Administrators must lead the development of programs through organized, continual professional development in order to attract and retain quality educators (Duffey & Fox, 2012). If professional development can be constructed which is not grade or discipline-specific, the training will help ensure more active engagement from teaching staff in the professional development provided (Duran et al., 2012). Technologies change at a rapid pace, and personalities which do not allow teachers to ask for help in technology integration are a significant barrier to the expansion of technological offerings to students, even if technical and curricular supports are readily available (Moore-Hays, 2011). Smolin and Lawless (2011) suggested collaborative evaluations to assess the effectiveness of technology integration professional development. By raising teacher skills, misconceptions may be addressed, and self-efficacy will increase, which would relate to higher technological integration with students (Graham et al., 2012).

In Chapter Three, the design of this causal-comparative study is explained, as well as the design of the convenience sample. The necessity to utilize correlation between traditional and technology-enhanced lesson design is discussed. Assumptions are clearly outlined, as well as the role of the primary investigator and to what extent protection was in place to protect the respondents to the survey. Data collection and analysis methods are also outlined.

In Chapter Four, the problem statement is revisited, as well as the questions the primary investigator addressed. A summary of data collected and any relevant significance are presented. Tables and figures are used to correlate survey data and MAP data, as well as a summary of how the data were collected and relevant results related to the study.

Chapter Five includes a review of the major portions of the study and relation of the findings in a verbal format, as opposed to graphical. This chapter summarizes the project. Conclusions drawn from the analyzed data determined the scope of suggested implications for practice. Suggestions for further research are presented, as there will be the potential for others to apply a similar approach in school districts of a different socio-economic background, which may produce dissimilar results.

Chapter Three: Methodology

This causal-comparative analysis involved the measurement of any changes in student achievement on standardized MAP scores due to the integration of technology in the classroom setting for student use. Convenience sampling was used to analyze student perceptual survey data and student standardized MAP scores. Teacher perceptual survey data were compared to student perceptual survey data to examine similarities. Correlational research was a key element in the analysis of student perception of academic gain versus any measurable gains in standardized student testing data from the MAP. The comparative study between traditional teaching methods versus technology-enhanced teaching methods compared standardized student achievement data from both educational settings.

The application of the technology treatments was completed without risk by non-discriminatory selection. All students had equal access to any benefits of the availability of technology. The examiner analyzed data from the 2012-2013 and 2013-2014 academic years. Surveys (see Appendix A; Appendix B) were used to identify student and teacher perceptions of technology integration into the classroom. Student perceptions were analyzed in concert with standardized MAP results, utilizing de-identified information. The research design yielded useful results, as the collected and analyzed data included students' perceived gains in knowledge when compared to actual performance on the standardized, MAP grade-level assessments. The research design was bolstered with the addition of student and teacher perceptual data.

The examiner studied a specific group of students, currently enrolled in grades five, six, and seven, to assess student perceptions of academic gain versus measurable academic gain as measured by standardized MAP data results. The examiner also studied teacher perceptions of technology integration into the educational setting of the sampled students in grades three through seven. Permission was gained from building-level administration(see Appendix C; Appendix D) , the president of the board of education (see Appendix E), and the parents/guardians (see Appendix F) of the students in order to disseminate the surveys and to review the necessary de-identified student data per the Family Educational Rights and Privacy Act (FERPA) regulations. Teacher consent was obtained, as well (see Appendix G). All confidential information was kept in a secure location, either by way of lock or pass-code. Personal information was de-identified by a third party. Participants in the study had the opportunity to opt-out at any time.

MAP data were collected and analyzed due to the significance to Missouri school systems and the statewide delivery of the test. Archival testing data were collected from electronic and paper databases. Student perceptual data were collected and correlated to standardized testing results to gain insight to student perception versus academic reality. Teacher perceptual data were collected and compared to student perceptual data to look for correlations or dissimilarities in perceptions. Survey data were collected through electronic delivery or paper/pencil versions of the same. Data were recorded in alpha-numeric and/or graphical form, whichever was the most applicable for ease of interpretation of results. The results of this study, if replicated, should yield similar results if the districts are of similar size, ethnographic, and socioeconomic composition. Similar results are not expected if a study were to be conducted in a wealthy, urban, or suburban school district. De-identified student test scores were recorded and analyzed from historical data, aligning the scores with the availability of student-use technology, through the use of a random number method.

Problem and Purpose Overview

Problem. There are currently a limited number of existing studies devoted to technology integration as related to advancement in student learning. There is limited research which compares student and teacher perceptions relating to the integration of technology into the classroom. The rural district sampled for this study introduced technology hardware and software to instructors and students prior to offering a curricular implementation plan for instructional integration.

Purpose. The purpose of the study was to statistically analyze the impact of technology on the third through seventh-grade classroom setting and the effects on student performance and subject-matter comprehension, as measured by MAP scores and correlated through perceptual survey data. Teacher perceptions of student technology integration were used for triangulation with student perceptions and student performance on the MAP.

Research Questions and Hypotheses

This causal-comparative study compared standardized test scores of current fifth, sixth, and seventh-grade students enrolled in a rural, low socio-economic k-12 school district.

The research question(s) for the study were:

1. What is the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Mathematics (MA) for those students who

initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014)?

$H1_0$: There is no correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Mathematics (MA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014).

2. What is the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Communication Arts (CA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014)?

$H2_0$: There is no correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Communication Arts (CA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014).

3. What is the correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP MA test in spring 2014?

$H3_0$: There is no correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP MA test in spring 2014.

4. What is the correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP CA test in spring 2014?

H4$_0$: There is no correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP CA test in spring 2014.

5. What are the perceptions of teacher respondents regarding technology integration in one rural, low-socioeconomic K-12 school district?

Research Design

This causal-comparative study was used to assess the effects of technology integration into a public school environment. The effects of device availability to the student results on standardized testing were compared to the students' self-perceived connotations of success due to an influx of technology. Teacher perceptual survey data were compared to the student perceptual survey data to determine if there were any significant correlations.

Population and Sample

Potential participants were recruited from a population of 210 possible respondents who were student participants from grades five, six, and seven during the 2014-2015 school year. The students attended a rural, low-socioeconomic K-12 school district.

Following parent/guardian consent, assenting students from grades five, six, and seven during the 2014-2015 school year were recruited to voluntarily complete surveys so perceptual data could be obtained and correlated with archival MAP data.

In this causal-comparative study, archival and survey data were extracted or derived from a sample of the fifth, sixth, and seventh-grade students enrolled during the 2014-2015 school year. Group performances were compared to determine relationships between technology integration and student performance (Fraenkel et al., 2015). The sample was a convenience sample of all students in grades five, six, and seven enrolled during the 2014-2015 school year who also attended the same district during the 2012-2013 and 2013-2014 school years. This allowed for a correlation comparison before technology-integrated instruction and after technology-integrated instruction. Of the potential populations, the final sample size was 139 students with complete survey and performance data. Teacher perceptual survey data were collected from the teachers of the student study groups.

Instrumentation

A survey was developed to ascertain basic perceptions of the benefits students felt were gained by having technology available for classroom use. The brief survey targeted upper elementary and middle school-aged students. Survey results were compared to each student's actual standardized state test scores. All survey results and test scores were redacted of personally identifiable information by a third person. The teacher survey followed a similar theme as the student version to compare results. The survey was piloted among colleagues with appropriate age/grade-level experience and revised for clarity and brevity. Additional instrumentation from which data were drawn included the Missouri Assessment Program (MAP) grade-level assessment for English Language Arts (ELA) and Math (MA).

Data Collection

Permissions were gained through written consent from the president of the board of education and the appropriate building principals in order to utilize respective buildings' staff survey responses and student body survey responses and standardized test scores. The student data were collected by distributing a parental consent form and student assent portion of the student survey. Teachers signed adult informed consent forms before completing the teacher survey. A third person was utilized to redact student and staff names for the survey and to correlate survey responses with student MAP performance data.

Data Analysis

A Pearson product-moment correlation coefficient (Fraenkel et al., 2015) was utilized in order to determine if any significance existed between student survey results of perceived academic gains and the student's associated state MAP test results. A *t*-test was also utilized to compare student perceptual data as compared to teacher perceptual data.

A Pearson product-moment correlation coefficient (Pearson *r*) (Fraenkel et al., 2015) was utilized to determine if a correlation existed between student performance data pre-technology device deployment and post-technology device deployment. This was based from the analysis of student test results on the Missouri state assessment (MAP) test from sequential years. Additional descriptive analyses were used to report the results of survey data.

Ethical Considerations

Informed parental consent forms were given to all parents/guardians of students in the study groups prior to the student survey being released. Students were given an assent choice in the survey instrument. Teachers were provided an adult consent form. The forms and other data were kept in a secured file cabinet, or electronically protected by a pass-code. All surveys and testing results were anonymized and given a random number by a third person to ensure confidentiality.

Summary

This causal-comparative study involved analysis of a convenience sample of students and their achievement on the Missouri MAP test. There were limited existing studies comparing student and teacher perceptions relating to the integration of technology into the classroom. The purpose of the study was to gain a better understanding of the impact of technology on the third through seventh-grade classroom setting, combined with an attempt to gain student and teacher perceptions of technology integration efforts. This causal-comparative study was designed to question the correlation and significance of technology integration perceptions on student achievement from the student and teacher point of view and as measured by the MAP test scores.

Chapter Three included the research design and methodology. Chapter Four includes a review of findings. Chapter Five contains discussion, conclusions, and suggestions for future research.

Chapter Four: Analysis of Data

The purpose of this project was to gain a better understanding of the impact of technology on the third through seventh-grade classroom setting and the effects on student performance and subject-matter comprehension, as measured by MAP scores and correlated through perceptual survey data. It was also designed to review teacher perceptions of student-use technology integration as compared to student perceptions of the same.

The problem faced was the limited number of existing studies devoted to technology integration as related to advancements in student learning. There was also very little research comparing student and teacher perceptions relevant to the integration of technology into the classroom. The rural district sampled for this study introduced technology hardware and software to instructors and students prior to offering a curricular implementation plan for instructional integration.

This causal-comparative study involved comparison of standardized test scores of fifth, sixth, and seventh-grade students enrolled in a rural, low-socioeconomic K-12 school district. Questions posed included the following:

1. What is the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Mathematics (MA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014)?

2. What is the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Communication Arts (CA) for those

students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014)?

3. What is the correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP MA test in spring 2014?

4. What is the correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP CA test in spring 2014?

5. What are the perceptions of teacher respondents regarding technology integration in one rural, low-socioeconomic K-12 school district?

The examiner designed a survey instrument to gain insight into student and teacher perceptions of technology integration in the classroom setting. Questions were designed to reveal perceptions specifically as to the academic impact of technology on learning in mathematics and reading/language.

Data were presented to surmise the perceptual survey results of the students and the teachers. Survey data were corresponded to MAP results when and where applicable, and the results presented in graphical form for clarity. Results were analyzed with the statistical application of a *t*-test and Pearson product-moment coefficient calculation.

Findings

Research question one. A Pearson product-moment correlation coefficient was used to examine the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Mathematics (MA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) versus technology-enhanced instruction (school year 2013-2014). The Pearson *r* determines the strength of a straight linear fit closest to $r = 1.0$ (Fraenkel et al., 2015). Bluman (2013) noted, data values become closer to an increasingly stronger relationship as the correlation coefficient increases from 0 to +1. When interpreting the strength of correlations, it is noted if $r \geq .70$ or higher, there is a strong positive linear relationship (Bluman, 2013, p. 539). In examining the current fifth-grade student scores in MA for the school years 2012-2013 and 2013-2014, there was a strong positive linear correlation between the two variables [$r = .79$, $n = 31$] which was statistically significant [$p < .01$]. The resulting data are presented in Table 1.

Table 1

Fifth-Grade Correlation of MAP MA Scores Utilizing Traditional Methods vs. Technology-Enhanced Instruction

		Traditional MA	Technology-Enhanced MA
Traditional MA	Pearson Correlation	1	0.79
	Sig. (2-tailed)		0.00
	N	31	31
Technology-Enhanced MA	Pearson Correlation	0.79	1
	Sig. (2-tailed)	0.00	
	N	31	31

Note. Statistical significance is noted at $p \leq .05$.

The examiner conducted descriptive statistical analyses using SPSS of the mean difference between fifth-grade scale scores in MA before and after technology-enhanced instruction. As seen in Figure 5, the mean scale score improved 23.17 points, from 619.77 to 642.94, after technology was introduced for instruction.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
2013 SCORE	31	575	690	619.77	26.697
2014 SCORE	31	611	686	642.94	20.209
Valid N (listwise)	31				

Figure 5. Mean scale score difference fifth-grade MA.

In examining the current sixth-grade student scores in MA for the school years 2012-2013 and 2013-2014, there was a strong positive linear correlation between the two variables [$r = .85$, $n = 45$] which was statistically significant [$p < .01$]. The resulting data are presented in Table 2.

Table 2

Sixth-Grade Correlation of MAP MA Scores Utilizing Traditional Methods vs. Technology-Enhanced Instruction

		Traditional MA	Technology-Enhanced MA
Traditional MA	Pearson Correlation	1	0.85
	Sig. (2-tailed)		0.00
	N	45	45
Technology-Enhanced MA	Pearson Correlation	0.85	1
	Sig. (2-tailed)	0.00	
	N	45	45

Note. Statistical significance is noted at $p \leq .05$.

The examiner conducted descriptive statistical analyses of the mean difference between sixth-grade scale scores in MA before and after technology-enhanced instruction. As seen in Figure 6, the mean scale score improved 5.95 points, from 649.69 to 655.64, after technology was introduced for instruction.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
2013 SCORE	45	592	716	649.69	29.530
2014 SCORE	45	588	730	655.64	34.944
Valid N (listwise)	45				

Figure 6. Mean scale score difference sixth-grade MA.

In examining the current seventh-grade student scores in MA for the school years 2012-2013 and 2013-2014, there was a strong positive linear correlation between the two variables [$r = .85$, $n = 61$] which was statistically significant [$p < .01$]. The resulting data are presented in Table 3.

Table 3

Seventh-Grade Correlation of MAP MA Scores Utilizing Traditional Methods vs. Technology-Enhanced Instruction

		Traditional MA	Technology-Enhanced MA
Traditional MA	Pearson Correlation	1	0.85
	Sig. (2-tailed)		0.00
	N	61	61
Technology-Enhanced MA	Pearson Correlation	0.85	1
	Sig. (2-tailed)	0.00	
	N	61	61

Note. Statistical significance is noted at $p \leq .05$.

The examiner conducted descriptive statistical analyses of the mean difference between seventh-grade scale scores in MA before and after technology-enhanced instruction. As seen in Figure 7, the mean scale score improved 23.38 points, from 653.13 to 676.51, after technology was introduced for instruction.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
2013 SCORE	61	576	817	653.13	41.005
2014 SCORE	61	612	750	676.51	32.114
Valid N (listwise)	61				

Figure 7. Mean scale score difference seventh-grade MA.

Research question two. A Pearson product-moment coefficient was used to examine the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Communication Arts (CA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) versus technology-enhanced instruction (school year 2013-2014). The Pearson *r* determines the strength of a straight linear fit closest to *r* =1.0 (Fraenkel et al., 2015). In examining the current fifth-grade student scores in CA for the school years 2012-2013 and 2013-2014, there was a strong positive linear correlation between the two variables [$r = .70$, $n = 31$] which was statistically significant [$p < .01$]. The resulting data are presented in Table 4.

Table 4

Fifth-Grade Correlation of MAP CA Scores Utilizing Traditional Methods vs. Technology-Enhanced Instruction

		Traditional CA	Technology-Enhanced CA
Traditional CA	Pearson Correlation	1	0.70
	Sig. (2-tailed)		0.00
	N	31	31
Technology-Enhanced CA	Pearson Correlation	0.70	1
	Sig. (2-tailed)	0.00	
	N	31	31

Note. Statistical significance is noted at $p \leq .05$.

The examiner conducted descriptive statistical analyses of the mean difference between fifth-grade scale scores in CA before and after technology-enhanced instruction. As seen in Figure 8, the mean scale score improved 24.71 points, from 641.03 to 665.74, after technology was introduced for instruction.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
2013 SCORE	31	591	683	641.03	24.310
2014 SCORE	31	616	717	665.74	22.444
Valid N (listwise)	31				

Figure 8. Mean scale score difference fifth-grade CA.

In examining the current sixth-grade student scores in CA for the school years 2012-2013 and 2013-2014, there was a strong positive linear correlation between the two variables [*r* = .82, n = 46] which was statistically significant [$p < .01$]. The resulting data are presented in Table 5.

Table 5

Sixth-Grade Correlation of MAP CA Scores Utilizing Traditional Methods vs. Technology-Enhanced Instruction

		Traditional CA	Technology-Enhanced CA
Traditional CA	Pearson Correlation	1	0.82
	Sig. (2-tailed)		0.00
	N	46	46
Technology-Enhanced CA	Pearson Correlation	0.82	1
	Sig. (2-tailed)	0.00	
	N	46	46

Note. Statistical significance is noted at $p \leq .05$.

The examiner conducted descriptive statistical analyses of the mean difference between sixth-grade scale scores in CA before and after technology-enhanced instruction. As seen in Figure 9, the mean scale score improved 5.89 points, from 667.52 to 673.41, after technology was introduced for instruction.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
2013 SCORE	46	578	750	667.52	32.713
2014 SCORE	46	619	720	673.41	22.245
Valid N (listwise)	46				

Figure 9. Mean scale score difference sixth-grade CA.

In examining the current seventh-grade student scores in CA for the school years 2012-2013 and 2013-2014, there was a strong positive linear correlation between the two variables [$r = .81$, n = 61] which was statistically significant [$p < .01$]. The resulting data are presented in Table 6.

Table 6

Seventh-Grade Correlation of MAP CA Scores Utilizing Traditional Methods vs. Technology-Enhanced Instruction

		Traditional CA	Technology-Enhanced CA
Traditional CA	Pearson Correlation	1	0.81
	Sig. (2-tailed)		0.00
	N	61	61
Technology-Enhanced CA	Pearson Correlation	0.81	1
	Sig. (2-tailed)	0.00	
	N	61	61

Note. Statistical significance is noted at $p \leq .05$.

The examiner conducted descriptive statistical analyses of the mean difference between seventh-grade scale scores in CA before and after technology-enhanced instruction. As seen in Figure 10, the mean scale score improved 7.49 points, from 668.08 to 675.57, after technology was introduced for instruction.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
2013 SCORE	61	608	747	668.08	28.350
2014 SCORE	61	628	747	675.57	28.338
Valid N (listwise)	61				

Figure 10. Mean scale score difference seventh-grade CA.

Research question three. A Pearson product-moment coefficient was used to examine the correlation between the student survey responses which indicate technology positively impacted student achievement and students who scored proficient or advanced on the fifth, sixth, and seventh-grade level MAP MA test in spring 2014. There were 56 students who scored proficient or advanced in fifth, sixth, and seventh grade on the 2014 MAP MA test. The Pearson *r* determines the strength of a straight linear fit closest to r = 1.0 (Fraenkel et al., 2015). There was a correlation between the two variables [$r = .18$, $n = 56$], yet it was not statistically significant [$p = .19$].

Student survey question number six requested of student, “Do you feel using a computer helps you to better understand math?” Figure 11 is a frequency bar graph of the tally of responses for the 56 students who scored proficient or advanced in fifth, sixth, and seventh-grade on the 2014 MAP MA test. From this sample 30 students responded “Yes, Quite a Bit” or “Sometimes,” while 26 students responded “A Little Bit” or “Not At All.”

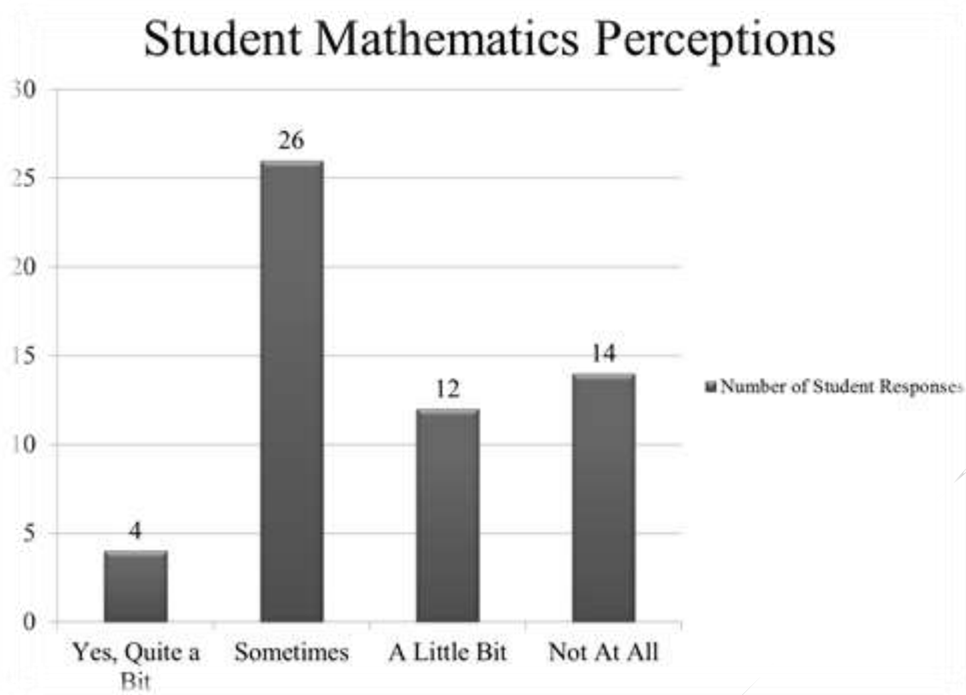

Figure 11. Student perceptions of technology related to math achievement frequency. Bar graph depicting number of student responses for 56 students who scored proficient or advanced on 2014 MAP grade-level MA test for survey question, "Do you feel using a computer helps you to better understand math?"

Research question four. A Pearson product-moment coefficient was used to examine the correlation between the student survey responses which indicate technology positively impacted student achievement and students who scored proficient or advanced on the fifth, sixth, and seventh-grade level MAP CA test in spring 2014. There were 67 students who scored proficient or advanced in fifth, sixth, and seventh grade on the 2014 MAP CA test. There was a correlation between the two variables [r = .38, n = 67], and it was statistically significant [p < .01]. The resulting data are presented in Table 7.

Table 7

Correlation between Responses Technology Positively Impacted Achievement and Students Who Scored Proficient or Advanced on MAP CA Test in spring 2014

		CA Score	Do you feel you do better on academic tests after having computers in the classroom?
CA Score	Pearson Correlation	1	0.38
	Sig. (2-tailed)		0.00
	N	67	67
Do you feel you do better on academic tests after having computers in the classroom?	Pearson Correlation	0.38	1
	Sig. (2-tailed)	0.00	
	N	67	67

Note. Statistical significance is noted at $p \leq .05$.

Research question five. Question five prompted exploration of the perceptions of teacher respondents regarding technology integration in one rural, low-socioeconomic K-12 school district. For teacher survey questions, a frequency analysis was conducted to examine the prevailing perceptions regarding each question (see Tables 8 and 9).

Table 8

Frequency Analysis of Teacher Perceptions of Technology-Enhanced Classrooms

Survey Question	Yes	No
Do you like technology in the classroom?	13	0
Do you want to work at a school more because there are computers available?	9	4
Does having lessons on a computer make the material more interesting to teach?	10	3
Does having lessons on the computer make the material more interesting to students?	11	2
Do you feel students do better on big tests, like the MAP test after having computers in the classroom?	10	3
Do you feel students need more time with computers in class?	10	3

Note. *N* = 13 Teacher Respondents

Table 9

Frequency Analysis of Teacher Perceptions of Technology-Enhanced Classrooms Likert

Survey Question	Yes	Sometimes	A little	Not at all
Do you feel using a computer for instruction helps you to teach?	7	5	1	0
	I always prefer a computer	Sometimes, I prefer a computer	Sometimes, I prefer a book	I always prefer a book
How much more do you prefer to teach from a computer-based lesson compare to a textbook?	3	8	2	0
	When the teacher reads and works the examples out for students	When the material is on a computer	When the material is read from a book	Students learn best with a combination of all three
How do you feel students learn best?	1	0	0	12

Note. *N* = 13 teacher respondents.

Summary

Chapter Four began with the descriptive data collected for this study and the criteria used to select the sampled population. The chapter included the results of the statistical analysis in response to the research questions for this study. The results of the Pearson product-moment correlation coefficient (denoted by *r*) and test of statistical significance (denoted by *p*) were clear there are positive and significant relationships between student perceptions of technology use in the classroom and student performance on standardized Missouri Assessment Program (MAP) grade-level tests.

In Chapter Five, the examiner describes the implications of the findings from the statistical analyses and outlines implications and recommendations for future research and practice.

Chapter Five: Summary and Conclusions

The ready availability of technology for instructional use has transformed the twenty-first century classroom for both the student and teacher (Hsu & Kuan, 2013). Decades ago, students were only privy to information as current as the last printing of the textbook. Today, information available to students may be almost instantaneous by comparison. With advances in available internet connections, classrooms may be connected to the world regardless of the physical location of the school (Fook, Sidhu, Kamar, & Aziz, 2011). If students are afforded a sufficient internet connection and serviceable devices, they are limited by ability and creativity, not by geographical location.

Continued longitudinal examination of the effectiveness of technology integration with respect to fiscal resources, time, and effort is in order as technologies quickly become outdated and new technologies must be adapted in order to stay current (Betrus, 2012). Craft (2012) identified administration as a main determinant in the direction a school takes toward technology integration; without proper guidance and planning, schools may not produce desired gains in the educational setting. The ability for teachers and students in today's classroom to share information and ideas globally is a necessity identified through multiple studies (Fortin, 2010; Schweder & Wissick, 2011; Shand et al., 2012).

The definition of technology is considered time-relevant as seen in the Mayan temples (Pollard, 2011) utilizing hieroglyphics to record events (Pezzati, 2012). Space-race technology (O'Brien & Sears, 2011) led into the Cold War Era (Hoffman, 2013). For teachers of today's modern classroom, technology is defined as tools used to deliver lessons to students to maximize student engagement (Yeung et al., 2012), even if the teaching process doesn't change with the method of delivery (Polly & Hannafin, 2010). Generational characteristics surface in the expectations and use of technology as Baby Boomers, Generation X, and Millennial generations have much-varied experiences with technology (Werth & Werth, 2011). *The Internship* (Vaughn, Levy, & Levy, 2013) depicted two characters who were out-of-sync with the expectations of the perceived Google environment, yet through team building and a collaborative effort, technology was harnessed in a beneficial way. School leadership must use team-building experiences with current teaching staff members in order to encourage staff from different technology backgrounds to utilize existing technology in a consistent and meaningful way to impact student learning (Austin & Hunter, 2013; Berrett et al., 2012; Uslu & Bumen, 2012).

The infusion of technology into the classroom has allowed students exposure to multiple avenues of information. Teachers have essentially limitless ways to acquire presentation materials for lesson plans and delivery of instruction (Lawrence & Lentle-Keenan, 2013). Entering as well as practicing educators reflect the increased need for technology access and integration into the classroom (Wright & Wilson, 2011). Technology has allowed educators around the world to connect (Istifci, Lomidazde, & Demiray, 2011). From collaborative efforts utilizing internet-based communication to being able to quickly locate and relay historically significant or current events to students, today's educators have a breadth of information at their disposal (Almekhlafi & Almeqdadi, 2010). Educators of a modern classroom must lead students though a technological maze, facilitating the learning process (Johnston, 2012).

Legislation comes into play through the enactment of policies, whether proactive or reactive, with the intent of strengthening technology programs (Austin & Hunter, 2013). School leaders must take an active role in monitoring current trends in technology, as well as the political side of education, in order to maintain an accurate focus for long-range planning, as program development is ultimately an administrative responsibility (Akbulut et al., 2011; Duffey & Fox, 2012; Schrum et al., 2011). An administrator's perception of technology and the associated political climate directly impacts the professional development and program design for the teacher, who is the critical link in the delivery of technology education to students (Persichitte, 2013; Uslu & Bumen, 2012). Administrators need sound fiscal training, as governmental agencies take a stronger look at the return on investment of long and short-term investment of funds into the development of the multitude of technology integration educational programs (Austin & Hunter, 2013; Uslu & Bumen, 2012).

Participation of the administrator in productive professional development is critical for the administrator to have a solid understanding of which potential technologies improve classroom instruction most readily; the administrator may then foster a professional development climate for technological integration and support of change (Berrett et al., 2012; Killion, 2013; Mann et al., 2011; Polizzi, 2011). Regardless of the model chosen, the literature is clear a structured process is to be in place in order to systematically devote fiscal resources, plan facility modifications, acquire technology, and provide teachers with appropriate professional development to ensure a successful technology integration program for students (Courville, 2011; Killion, 2013; McLeod et al., 2011; Polizzi, 2011). Persichitte (2013) indicated an effective technology leader must also possess the necessary skills to demonstrate proficiency, therefore building collective support from teachers. The professional development of the administrator is a key factor from both an application base to the political forefront in order to develop sustainable programs with a strong, positive technology-supportive culture (Berrett et al., 2012; Duffey & Fox, 2012; McLeod et al., 2011; Richardson et al., 2013). Teachers need to see a direct link into the educational setting; if administrators do not focus professional development to provide meaningful training to staff or treat the training as having little to no significant value, technology integration efforts will face quite a difficult challenge (Berrett et al., 2012; Brooks, 2011; Killion, 2013; Polizzi, 2011).

Teachers are the key element to successful technology integration, and the preparatory studies pre-service teachers receive are often not sufficient enough to foster a strong level of self-efficacy, which is an area of concern in need of being addressed (Akbulut et al., 2011; Pan & Franklin, 2011). A series of preparatory training and behaviors have been identified which lead to stronger teacher preparation, yet little has been done (Al-Ruz & Khasawneh, 2011; Hughes, 2013). Through significant and meaningful training, pre-service teachers and teachers alike may be prepared to deliver effective technology-based curriculums to students, with a self-efficacy to promote a positive learning climate (Kalota & Hung, 2013; Teo, 2012). A potential barrier of significance is the restriction of web 2.0 applications, which may be restricted or blocked from the institutional side or as a parental restriction from the family side, either of which limits some emerging technology-integration strategies (Kalota & Hung, 2013; Pamuk, 2012; Pan & Franklin, 2011).

Teachers ultimately determine what is and is not taught to students in the classroom, and ensuring classrooms are equipped with technology does not ensure the integration with students will occur; the instructor must also realize the beneficial addition to technology in the classroom environment (Al-Ruz & Khasawneh, 2011; Graham et al., 2012; Pamuk, 2012). Teachers need the ability to assess the effectiveness of technologies in curriculum, providing feedback to administrators for future planning, as just having the devices and knowledge of how to use the technology does not ensure effectiveness upon deployment (Al-Awidi & Alghazo, 2012; Graham et al., 2012; Ham, 2010; Kalota & Hung, 2013; Pamuk, 2012). Teachers and pre-service teachers alike express a concern for integration of technology with students, especially web 2.0 activities, as there is a necessary change from teacher-centered to student-centered programs which is in contrast to traditional teaching methods (Al-Awidi & Alghazo, 2012; Al-Ruz & Khasawneh, 2011; Latham & Carr, 2012). This uncertainty will not lead to successful technology integration programs, and confidence is an important component any systems change (Al-Awidi & Alghazo, 2012). Akbulut et al. (2011) found an average technology training experience level of just over five years, which is determined not to be sufficient to build self-efficacy. The lack of a supporting climate negates implementation efforts, yet is not tied to income or urban versus rural setting (Akbulut et al., 2011; Teo, 2012).

Social media is taking on a new front with relation to education, and the perceptual image of a teacher may be pre-determined (Carr et al., 2013). Web 2.0 technologies have a place in the educational setting as students today have interacted with technology essentially since birth, but as with any technology-related item, the propensity exists for the effects not to be positive (Blair, 2012; Carr et al., 2013; Downes & Bishop, 2012). Therefore, developing and projecting a positive climate is essential for a technology-based curriculum, for both the educational content delivered to students and the professional image presented to social media (Cviko et al., 2012; Howley et al., 2011). Pre-service teachers and veteran teachers alike express self-efficacy concerns, whether it is from lack of dedicated technological support personnel, lack of classroom experience, or from lack of technical background knowledge. This therefore presents an ideal partnership of strong mentor pairing of educators with varying levels of experience (Aypay et al., 2012; Cviko et al., 2012; Howley et al., 2011).

Through a study conducted by Akbulut et al. (2011), male educators were determined to possess a positive outlook for technology in and of itself, yet women educators were found to prefer a Learning-Community approach to technology delivery. Deployment of technology alone without a significant professional development program will do nothing more than expend funds and perhaps increase basic technology uses such as word processing, presentations, and communication (Anthony, 2012; Hughes, 2013). Students and technologically driven staff alike have high expectations for instant communication, with students in particular being very adept with social media, yet the benefit to the learning environment is lacking (Blair, 2012; Cviko et al., 2012; Germany, 2014).

Students of today will struggle to meet societal expectations if without a solid technological background, reaffirming the need for teachers to have direct and meaningful input as to what technology integrations designs work in the classroom (Anthony, 2012; Howley et al., 2011). Students also need to be given the supports needed to effectively engage students in the technology-based learning environment (Hughes, 2013; Tannis, 2013). Teaching staff do not see a direct link between administrative support and student growth, but do see a link between student growth and climate, as well as the usefulness seen by the teacher as a meaningful link to technology integration (Anthony, 2012; Aypay et al., 2012; Howley et al., 2011).

Societal reluctance as a barrier to technology integration was identified in some settings, as parents or schools were apprehensive of technologies with students, especially elementary students, which limits technology integration of web 2.0 curriculums and potentially leads teachers to design ineffective lessons (Cviko et al., 2012; Germany, 2014; Howley et al., 2011). The most effective lesson designs are those which incorporate technology the teacher can see directly benefitting the student lesson; therefore, clear goals need to be set, as each school will apply lessons differently (Anthony, 2012; Aypay et al., 2012; Ham, 2010). To foster creative student growth, experimental learning needs to take place to foster and engage creativity, which will also bolster self-efficacy (Blair, 2012; Ketsman, 2012; Otamendi & Doncel, 2013). Such non-conventional methods of technology integration may require restructuring policies as these methods could include structured social media and gaming (Anthony, 2012; Aypay et al., 2012; Germany, 2014; Otamendi & Doncel, 2013).

Research has proven targeted meaningful professional development helps to foster and support technology integration, even though the leadership is still reorganizing programs of professional development with the intent of assessing whether lack of successful integration is dependent upon teacher skills or upon student-use devices (Anthony, 2012; Duran et al., 2012; Hsu, 2010). Lack of adequate training, time for planning, and implementation are barriers for teachers, but the lack of adequate technological support impedes desired technology integration levels (Anthony, 2012; Germany, 2014; Hsu, 2010). With proper technology supports in place, distance learning and other technologically-based student learning experiences may take place, fostering higher-ordered thinking skills applicable to a technologically-driven society (Ketsman, 2012; Martinez & McGrath, 2014; Otamendi & Doncel, 2013).

Student technology-device policies may inhibit technology integration, be a source of contention with students, and deter public support of the school system (Anthony, 2012; Otamendi & Doncel, 2013). As many parents may see restrictions upon personal technology devices as a non-proactive technology lesson design as many students may prefer communicating though technology rather than in person (Downes & Bishop, 2012; Germany, 2014). Teachers and students may use collaboration technologies in order to foster learning as both have indicated a high level of satisfaction with using such technologies, which builds self-efficacy in both groups, fostering a supportive climate of growth (Martinez & McGrath, 2014; Moore-Hays, 2011; Otamendi & Doncel, 2013).

Teachers as well as students benefit from sufficient time being allotted for technology lessons and skill attainment, as well as indicators of progress such as a digital badge when a particular skill has been mastered (Anthony, 2012; Ketsman, 2012; Randall et al., 2013). Administrators face the daunting task of providing meaningful professional development when teaches are entering at different levels of proficiency and progress to additional levels at different rates, necessitating a clear set of goals (Anthony, 2012; Baran et al., 2011; Ketsman, 2012). Teachers willing to integrate technology need the administrative support to find the resources to be successful, such as fiscal resources and media specialist support to increase staff and student use of technology (Anthony, 2012; Ketsman, 2012).

There is consensus teachers need a fluent knowledge of technology prior to integrating with students, and learning is more effective when students are empowered through facilitative teaching (Baran et al., 2011; Martinez & McGrath, 2014). Modeling by the teacher may only be accomplished if self-efficacy is raised to a level where the teacher feels comfortable as a facilitator (Al-Ruz & Khasawneh, 2011; Baran et al., 2011). Students have shown the strongest progress when the learning is relevant and self-driven, supporting the need for teachers to have a high level of self-efficacy to foster education facilitation rather than lecture, which is dependent upon planned, targeted, meaningful, ongoing professional development (Sethy, 2012; Smolin & Lawless, 2011).

For both the student and the teacher to gain the greatest impact from technology integration, both need a high level of fluency in technology, which can be attained from initial high-quality professional development (Davies, 2011; Teck, 2013). Previously, digital communication meant a recording such as a DVD, while digital communication used by students today includes social media platforms, online gaming, and other open source methods (Carr et al., 2013; Raob et al., 2012). Students now expect an ability to communicate virtually anywhere at any given point in time, which has the potential to dramatically increase the wealth of global information and increases the need for dependable technology devices and supports in the classroom, especially with second-generation web tools, so as not to lose the entire lesson and negate the climate of the educational setting (Carr et al., 2013; Cifuentes et al., 2011 Owens, 2012; Terras & Ramsay, 2012).

Administrators have had a long-standing role of developing meaningful professional development programs to support technology integration, to foster a positive climate, and to ensure teachers have the resources needed to affect change (Cakiroglu et al., 2012; Potter & Rockinson-Szapkiw, 2012; Teck, 2013). Many teachers find social-media supports such as YouTube to potentially support the classroom curriculum; however, some may struggle to balance such technologies with traditional methods, as the online supports possess a higher risk of student exposure to undesirable content (Carr et al., 2013; Raob et al., 2012; Shinsky & Stevens, 2011). The rapid rate of technological expansion causes increased challenges for teachers to keep up with current technologies and deliver information to students in a meaningful way, which fosters the development of a teacher-facilitator as opposed to a teacher-lecturer (Carr et al., 2013; Potter & Rockinson-Szapkiw, 2012; Tingoy & Gulluoglu, 2011).

Technology alone will not foster in-depth teaching or higher learning, but quality professional development may help promote self-efficacy, which in-turn promotes technology integration with students, increasing the likelihood of higher-order thinking (An & Reigeluth, 2012; Teck, 2013; Yucel et al., 2010). Classroom technology oftentimes goes underutilized forging a stronger path for the development of a supportive technology-rich climate, as there is a direct link between a strong technology program and a highly skilled teaching force with a developed self-efficacy which allows classroom facilitation (Berlin & White, 2012; Cakiroglu et al., 2012; Potter & Rockinson-Szapkiw, 2012; Tingoy & Gulluoglu, 2011). Teacher training developed to build technological skills and self-efficacy is essential for the effective delivery of technologically-based instruction to students and to attract and retain quality teachers for the students served (Carr et al., 2013; Duffey & Fox, 2012; Pan & Franklin, 2011; Tingoy & Gulluoglu, 2011).

A key component of an educator of today is the ability to teach a skill to students to be able to filter through the vastness of the global information system. (Everhart, Mardis, & Johnston, 2011; Hagerman, Keller, & Spicer, 2013; Jones & McLean, 2012). The successful student of tomorrow must be able to ascertain which information is credible and which is not useful as presented online (Cikar, 2012; Johnston, 2012). Given the proper technological tools combined with solid facilitative instruction, the potential for growth of a student's intellectual capacity is as much self-governed as it is opportunistic (Hsu & Kuan, 2013; Peterson-Karlan, 2011). A student who has been given an adequate technological background may access data and ideas from around the world to synthesize potential solutions to virtually any given problem (Dawson, 2012).

Findings

To more closely examine the perceived benefits versus actual effectiveness of technology integration into the educational setting from both the student and instructor points of view, this study involved examination of the following research questions to determine the statistical impact of one rural, low-socioeconomic K-12 school district.

Research question one. What is the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Mathematics (MA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014)?

$H1_0$: There is no correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Mathematics (MA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014).

To examine research question one, a Pearson product-moment coefficient was used to examine the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Mathematics (MA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) versus technology-enhanced instruction (school year 2013-2014). The Pearson *r* determines the strength of a straight linear fit closest to $r = 1.0$ (Fraenkel et al., 2015). In examining the current fifth-grade student scores in MA for the school years 2012-2013 and 2013-2014, there was a strong positive linear correlation between the two variables [$r = .79$, $n = 31$] which was statistically significant [$p < .01$]. For this reason the null hypothesis $H1_0$ was rejected for fifth-grade results. In examining the current sixth-grade student scores in MA for the school years 2012-2013 and 2013-2014, there was a strong positive linear correlation between the two variables [$r = .85$, $n = 45$] which was statistically significant [$p < .01$]. For this reason the null hypothesis $H1_0$ was rejected for sixth-grade results. In examining the current seventh-grade student scores in MA for the school years 2012-2013 and 2013-2014, there was a strong positive linear correlation between the two variables [$r = .85$, $n = 61$] which was statistically significant [$p < .01$]. For this reason the null hypothesis $H1_0$ was rejected for seventh-grade results.

Technology can be very beneficial when properly applied into the curriculum delivered to students of mathematics (Borovik, 2011). Students benefit from the expanded curriculum supports available through technological devices (Brusi, Portnoy, & Toro, 2013). A key component to understanding and applying mathematics is the students' ability to combine lessons learned in the classroom and apply skills in a productive way to solve problems (Niess, 2011).

Research question two. What is the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Communication Arts (CA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014)?

$H2_0$: There is no correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Communication Arts (CA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014).

To examine research question two, a Pearson product-moment coefficient was used to examine the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Communication Arts (CA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) versus technology-enhanced instruction (school year 2013-2014). The Pearson *r* determines the strength of a straight linear fit closest to $r = 1.0$ (Fraenkel et al., 2015). In examining the current fifth-grade student scores in CA for the school years 2012-2013 and 2013-2014, there was a strong positive linear correlation between the two variables [$r = .70$, $n = 31$] which was statistically significant [$p < .01$]. For this reason the null hypothesis $H2_0$ was rejected for fifth-grade results. In examining the current sixth-grade student scores in CA for the school years 2012-2013 and 2013-2014, there was a strong positive linear correlation between the two variables [$r = .82$, $n = 46$] which was statistically significant [$p < .01$]. For this reason the null hypothesis $H2_0$ was rejected for sixth-grade results. In examining the current seventh-grade student scores in CA for the school years 2012-2013 and 2013-2014, there was a strong positive linear correlation between the two variables [$r = .81$, $n = 61$] which was statistically significant [$p < .01$]. For this reason the null hypothesis $H2_0$ was rejected for seventh-grade results.

Through the use of technology, instructors have yet another tool in the quest of bringing relevance into the classroom (Sangra & Gonzalez-Sanmamed, 2011). The training teachers receive to combine content knowledge and to integrate technology into the curriculum is an important step in seeing the desired results in student performance (Abbitt, 2011). Technology integration helps with student skill attainment in communication arts, as document writing and using technology to communicate are a dominant use of technologies in the classroom environment (Hughes, 2013).

Research question three. What is the correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP MA test in spring 2014?

$H3_0$: There is no correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP MA test in spring 2014.

To examine research question three, a Pearson product-moment coefficient was used to examine the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Mathematics (MA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) versus Technology-enhanced instruction (school year 2013-2014). The Pearson *r* determines the strength of a straight linear fit closest to $r = 1.0$ (Fraenkel et al., 2015). There was a correlation between the two variables [$r = .18$, $n = 56$] which was statistically significant [$p = .19$]. For this reason the null hypothesis $H3_0$ was rejected.

Students who perceived technology benefits their education have seen a reflection in standardized test scores as well as stronger self-esteem with being technology-savvy. For students who may not reflect a high standardized test score, they may not have performed as well as they did had it not been for the technology integration efforts and curriculums designed and delivered by teachers (Anthony, 2012). Utilizing technology in context provides an environment for focused self-driven skill attainment (Sethy, 2012).

Research question four. What is the correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP CA test in spring 2014?

$H4_0$: There is no correlation between the survey respondents who believe technology positively impacted their achievement and students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP CA test in spring 2014.

To examine research question four, a Pearson product-moment coefficient was used to examine the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Communication Arts (CA) for students who initially were instructed utilizing traditional methods (school year 2012-2013) versus technology-enhanced instruction (school year 2013-2014). The Pearson *r* determines the strength of a straight linear fit closest to $r = 1.0$ (Fraenkel et al., 2015). There was a correlation between the two variables [$r = .38$, $n = 67$] which was statistically significant [$p < .01$]. For this reason the null hypothesis $H4_0$ was rejected.

Society has drastically increased the demand with regard to technology and communication, necessitating today's students to be technology fluent in multiple platforms, including utilization such as word processing and second-generation web technologies in order to be competitive (Brooks, 2011; Hughes, 2013).

Research question five. What are the perceptions of teacher respondents regarding technology integration in one rural, low-socioeconomic K-12 school district?

For teacher survey questions, a frequency analysis was conducted to examine the prevailing perceptions regarding each question. The teacher survey results indicate a feeling technology helps educators teach more effectively. One hundred percent of surveyed teachers expressed they like technology in the classroom, and 85% indicted teaching the lessons on the computer makes the material more interesting to students. The lowest expression of affirmation came from the question, "Do you want to work at school more because there are computers available?" Only 69% of surveyed teachers perceived computers to be an enticement for working at school (see Table 9).

A Likert scale analysis of additional teacher survey questions produced results which would indicate a positive perception of the addition of computers for instructional use. When asked, "How do you feel students learn best?" 12 of 13 teachers expressed the combination of teacher-led instruction, computer-enhanced instruction, and traditional textbook information provides the best learning solution for students.

Teachers indicated a benefit from the integration of technology into classroom curriculum, yet hold fast to the ideology the classroom teacher is an irreplaceable stronghold. Teachers indicated the best integration occurs when teachers have received proper training and students have adequate access to dependable technologies with which to utilize technologically-based activities in the classroom (Howley et al., 2011). Aypay et al. (2012) found the ease of technology integration and its perceived usefulness had a direct effect upon the successful integration of technology into the classroom for student support. Students were found to benefit the most from technological integration when the self-efficacy of the teacher was great enough to transform the instructor from a lecturer to a facilitator, allowing students to develop higher-ordered thinking skills and technological applications (Blair, 2012).

Conclusions

When interpreting the strength of correlations, it is noted if $r \geq .70$ or higher, there is a strong positive linear relationship (Bluman, 2013, p. 539). As seen in Figure 12, all six of the hypothesized paths for research question one and research question two were supported by a strong positive Pearson product-moment correlation coefficient (Bluman, 2013).

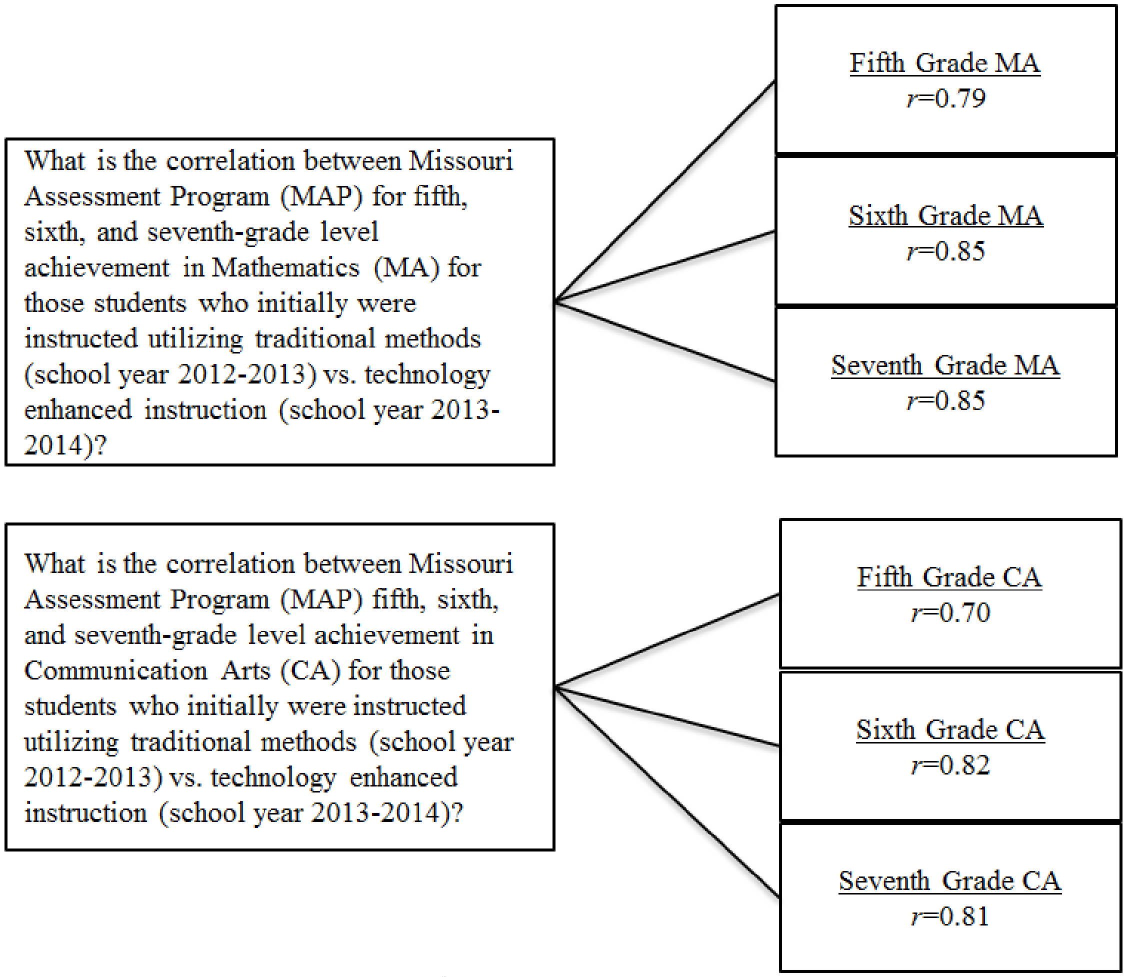

Figure 12. A model of correlation between student performance increase on MAP assessments after technology integration.

Research question one. What is the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Mathematics (MA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014)?

Mean scores improved in fifth, sixth, and seventh-grade level achievement in Mathematics (MA) for students who initially were instructed utilizing traditional methods (school year 2012-2013) versus technology-enhanced instruction (school year 2013-2014). As seen in Table 10, the fifth-grade mean scale score improved 24.71 points, from 619.77 to 642.94; the sixth-grade mean scale score improved 5.95 points, from 649.69 to 655.64; and the seventh-grade mean scale score improved 23.38 points, from 653.13 to 676.51, after technology was introduced for instruction. Eighth grade and fifth grade realized the greatest improvement, yet it should be noted the 2013 before score and 2014 after score for fifth grade were below both the before and after scores for sixth and seventh grades.

Table 10

Descriptive Statistical Comparison among Fifth-Grade, Sixth-Grade, and Seventh-Grade MA Mean Scores Before and After Technology Instruction

	Valid *N*	2013 Score	2014 Score	Mean Difference
5th Gr. Mean	31	619.77	642.94	23.17
6th Gr. Mean	46	649.69	655.64	5.95
7th Gr. Mean	61	653.13	676.51	23.38

Research question two. What is the correlation between Missouri Assessment Program (MAP) fifth, sixth, and seventh-grade level achievement in Communication Arts (CA) for those students who initially were instructed utilizing traditional methods (school year 2012-2013) vs. technology-enhanced instruction (school year 2013-2014)?

Mean scores improved in fifth, sixth, and seventh-grade level achievement in Communication Arts (CA) for students who initially were instructed utilizing traditional methods (school year 2012-2013) versus technology-enhanced instruction (school year 2013-2014). As seen in Table 11, the fifth-grade mean scale score improved 24.71 points, from 641.03 to 665.74; the sixth-grade mean scale score improved 5.89 points, from 667.52 to 673.4; and the seventh-grade mean scale score improved 7.49 points, from 668.08 to 675.57, after technology was introduced for instruction. Fifth grade realized the greatest improvement, yet it should be noted the 2013 before score and 2014 after score for fifth grade were below both the before and after scores for sixth and seventh grades.

Table 11

Descriptive Statistical Comparison among Fifth-Grade, Sixth-Grade, and Seventh-Grade CA Mean Scores Before and After Technology Instruction

	Valid *N*	2013 Score	2014 Score	Mean Difference
5th Gr. Mean	31	641.03	665.74	24.71
6th Gr. Mean	46	667.52	673.41	5.89
7th Gr. Mean	61	668.08	675.57	7.49

Research question three. What is the correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP MA test in spring 2014?

Of the responding students surveyed who earned a proficient or advanced rating on the standardized MAP exam, 68% indicated a benefit from having access to computers in understanding mathematics, ranging from a little bit to quite a bit. Twenty-eight percent of the same tested population did not express a benefit from having access to computers in understanding mathematics. In 2014, of the responding students surveyed who earned a proficient or advanced rating on the standardized MAP exam, 75% indicated a benefit from having access to computers in understanding mathematics, ranging from a little bit to quite a bit. Twenty-five percent of the same tested student population indicated they felt no benefit from having access to computers in the classroom to help them understand mathematics. Survey data correlate to standardized testing data to indicate a 7% increase from 68% to 75% of students earning a proficient or advanced rating also perceiving a benefit from the access of technology and related student skill attainment.

Of the 139 potential student responses, 88 indicated a preference for reading from a computer screen. Fifty student responses indicated a preference for reading from a traditional book. Of the student responses, 86 indicated feeling they performed better on large tests, such as the MAP, due to having computers in the classroom. The same number (86) indicated they felt the need for more time to be spent on computers during class time. Students earned a combined 194 proficient and advanced scores on the standardized state MAP test during the studied period. Student perception and standardized MAP data both support the integration of technology in the classroom to improve communication arts skills for students.

Research question four. What is the correlation between the survey respondents who believe technology positively impacted their achievement and those students who scored Proficient or Advanced on the fifth, sixth, and seventh-grade level MAP CA test in spring 2014?

Of the responding students surveyed who earned a proficient or advanced rating on the standardized MAP exam, 42% indicated a preference in reading from a book in 2013. Fifty-eight percent of the same tested population in 2013 indicated a preference in reading from a computer. In 2014, of the responding students surveyed who earned a proficient or advanced rating on the standardized MAP exam, 44% indicated a preference in reading from a book. Fifty-six percent of the same tested student population indicated a preference in reading from a computer. Survey data correlate to standardized testing data to indicate a 2% variance in students who earned proficient and advanced ratings on the standardized testing preferential reading from a technological device versus traditional printed means.

Research question five. What are the perceptions of teacher respondents regarding technology integration in one rural, low-socioeconomic K-12 school district?

Teachers of the studied student groups were asked to voluntarily share opinions from the teacher's perspective as to whether or not technology and related devices are beneficial to students in the classroom setting. Responding teachers overwhelmingly indicated a consistent response relating to the benefits of technology with regards to having more resources at the teacher's disposal for designing and delivering lessons, as well as offering students another avenue to review or expand upon information presented in the classroom. Some teachers did indicate school can be interesting, and teaching students to do their best can be accomplished without the use of technology. Some teachers also indicated a concern of some student's lack of technology interaction skills, such as typing. Teachers indicated a beneficial aspect to technology integration was allowing the teacher to be more able to address differentiated instructional needs. Teachers also expressed the ability of select technology applications to interact with students, increasing student engagement in learning activities through various means such as playing games to teach various mathematical principles.

Notable was a lingering connection to paper-pencil activities. Not indicating technology necessarily was bad, some teachers expressed a need for students to interact with a physical book. Some teachers also indicated the expectation for students to learn by paper-pencil and for students to use technology for reinforcement. Some teachers expressed a concern for the various potential ergonomic hazards from technological interaction, such as eye-strain. Teachers also indicated essentially the learning process is a product of good teaching, regardless of the method of delivery.

With respect to the need to teach technology in today's classrooms, teachers had a consensus of yes. Technology is apparent in the everyday lives of most workplaces. Therefore, in order to become a viable employee, technologically savvy skills are inherently necessary. Teachers see the need to grow technology skills in students, as the wealth of information available to them is great and information is a key factor to student success in the modern world. As noted in the work of Lin (2012), proper professional development is essential for the effective school implementation of technology into the classroom to help ensure the timing, type, and way in which technology activities are integrated into the classroom become an inseparable component of a successful classroom. While there are limitations to student technology use, such as access and each student's ability to interface with technology, teachers indicate technology skills are to be a part of the students' future.

Implications for Practice

During the course of this study, the observation was made while much technology is in use, much more is sitting idle on tables or locked away from student use. The burden to actively use technology on a planned and regular basis is upon school administrators and classroom teachers alike. Anthony (2012) offered the potential contradictions between a district's technology planning intention and the actual integration of those systems (see Table 12). Anthony's (2012) guiding questions may be used to further investigate the intersystem linkages of efficiency among intent, support, and implementation of school technologies.

Table 12

Guiding Questions to Inform Investigation of Intersystem Linkages

Activity System Element	Possible Question
Objective	Is the objective of the technology initiative aligned with objectives of teachers' classroom practices?
Mediating artifacts	To what extent do computer technology and professional development support or hinder teaching practice?
Rules	How do district policies support or hinder technology integration?
Community	Do teachers have opportunities to work with and learn from colleagues to support technology integration?
Division of labor	Would teachers benefit from additional technology integration support (e.g., co-teaching, locating instructional resources, in-class professional development, data collection or analysis)? Do teachers have opportunities to provide suggestions for program improvement?

Note. Anthony (2012) table of guiding questions to inform technology integration improvement.

Anthony (2012) explained the planning process is improved by district efforts to increase teacher ownership over technology professional development resources. Teachers are surrounded by technology in the classroom setting, from computers for technological communication and instructional delivery to the students' personal devices (Hammonds, Matherson, Wilson, & Wright, 2013). The work of Hammonds, et al. (2013) also indicated the utilization of all devices is the burden of the classroom teacher who may feel are often behind on effective technology utilization, which further strengthens the need for strong, well-developed professional development for teachers. When developing a technology program rollout, it is very easy to get caught up in simply the fiscal and structural resources needed to make the technology work in a given location. Care must be taken to ensure newly planned technologies will interface with existing or upgraded school networks and sufficient filtering software and firewalls are readily available to protect students and the district network from undesirable situations. Essential to such planning is to involve the head of the district technology program, or to consult with a competent outside vendor to ensure compatibility and functionality of the intended technology in a given classroom setting. There is a perceptual benefit by teachers with regards to having access to a technology coach in order to successfully integrate technology with students in the areas of collaboration and discussion (Sugar & Tryon, 2014). Through support for the classroom teacher, Sugar and Tryon (2014) also found teachers to have a retentive preference for paper-based examples, and assistance in seeking information extending beyond the walls of the classroom. Support helped teachers overcome the customary use of paper-pencil activities, to integrating technology infused lessons which met the growing expectations from multiple levels, including state and national standards (Sugar & Tryon, 2014).

Professional development for staff should be paramount on the agenda. The assumption all or any one particular group of teachers already have the necessary background skills to implement a technology program will undoubtedly lead to at the least frustration, and at the worst, failure. A secondary downside of a struggling beginning to a technology deployment is losing the momentum and enthusiasm of the teachers, which may be difficult to regain at best. The professional development needs to be not only inclusive of how to functionally use the technologies being deployed, classroom-specific professional development is needed as a part of a training series, which will help teachers integrate new technologies into classroom curriculum.

Finally, there is a need for administration to regularly touch base with teachers as to the positive and negative effects of the newly deployed technology device or program. Without direct input from the teaching staff, administration will be less likely to plan meaningful professional development activities to assist teachers to educate students with ongoing training. The process of technology integration is not a one-time event. Technology has become an integral part of a modern society, necessitating a continual growth of all involved in order to keep up with the rapid pace of technology development and expansion.

Recommendations for Future Research

With regards to future research, much attention could be paid to the study of the effects upon the learning climate students experience as a result of technology integration. Research study would also be well spent investigating the culture of those schools which have integrated technology into the curriculum. To date, many research projects have focused primarily upon the integration of technology devices or end-user software programs. Previous studies were designed logically given the rapid rate of technology growth in the twentieth and twenty-first centuries. However, the ultimate goal is and should be student learning, which may take an additional level of analysis to study and address the long-term cultural and educational impact of technology integration in the classroom.

Summary

The vast amounts of time and resources devoted to technology acquisition, training, and implementation may or may not have the desired effects upon the educational setting, regardless of public perception (Austin & Hunter, 2013). The primary investigator attempted to address the lack of research with regards to student perception as compared to measurable outcomes as evidenced on the MAP (Fraenkel et al., 2015). The studied district had deployed various technology enhancement programs over several years in one form or another, with varying success. Some technology rollouts or device implementations were accompanied by associated professional development as part of the implementation process. Due to time constraints, some deployments did not receive the types of professional development teachers needed for the strongest implementation of technologies with students.

To qualify as a current student, the student must have been enrolled in the district and in the studied groups for two consecutive years. The definition of the design of a traditional classroom was to include chalkboards, whiteboards, multimedia projectors, and traditional textbooks. The definition of the design of technology-enhanced instruction classrooms was to include a high enough concentration of student-use technology devices to allow for the teacher to become a facilitator of student instruction and learning, rather than just a lecturer to a captive audience (Shand et al., 2012).

Multiple research-based methods were reviewed to determine the best way to analyze and interpret collected data (Bernhardt, 2013), social research methods (Maxwell, 2013), professional development and related transformations (Reeves, 2010), interpretation of research methods and data (McEwan & McEwan, 2003), and research design guidelines (Fraenkel et al., 2015). From the review of research design practices, two examiner-designed surveys were administered to students and teachers of the studied district after appropriate permissions were gained from the president of the board of education, the building principals, the parents of the student, and the students.

Each survey was designed to gather perceptual data from the perspective of a student or from the perception of a teacher. The respective surveys were designed to gather information with regards to the effects upon student learning as related to the implementation of technology integration into the classroom setting. Similar surveys were given to students and teachers with comparable questions to gain comparative data for analysis. The significant difference in the language among the research questions posed was to direct the reader to a particular frame of reference.

Similar results are possible, yet not expected, if a similar study were conducted in an economically affluent district, where technology-integration efforts may be more prevalent. Further, rural areas may experience a weaker infrastructure resulting in disparities or barriers for effective technology integration (Real, Bertot, & Jaeger, 2014). In either case, if a study were constructed for application to the aforementioned socioeconomic and demographic settings, care should be taken to account for the potential influx of the external mediating factors previously mentioned. Student perceptions of the benefits of technology integration were compared to actual academic achievement of the same students, as measured by a standardized statewide exam, the MAP test.

Results from student surveys indicated a student perception of benefit to learning with technology in regard to mathematics, which was also supported by standardized testing results. Results from student surveys indicated a student perception of benefit to with technology in regard to communication arts, which was also supported by standardized testing results. There was a stronger link to student perception with regards to learning mathematics through technology utilization as compared to learning communication arts through technology utilization.

Teacher perception was relevant to the availability of information for lesson preparation and methods of delivery, as the most beneficial component to the incorporation of technology into the classroom setting. The integration of technology into the classroom environment was perceived as a benefit by both students and teachers, and was supported as beneficial by the measurable gains achieved by the students on the state-wide standardized MAP test.

Appendix A

Student Perception Survey of Technology-Enhanced Classrooms

1. I have returned the Informed Consent Form signed by my parents.

    __ Yes __ No

2. I understand this survey is voluntary.

    __ Yes __ No

3. Do you like having technology in your classroom?

    __ Yes __ No

4. Do you want to be at school more because there are computers available?

    __ Yes __ No

5. Does having lessons on a computer make the material more interesting?

    __ Yes __ No

6. Do you feel using a computer helps you to better understand math?

    __ Yes, quite a bit

    __ Sometimes

    __ A little bit

    __ No, not at all

7. How much more do you prefer to read from a computer, compared to a textbook?

    __ Quite a bit, I prefer reading on a computer

    __ Sometimes I prefer reading on a computer

    __ Sometimes I prefer reading from a book.

    __ I always prefer reading from a book

8. How do you feel you learn best?

__ I learn best when the teacher reads and works example problems out with us

__ I learn better when the material is on a computer

__ I learn better when the material is from a book

__ I learn best from a combination of all three

9. Do you feel you do better on big tests, like the MAP test after having computers in the classroom?

__ Yes

__ No

10. Do you feel you need more time with computers in class?

__ Yes

__ No

11. Do you feel technology helps you learn? Why or why not?

12. Do you feel technology makes school more interesting? Why or why not?

13. Do you feel you enjoy reading better from a computer screen? Why or why not?

14. Do you feel working math problems on a computer are easier to understand? Why or why not?

15. Do you feel you need to understand how to use computers to learn to be successful in life? Why or why not?

Appendix B

Teacher Perception Survey of Technology-Enhanced Classrooms

1. I have returned the Adult Informed Consent Form.

   __ Yes

   __ No

2. I understand that identifiable data will be removed before any results are shared with the Primary Investigator.

   __ Yes

   __ No

3. I understand this survey is voluntary.

   __ Yes

   __ No

4. I teach students primarily in grade:

   __ 3

   __ 4

   __ 5

   __ 6

   __ 7

5. Do you like having technology in your classroom?

   __ Yes

   __ No

6. Do you want to work at a school more because there are computers available?

__ Yes

__ No

7. Does having lessons on a computer make the material more interesting to teach?

__ Yes

__ No

8. Does having lessons on a computer make the material more interesting to your students?

__ Yes

__ No

9. Do you feel using a computer for instruction helps you to teach?

__ Yes, quite a bit

__ Sometimes

__ A little bit

__ No, not at all

10. How much more do you prefer to teach from a computer-based lesson compared to a textbook?

__ Quite a bit, I prefer teaching from a computer

__ Sometimes I prefer teaching from a computer

__ Sometimes I prefer teaching from a book.

__ I always prefer teaching from a book

11. How do you feel your student's learn best?

__ When the teacher reads and works example problems out for students

__ When the material is on a computer

__ When the material is read from a book

__ Students learn best from a combination of all three

12. Do you feel students do better on big tests, like the MAP test after having computers in the classroom?

__ Yes

__ No

13. Do you feel students need more time with computers in class?

__ Yes

__ No

14. Do you feel technology helps you to be a more effective teacher? Why or why not?

15. Do you feel technology makes school more interesting? Why or why not?

16. Do you feel you enjoy teaching reading better from a computer screen? Why or why not?

17. Do you feel teaching math problems on a computer are easier for students to understand? Why or why not?

18. Do you feel your students need to understand how to use computers to learn to be successful? Why or why not?

Appendix C

[redacted]

To Whom It May Concern:

As Elementary Principal for the [redacted] School District, I hereby authorize Richard Sullivan as the primary researcher to utilize elementary school standardized testing data and to disseminate surveys and to collect other information as needed for research purposes.

Sincerely,

[redacted]

Appendix D

[redacted]

To Whom It May Concern:
As Middle School Principal for the [redacted] School District, I hereby authorize Richard Sullivan as the primary researcher to utilize middle school standardized testing data and to disseminate surveys and to collect other information as needed for research purposes.

Sincerely,

[redacted]

Appendix E

[redacted]

To Whom It May Concern:

As President of the Board of Education for the [redacted] School District, I hereby authorize Richard Sullivan as the primary researcher to utilize overall district and individual school standardized testing data and to disseminate surveys and to collect other information as needed for research purposes.

Sincerely,

[redacted]

Appendix F

Lindenwood University

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

Informed Consent for Parents to Sign for
Student Participation in Research Activities

Integration of Technology into the Classroom Environment:
A Study of Student Perceptions as Related to Skill Attainment

Principal Investigator: Richard Sullivan
Telephone: [redacted] E-mail: [redacted]

Participant ______________________________ Parent Contact info ___________________

Dear Parent,

1. Your child is invited to participate in a research study conducted by Mr. Richard Sullivan under the guidance of Dr. Julie Williams of Lindenwood University. The purpose of this research is to determine the benefit to students of utilizing technology in the classroom.

2. a) Your child's participation will involve
   - ➢ The Primary Investigator (PI) is the superintendent of the district.
   - ➢ Completing a one-time, paper/pencil or electronic survey to determine his or her perception of the impact of technology in their academic success at [redacted].
   - ➢ The survey results will be combined with the student's MAP score results.
   - ➢ All student identifiable information will be removed by a third party.
   - ➢ Students will only be identified by a random number.
   - ➢ The third party is the District's Data Reporter, whom regularly uploads results to the state department and compiles reports for the district administration.

   Approximately 100-150 students may be involved in this research.

   b) The amount of time involved in your child's participation will be approximately 10 to 15 minutes.

3. There are no anticipated risks to your child associated with this research.

4. There are no direct benefits for your child's participation in this study. However, your child's participation will contribute to the knowledge about the continued expansion of technology for education at [redacted].

5. Your child's participation is voluntary and you may choose not to let your child participate in this research study or to withdraw your consent for your child's participation at any time. Your child may choose not to answer any questions that he or she does not want to answer. You and your child will NOT be penalized in any way should you choose not to let your child participate or to withdraw your child.

6. We will do everything we can to protect your child's privacy. As part of this effort, your child's identity will not be revealed in any publication or presentation that may result from this study.

7. If you have any questions or concerns regarding this study, or if any problems arise, you may call the Investigator, Mr. Richard Sullivan, or the Supervising Faculty, Dr. Julie Williams (417-256-6150). 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 may request a copy of this consent form for my records. I consent to my child's participation in the research described above.

__________________________________ ______________________________

Parent's/Guardian/s Signature Date Parent's/Guardian/s Printed Name

____

Child's Printed Name

__________________________________ ______________________________

Signature of Investigator Printed Name of Investigator

Appendix G

Lindenwood University

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

Informed Consent for Participation in Research Activities

Integration of Technology into the Classroom Environment:
A Study of Student Perceptions as Related to Skill Attainment

Principal Investigator: Richard Sullivan
Telephone: [redacted] E-mail: [redacted]

Participant ________________________________
Contact info __________________________________

1. You are invited to participate in a research study conducted by Mr. Richard Sullivan under the guidance of Dr. Julie Williams of Lindenwood University. The purpose of this research is to determine the benefit to students of utilizing technology in the classroom.

2. a) The Primary Investigator (PI) is the superintendent of the district.

   b) Your participation will involve:
   - Completing a one-time, paper/pencil or electronic survey to determine your perception of the impact of technology in the classroom, relating to student success at [redacted].

   b) The amount of time involved in your participation will be approximately 10 to 15 minutes.
   - Approximately 15 subjects will be involved in this research.

7. 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 the continued expansion of technology for education at [redacted] and may help society.

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, Mr. Richard Sullivan, [redacted] the Supervising Faculty, Dr. Julie Williams (417) 256-6150. 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 may request 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 H

LINDENWOOD

LINDENWOOD UNIVERSITY ST. CHARLES, MISSOURI

DATE:	March 16, 2015
TO:	Richard Sullivan, EdS
FROM:	Lindenwood University Institutional Review Board
STUDY TITLE:	[698246-1] Integration of Technology into the Classroom Environment: A Study of Student Perceptions as Related to Skill Attainment
IRB REFERENCE #:	
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
APPROVAL DATE:	March 16, 2015
EXPIRATION DATE:	March 16, 2016
REVIEW TYPE:	Full Committee 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 Full Committee 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 March 16, 2016.

Please note that all research records must be retained for a minimum of three years.

If you have any questions, please contact Robyne Elder at (314) 566-4884 or relder@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 relder@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.

References

Abbitt, J. T. (2011). An investigation of the relationship between self-efficacy beliefs about technology integration and technological pedagogical content knowledge (TPAK) among preservice teachers. *Journal of Digital Learning in Teacher Education, 27*(4), 134-143.

Akbulut, Y., Odabasi, H., & Kuzu, A. (2011). Perceptions of preservice teachers regarding the integration of information and communication technologies in Turkish education faculties. *Turkish Online Journal of Educational Technology - TOJET*, *10*(3), 175-184.

Al-Awidi, H., & Alghazo, I. (2012). The effect of student teaching experience on preservice elementary teachers' self-efficacy beliefs for technology integration in the UAE. *Educational Technology Research and Development*, *60*(5), 923-941.

Almekhlafi, A., & Almeqdadi, F. (2010). Teachers' perceptions of technology integration in the United Arab Emirates school classrooms. *Journal of Educational Technology & Society*, *13*(1), 165-175.

Al-Ruz, J., & Khasawneh, S. (2011). Jordanian pre-service teachers' and technology integration: A human resource development approach. *Educational Technology & Society*, *14*(4), 77-87.

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

Anthony, A. B. (2012). Activity theory as a framework for investigating district-classroom system interactions and their influences on technology integration. *Journal of Research on Technology In Education*, *44*(4), 335-356.

Austin, R., & Hunter, B. (2013). ICT policy and implementation in education: Cases in Canada, Northern Ireland and Ireland. *European Journal of Education*, *48*(1), 178-192.

Aypay, A., Celik, H., Aypay, A., & Sever, M. (2012). Technology acceptance in education: A study of pre-service teachers in Turkey. *Turkish Online Journal of Educational Technology - TOJET*, *11*(4), 264-272.

Baran, E., Chuang, H., & Thompson, A. (2011). TPAK: An emerging research and development tool for teacher educators. *The Turkish Online Journal of Educational Technology*, *10*(4), 370-377.

Benson, V., Anderson, D., & Ooms, A. (2011). Educators' perceptions, attitudes and practices: Blended learning in business and management education. *Research in Learning Technology*, *19*(2), 143-154.

Berlin, D. F., & White, A. L. (2012). A longitudinal look at attitudes and perceptions related to the integration of mathematics, science, and technology education. *School Science and Mathematics*, *112*(1), 20-30.

Bernhardt, V. L. (2013). *Data analysis for continuous school improvement* (3rd ed.). New York, NY: Routledge.

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

Betrus, A. (2012). Historical evolution of instructional technology in teacher education programs: A ten-year update. *Techtrends: Linking Research & Practice to Improve Learning*, *56*(5), 42-45.

Blair, N. (2012). Technology integration for the new 21st century learner. *Principal: Technology, January/February*, 8-13.

Blank, R. (2013). Science instructional time is declining in elementary schools: What are the implications for student achievement and closing the gap?. *Science Education*, *97*(6), 830-847.

Block and tackle. (n.d.). In *Dictionary.com's unabridged online dictionary*. Retrieved from http://dictionary.reference.com/browse/block and tackle

Bluman, A. (2013). *Elementary statistics: A step by step approach* (9th edition). New York, NY: McGraw-Hill.

Borovik, A. (2011). Information technology in university-level mathematics teaching and learning: A mathematician's point of view. *Research in Learning Technology*, *19*(1), 73-85.

Brooks, C. (2011). Locating leadership: The blind spot in Alberta's technology policy discourse. *Education Policy Analysis Archives*, *19*(26), 1-27.

Brusi, R., Portnoy, A., & Toro, N. (2013). Student engagement and completion in precalculus mega section: Efficiently assisting student engagement and completion with communications and information technology. *Journal of STEM Education: Innovations and Research*, *14*(1), 20-25.

Cakiroglu, U., Akkan, Y., & Guven, B. (2012). Analyzing the effect of web-based instruction applications to school culture within technology integration. *Educational Sciences: Theory and Practice*, *12*(2), 1043-1048.

Carr, C. T., Zube, P., Dickens, E., Hayter, C. A., & Barterian, J. A. (2013). Toward a model of sources of influence in online education: Cognitive learning and the effects of web 2.0. *Communication Education*, *62*(1), 61-85.

Christensen, C. M. (2008). *Disrupting class: How disruptive innovation will change the way the world learns.* New York, NY: McGraw-Hill.

Cifuentes, L., Maxwell, G., & Bulu, S. (2011). Technology integration through professional learning community. *Journal of Educational Computing Research*, *44*(1), 59-82.

Cikar, R. (2012). Technology integration and technology leadership in schools as learning organizations. *Turkish Online Journal of Educational Technology, 11*(4), 273-282.

Courville, K. (2011, November). *Educational technology: Effective leadership and current initiatives.* Paper presented at the 2011 Louisiana Computer Using Educator's Conference, New Orleans, LA. Retrieved from http://files.eric.ed.gov/fulltext/ED527339.pdf

Craft, A. (2012). Childhood in a digital age: Creative challenges for educational futures. *London Review of Education*, *10*(2), 173-190.

Cviko, A., McKenney, S., & Voogt, J. (2012). Teachers enacting a technology-rich curriculum for emergent literacy. *Educational Technology Research and Development*, *60*(1), 31-54.

Davies, R. S. (2011). Understanding technology literacy: A framework for evaluating educational technology integration. *Techtrends: Linking Research and Practice To Improve Learning*, *55*(5), 45-52.

Dawson, K. (2012). Using action research projects to examine teacher technology integration practices. *Journal of Digital Learning in Teacher Education, 28*(3), 117-124.

Downes, J. M., & Bishop, P. (2012). Educators engage digital natives and learn from their experiences with technology. *Middle School Journal*, *43*(5), 6-15.

Duffey, D. R., & Fox, C. (2012). National educational technology trends: 2012. State leadership empowers educators, transforms teaching and learning. *State Educational Technology Directors Association*.

Duran, M., Brunvand, S., Ellsworth, J., & Sendag, S. (2012). Impact of research-based professional development: Investigation of inservice teacher learning and practice in wiki integration. *Journal of Research on Technology in Education*, *44*(4), 313-334.

Everhart, N., Mardis, M. A., & Johnston, M. (2011). National board certified school librarians' leadership in technology integration: Results of a national survey. *School Library Research, 14,* 1-18. Retrieved from http://www.ala.org/aasl/sites/ala.org.aasl/files/content/aaslpubsandjournals/slr/vol14/SLR_NationalBoardCertified_V14.pdf

Fook, C., Sidhu, G., Kamar, N., & Aziz, A. (2011). Pre-service teachers' training in information communication and technology for the ESL classrooms in Malaysia. *Turkish Online Journal of Distance Education*, *11*(3), 97-108.

Fortin, M. A. (2010). "Face/Book/Net/Work" and the dream of limitless freedom. *English Studies in Canada*, *36*(4), 17-20.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2015). *How to design and evaluate research in education* (9th ed.). New York, NY: McGraw-Hill.

Germany, J. O. (2014). Timely integration: Sociocultural issues that influence technology integration in childhood development. *International Journal of Technology, Knowledge & Society*, *9*(4), 129-142.

Gonzales, R. F. (1997). The perspectives of technology education. *Techniques: Making Education & Career Connections*, *72*(7), 60.

Graham, C. R., Borup, J. J., & Smith, N. B. (2012). Using TPACK as a framework to understand teacher candidates' technology integration decisions. *Journal of Computer Assisted Learning*, *28*(6), 530-546.

Greer, C. (2008). The importance of integration ideas in a required technology class. *International Journal of Instructional Media*, *35*(2), 167-174.

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

Ham, V. (2010). Participant-directed evaluation: Using teachers’ own inquiries to evaluate professional development in technology integration. *Journal of Digital Learning in Teacher Education, 27*(4), 22-29.

Hammonds, L., Matherson, L., Wilson, E., & Wright, V. (2013). Gateway tools: Five tools to allow teachers to overcome barriers to technology integration. *Delta Kappa Gamma Bulletin*, *80*(1), 36-40.

Hoffman, E. (2013). Ratings, quality, and accreditation: Policy implications for educational communications and technology programs in a digital age. *Techtrends: Linking Research & Practice to Improve Learning*, *57*(5), 47-54.

Howley, A., Wood, L., & Hough, B. (2011). Rural elementary school teachers' technology integration. *Journal of Research In Rural Education*, *26*(9), 1-13.

Hsu, S. (2010). The relationship between teacher's technology integration ability and usage. *Journal of Educational Computing Research*, *43*(3), 309-325.

Hsu, S., & Kuan, P. (2013). The impact of multilevel factors on technology integration: The case of Taiwanese grade 1-9 teachers and schools. *Educational Technology Research and Development*, *61*(1), 25-50.

Hughes, J. E. (2013). Descriptive indicators of future teachers' technology integration in the PK-12 classroom: Trends from a laptop-infused teacher education program. *Journal of Educational Computing Research*, *48*(4), 491-516.

Istifci, I., Lomidazde, T., & Demiray, U. (2011). An effective role of e-learning technology for English language teaching by using meta communication actors. *Turkish Online Journal of Distance Education*, *12*(4), 201-211.

Jackson, L. D. (2013). Is mobile technology in the classroom a helpful tool or a distraction? A report of university students' attitudes, usage practices, and suggestions for policies. *International Journal of Technology, Knowledge & Society*, *8*(5), 129-140.

Johnston, M. P. (2012). School librarians as technology integration leaders: Enablers and barriers to leadership enactment. *Research Journal of the American Association of School Librarians, 15*, 1-33.

Jones, M. M., & McLean, K. J. (2012). Personalising learning in teacher education through the use of technology. *Australian Journal of Teacher Education*, *37*(1), 75-92.

Kalota, F., & Hung, W. (2013). Instructional effects of a performance support system designed to guide preservice teachers in developing technology integration strategies. *British Journal of Educational Technology*, *44*(3), 442-452.

Kasman Valenza, J., & Stephens, W. (2012). Reading remixed. *Educational Leadership*, *69*(6), 75.

Ketsman, O. (2012). Technology-enhanced multimedia instruction in foreign language classrooms: A methods study. *World Journal on Educational Technology*, *6*(2), 1-146.

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

Latham, G., & Carr, N. (2012). Authentic learning for pre-service teachers in a technology-rich environment. *Journal of Learning Design*, *5*(1), 32-42.

Lawrence, B., & Lentle-Keenan, S. (2013). Teaching beliefs and practice, institutional context, and the uptake of web-based technology. *Distance Education*, *34*(1), 4-20.

Lin, C. (2012). Application of a model for the integration of technology in kindergarten: An empirical investigation in Taiwan. *Early Childhood Education Journal*, *40*(1), 5-17.

Mann, D., Reardon, R. M., Becker, J. D., Shakeshaft, C. C., & Bacon, N. (2011). Immersive, interactive, web-enabled computer simulation as a trigger for learning: The next generation of problem-based learning in educational leadership. *Journal of Research on Leadership Education*, *6*(5), 272-287.

Mardis, M. A. (2013). What it has or what it does not have? Signposts from US data for rural children's digital access to informal learning. *Learning, Media & Technology*, *38*(4), 387-406.

Martinez, M., & McGrath, D. (2014). Technology alone won't transform teacher to facilitator. *Phi Delta Kappan*, *96*(1), 41-45.

Mason, K. (2007). Embracing technology in the secondary school curriculum: The status in two eastern Caribbean countries. *Journal of Negro Education*, *76*(1), 5-16.

Maxwell, J. A. (2013). *Qualitative research design, an interactive approach* (3rd ed.). Thousand Oaks, CA: Sage.

McEwan, E. K., & McEwan, P. J. (2003). *Making sense of research.* Thousand Oaks, CA: Corwin Press.

McLeod, S., Bathon, J. M., & Richardson, J. W. (2011). Studies of technology tool usage are not enough: A response to the articles in this special issue. *Journal of Research on Leadership Education*, *6*(5), 288-297.

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

Murphrey, T., Miller, K. A., & Roberts, T. (2009). Agricultural science and technology teachers' perceptions of iPod and mp3 technology integration into curricular and cocurricular activities. *Journal of Agricultural Education*, *50*(4), 110-119.

Mwalongo, A. (2011). Teachers' perceptions about ICT for teaching, professional development, administration and personal use. *International Journal of Education & Development Using Information & Communication Technology*, *7*(3), 36-49.

Ng'ambi, D. (2013). Effective and ineffective uses of emerging technologies: Towards a transformative pedagogical model. *British Journal of Educational Technology*, *44*(4), 652-661.

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

Norris, C., Sullivan, T., Poirot, J., & Soloway, E. (2003). No access, no use, no impact: Snapshot surveys of educational technology in K-12. *Journal of Research in Education (International Society for Technology in Education), 36*(1), 15-27.

O'Brien, J. E., & Sears, C. E. (2011). Victor or villain? Wernher von Braun and the space race. *Social Studies*, *102*(2), 59-64.

O'Neil, J. (1995). On technology & schools: A conversation with Chris Dede. *Educational Leadership*, *53*(2), 6-12.

Otamendi, F., & Doncel, L. (2013). Integration and implementation of web simulators in experimental e-learning: An application for capacity auctions. *Turkish Online Journal of Educational Technology - TOJET*, *12*(1), 88-101.

Owens, T. (2012). Hitting the nail on the head: The importance of specific staff development for effective blended learning. *Innovations in Education And Teaching International*, *49*(4), 389-400.

Ozel, S., Yetkiner, Z., & Capraro, R. M. (2008). Technology in K-12 mathematics classrooms. *School Science and Mathematics*, *108*(2), 80.

Pamuk, S. S. (2012). Understanding preservice teachers' technology use through TPACK framework. *Journal of Computer Assisted Learning*, *28*(5), 425-439.

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

Pellegrino, J. W., & Quellmalz, E. S. (2010). Perspectives on the integration of technology and assessment. *Journal of Research on Technology in Education*, *43*(2), 119-134.

Persichitte, K. (2013). Leadership for educational technology contexts in tumultuous higher education seas. *Techtrends: Linking Research & Practice to Improve Learning*, *57*(5), 14-17.

Peterson-Karlan, G. R. (2011). Technology to support writing by students with learning and academic disabilities: Recent research trends and findings. *Assistive Technology Outcomes and Benefits*, *7*(1), 39-62.

Pezzati, A. (2012). The excavation of the hieroglyphic stairway at Copan. *Expedition*, *54*(1), 4-6.

Polizzi, G. (2011). Measuring school principals' support for ICT integration in Palermo, Italy. *Journal of Media Literacy Education*, *3*(2), 113-122.

Pollard, J. J. (2011). The eccentric engineer. *Engineering & Technology (17509637)*, *6*(11), 98.

Polly, D., & Hannafin, M. (2010). Re-examining technology's role in learner-centered professional development. *Educational Technology Research & Development*, *58*(5), 557-571.

Potter, S. L., & Rockinson-Szapkiw, A. J. (2012). Technology integration for instructional improvement: The impact of professional development. *Performance Improvement*, *51*(2), 22-27.

Randall, D., Harrison, J. J., & West, R. (2013). Giving credit where credit is due: Designing open badges for a technology integration course. *Techtrends: Linking Research & Practice to Improve Learning*, *57*(6), 88-95.

Raob, I., Al-Oshaibat, H., & Ong, S. (2012). A factor analysis of teacher competency in technology. *New Horizons in Education*, *60*(1), 13-22.

Real, B., Bertot, J. C., & Jaeger, P. T. (2014). Rural public libraries and digital inclusion: Issues and challenges. *Information Technology & Libraries, 33*(1), 6-24.

Reeves, D. B. (2010). *Transforming professional development into student results*. Alexandria, VA: Association for Supervision and Curriculum Development.

Richardson, J. W., Flora, K., & Bathon, J. (2013). Fostering a school technology vision in school leader. *International Journal of Educational Leadership Preparation, 8*(1), 144-160.

Robertson, H. (2005). Black magic. *Phi Delta Kappan, 87*(1), 90.

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

Sawchuk, S. (2009). Skills of business. *Education Week, 29*(14), 18-21.

Schaffhauser, D. (2009). Which came first—the technology or the pedagogy? *T H E Journal*, *36*(8), 27-32.

Schrum, L., Galizio, L. M., & Ledesma, P. (2011). Educational leadership and technology integration: An investigation into preparation, experiences, and roles. *Journal of School Leadership*, *21*(2), 241-261.

Schweder, W. W., & Wissick, C. A. (2011). Content area applications. *Journal of Special Education Technology*, *26*(1), 57-60.

Sethy, S. (2012). Cognitive skills: A modest way of learning through technology. *Turkish Online Journal of Distance Education*, *13*(3), 260-274.

Shand, K., Winstead, L., & Kottler, E. (2012). Journey to medieval China: Using technology-enhanced instruction to develop content knowledge and digital literacy skills. *Social Studies*, *103*(1), 20-30.

Shinsky, E., & Stevens, H. A. (2011). Teaching in educational leadership using web 2.0 applications: Perspectives on what works. *Journal of Research on Leadership Education*, *6*(5), 195-215.

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

Sugar, W., & Tryon, P. (2014). Development of a virtual technology coach to support technology integration for K-12 educators. *Techtrends: Linking Research & Practice to Improve Learning*, *58*(3), 54-62.

Tannis, D. (2013). Lost in the lifeworld: Technology help seeking and giving on diverse, post-secondary campuses. *Canadian Journal of Learning and Technology*, *39*(2), 1-17.

Taylor, L. R., Campbell, H. L., Dvorak, R., Deatz,. R. C., Koger, L. E., Koger, M. E., & Thacker, A. A. (2010). *Missouri assessment program (MAP) alignment forms validation study: Technical report* (Contract No. C308004001-002). Alexandria, VA: Human Resources Research Organization (HumRRO).

Technology. (n.d.). In *Merriam-Webster's online dictionary*. Retrieved from http://www.merriam-webster.com/dictionary/technology

Teck, W. (2013). Affordances of interactive whiteboards and associated pedagogical practices: Perspectives of teachers of science with children aged five to six years. *Turkish Online Journal of Educational Technology - TOJET*, *12*(1), 1-8.

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

Terras, M. M., & Ramsay, J. (2012). The five central psychological challenges facing effective mobile learning. *British Journal of Educational Technology*, *43*(5), 820-832.

Tingoy, O., & Gulluoglu, S. (2011). Informatics education in different disciplines at university level: Case study--a survey of students' attitude toward informatics technologies. *Turkish Online Journal of Educational Technology - TOJET*, *10*(4), 221-229.

Turkle, S. (2011). The tethered self: Technology reinvents intimacy and solitude. *Continuing Higher Education Review*, *75*, 28-31.

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

Uzunboylu, H. H., & Ozdamli, F. F. (2011). Teacher perception for m-learning: Scale development and teachers' perceptions. *Journal of Computer Assisted Learning*, *27*(6), 544-556.

Vaughn, V. (Producer), Levy, S. (Producer), & Levy, S. (Director). (2013). *The internship* [Motion picture]. United States: Twentieth Century Fox.

Walker, A., Recker, M., Robertshaw, M., Olsen, J., Leary, H., Lei, Y., & Sellers, L. (2011). Integrating technology and problem-based learning: A mixed methods study of two teacher professional development designs. *Interdisciplinary Journal of Problem-Based Learning*, *5*(2), 70-94.

Werth, E. P., & Werth, L. (2011). Effective training for millennial students. *Adult Learning*, *22*(3), 12-19.

Wheel. (n.d.). In *Dictionary.com's unabridged online dictionary*. Retrieved from http://dictionary.reference.com/browse/wheel

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

Yang, S. (2009). A case study of technology-enhanced historical inquiry. *Innovations in Education and Teaching International*, *46*(2), 237-248

Yeung, A., Taylor, P. G., Hui, C., Lam-Chiang, A., & Low, E. (2012). Mandatory use of technology in teaching: Who cares and so what? *British Journal of Educational Technology*, *43*(6), 859-870.

Yucel, C., Acun, I., Tarman, B., & Mete, T. (2010). A model to explore Turkish teachers' ICT integration stages. *Turkish Online Journal of Educational Technology - TOJET*, *9*(4), 1-9.

Vita

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