A PREDICTIVE CORRELATIONAL STUDY OF FACTORS AFFECTING TEACHERS' TECHNOLOGY SELF-EFFICACY

by

Rebecca Peterson Shertzer

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Philosophy

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ABSTRACT

The purpose of this quantitative, correlational study is to examine the predictive relationship between teachers' age, gender, teaching experience, and grade level and teachers' technology self-efficacy. This study is important because of its potential to identify factors that may affect educational technology program efficacy and ultimately, academic achievement. The convenience sample included 118 elementary school, middle school, and high school teachers from one rural Pennsylvania school district that implemented a one-to-one (1:1) iPad initiative in 2016. Teachers' age, gender, teaching experience, and assigned grade levels were anonymously determined using a demographic survey, and teachers' technology self-efficacy was measured using the Educator Technology Self-Efficacy Survey (ETS-ES). The researcher used a multiple regression analysis to analyze the predictive strength of each predictor variable on teachers' technology self-efficacy. The researcher failed to reject the null hypothesis at the 95% confidence level since the researcher was unable to prove a significant, predictive relationship between all four predictor variables and the criterion variable of teachers' technology self-efficacy. The variables of age and gender did make a significant contribution to teachers' levels of technology self-efficacy, while the variables of grade level and teaching experience did not make a significant contribution. The results of the study can be used by educational leaders to create more targeted technology-related professional development opportunities for teachers. More research is needed to further investigate factors impacting teachers' technology self-efficacy.

Keywords: educational technology, one-to-one (1:1) iPad initiatives, self-efficacy, technology self-efficacy

Dedication

I dedicate this manuscript in memory of my grandmother, Eleanor. Her continued influence on my life is proof of an educator's lasting impact. She modeled a love for Jesus, her family, learning, and teaching that still inspires me today. I hope to continue her legacy by passing these same values on to others.

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It would not have been possible to complete this dissertation without God's grace and the love, support, and guidance of many individuals who are precious to me. I am grateful to my husband, Caleb, for his patience and understanding as I pursued this degree. Caleb, you have been by my side since the beginning of this process, helping me to push past challenges and celebrate small successes each step of the way. I love you. Thank you also to my parents, who have consistently believed in me even when I did not.

Additionally, I am grateful for the educators in my district who completed my survey and the friends and colleagues who have acted as sounding boards throughout each part of my doctoral journey. Thank you for helping me along. More importantly, thank you for devoting yourselves to the development of students in our district. You inspire me!

I would also like to acknowledge my chairperson and committee member. Dr. Wendt and Dr. Barthlow, thank you for guiding me throughout this process. Your encouragement and positivity have kept me going!

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List of Abbreviations

Bring Your Own Device (BYOB)

Educator Technology Self-Efficacy Survey (ETS-ES)

Information and Communications Technology (ICT)

Institutional Review Board (IRB)

International Society for Technology in Education (ISTE)

Measures of Academic Progress (MAP)

National Assessment of Educational Progress (NAEP)

Northwest Evaluation Association (NWEA)

One-to-one (1:1)

Professional development (PD)

Statistical Package for the Social Sciences (SPSS)

Variance Inflation Factor (VIF)

CHAPTER ONE: INTRODUCTION

Overview

The purpose of this quantitative, correlational study was to investigate the predictive relationship between teachers' age, gender, teaching experience, and grade level and teachers' technology self-efficacy in a rural, one-to-one (1:1) iPad setting. Chapter One provides background information regarding the topics of technology self-efficacy and 1:1 device initiatives. The background section contains historical context, a discussion of the impact on society at large, and an overview of the theoretical framework for the study. Next, the problem statement examines the current literature related to technology self-efficacy and the impacts of educational technology initiatives. The purpose of this study is outlined, followed by an explanation of the significance of the study. The concluding sections of Chapter One contain the research question and definitions relevant to this study.

Background

Only 34% of eighth-grade students scored at or above the proficiency level for reading and mathematics in 2019 (National Assessment of Educational Progress [NAEP], 2019a). Additionally, only 27% of eighth graders scored at or above the proficiency level for writing in 2019 (NAEP, 2019a). Since basic reading, writing, and mathematics skills are essential for students' success both inside and outside of the classroom, these statistics are concerning. The increased use of educational technology in classrooms across the country has added another dimension to the problem of basic skill deficits. Some educational institutions have introduced technology initiatives as instruments meant to boost basic skills. For example, some special education teachers have implemented iPads as reading intervention tools for students with intellectual disabilities (Alqahtani, 2020). Similarly, some have noted that features of educational technology, like the iPad's text-to-speech option, can be used as assistive technology for students with specific learning needs (Björn & Svensson, 2021). The impact of device initiatives on academic achievement remains unclear, though, as researchers have found positive results for preschool students (Altun, 2022; Eutsler & Trotter, 2020), mixed effects for middle school students (Kirkpatrick et al., 2018), and no significant impact for college students (Alqahtani, 2020).

Historical Overview

The issue of educational technology is well established in the literature base. Teachers began using radio and film in the classroom in the 1920s and 1930s, and instructional television gained acceptance in learning environments in the 1950s and 1960s (Cuban, 1994). According to a review of the literature on educational technology from 1986 to 2014, a variety of digital programs have shaped students' learning since then, including bring your own device (BYOD) programs, online learning, blended learning, and flipped classrooms (Delgado et al., 2015). In 1998, the International Society for Technology in Education (ISTE) developed technology standards that have since been adopted by all 50 states, suggesting that technology-related skills and knowledge have become crucial components of curricula that effectively prepare students for their futures (International Society for Technology in Education [ISTE], 2022). Furthermore, Houghton Mifflin Harcourt (2021) found that 77% of teachers view educational technology as a tool that has the potential to help them be more effective educators.

The issue of the impact of educational technology on students' academic skills and achievement has also been investigated. Some types of educational technology, like iPads, have been used successfully as an intervention for learners with specific needs. For example, iPads have been effective in increasing engagement (Gunderson et al., 2017) and shortening the length of traditional interventions for students with intellectual disabilities (Alqahtani, 2020). Educational technology has also shown promise in helping students with limited English proficiency learn faster than traditional textbook approaches (Grigoryan, 2020). On the other hand, some researchers have found mixed effects on students' academic achievement (Kirkpatrick et al., 2018). Although a significant amount of funding has been directed toward technology integration, the effect on students' academic achievement and college and career readiness has historically been inconsistent (Delgado et al., 2015).

To address the inconsistent results regarding the impact of 1:1 initiatives on student achievement, researchers have begun investigating factors that may be influencing program efficacy. For example, researchers have applied the heavily-researched theory of self-efficacy to the modern digital age to explore how confidence in using technology may influence results. Researchers conducting a review of the literature regarding teachers' general self-efficacy over a period of nearly 40 years from 1976 to 2014 revealed a link between teachers' self-efficacy and students' academic achievement (Zee & Koomen, 2016). Several researchers have used the established link between teachers' general self-efficacy and student achievement in traditional, face-to-face settings as justification for further research investigating self-efficacy as it specifically relates to technology use (Corry & Stella, 2018).

According to the Annual Educator Confidence Report, teachers' confidence in using technology is growing, but 34% still reported that they felt only somewhat confident or not very confident in their ability to use educational technology effectively (Houghton Mifflin Harcourt, 2021). Teachers' technology self-efficacy influences teachers' ability to implement technology effectively (O'Neil & Krause, 2019), their intentions to use technology in their classrooms in the future (Joo et al., 2018), and their technological, pedagogical, and content knowledge (Durak, 2021). Researchers have called for more studies exploring technology self-efficacy as a possible barrier to the successful implementation of 1:1 device initiatives (O'Neil & Krause, 2019). Despite the contradictory evidence in the literature base regarding the efficacy of technology initiatives, the use of educational technology continues to increase. According to a survey conducted by the National Assessment of Educational Progress (NAEP), 87% of eighth-grade students in Pennsylvania reported access to a computer in their homes in 2015 (NAEP, 2015). By 2019, the NAEP reported that 91% of eighth-grade students in Pennsylvania had access to both the Internet and a device in their homes (NAEP, 2019b). Educational technology continues to play a prominent role in the learning process.

Society-at-Large

The issue of educational technology affects society because of the impact on students' academic outcomes and the financial resources that are necessary to implement educational technology initiatives. The creation and adoption of the International Society for Technology in Education (ISTE) standards signaled a shift from traditional career and college preparation to an emphasis on digital skills and competencies. Technological knowledge is now part of the foundational education students will need to learn and grow in a variety of careers (ISTE, 2022). If the goal of education is to create lifelong learners who are productive members of society, it may be worthwhile to investigate the factors impacting the efficacy of educational technology initiatives.

Students with access to a device and Internet in their homes scored higher on national reading assessments than students who did not have access to both a device and Internet in their homes (NAEP, 2015), suggesting that educational technology may play a role in students' achievement. Since there is some evidence that educational technology initiatives positively impact reading comprehension (Altun, 2022), increase collaboration (Watkins et al., 2019), and support struggling learners (Alqahtani, 2020; Gunderson et al., 2017), society may benefit from additional research in this area. Furthermore, spending on educational technology continues to increase (Delgado et al., 2015). Community members and other educational stakeholders may be interested in whether financial resources are being allocated to effective programs.

Theoretical Background

Albert Bandura's (1977) theory of self-efficacy provides the framework for this study. Bandura described self-efficacy as one's belief in his or her ability to successfully achieve a desired outcome. Bandura's theory of self-efficacy is important to this study because self-efficacy impacts behaviors, persistence, and effort. Since Bandura contended that the level of self-efficacy affects persistence, further investigation of the factors that may impact technology self-efficacy, such as the grade level of the teacher, is justified. Teachers with higher levels of technology self-efficacy may persist longer in their use of digital classroom tools than those with lower levels of technology self-efficacy.

Bandura (1977) asserted that previous experiences also play a role in self-efficacy levels, as those who experience what it is like to successfully achieve a given outcome will have higher self-efficacy levels when similar situations arise. The theory of self-efficacy applies to the issue of educational technology since teachers with more technology experience are more likely to use technology (Paraskeva et al., 2008). Bandura differentiated between outcome and efficacy expectations, noting that an outcome expectation is one's belief that a specific set of behaviors results in a certain outcome while an efficacy expectation is one's belief in his or her ability to successfully engage in the behaviors that lead to specific outcomes. Efficacy expectations are also important to the issue of educational technology since teachers' technology self-efficacy levels impact teachers' intent to use technology (Joo et al., 2018), their technological knowledge (Durak, 2021), and their ability to successfully implement technology initiatives (O'Neil & Krause, 2019). Furthermore, several researchers have used the theory of self-efficacy to guide their research regarding the use of educational technology (Kuo & Kuo, 2020; Lee & Gao, 2020; Menon et al., 2020; O'Neil & Krause, 2019). The theory of self-efficacy may help to explain how individuals view the learning process in technology-integrated classrooms (Kuo & Kuo, 2020).

In summary, the issue of educational technology is well-established in the literature base. The literature regarding the impact of educational technology initiatives on students' academic outcomes contains mixed results, suggesting that more investigation of factors affecting program efficacy is warranted. One factor that may be influencing the effectiveness of educational technology programs is technology self-efficacy. The issue of educational technology affects society at large because of the potential for it to impact students' short-term and long-term success. The theory of self-efficacy will be used to further examine the issue of educational technology. The next section identifies the gap in the literature as it relates to teachers' technology self-efficacy.

Problem Statement

Many researchers have explored the impact of iPads on academic skills and achievement (Kirkpatrick et al., 2018; Moon et al., 2021). Researchers have yielded mixed results when investigating the effects of 1:1 iPad initiatives on academic achievement (Kirkpatrick et al., 2018). For example, researchers found positive impacts for preschoolers (Altun, 2022) but no significant impacts for college-age students (Alqahtani, 2020; Sheen & Luximon, 2021). Inconsistent study results regarding program efficacy could be related to how the devices are used, as students learning *with* technology demonstrate higher reading comprehension scores than students learning *from* technology (Moon et al., 2021). The results regarding perceptions of 1:1 device initiatives are also inconsistent, as some researchers reported positive perceptions (Altun, 2022; Watkins et al., 2019) while others found participants preferred traditional learning methods instead of the digital versions (Sheen & Luximon, 2021).

Researchers have also begun investigating technology self-efficacy as a factor in the successful integration of educational technology initiatives (Durak, 2021; Kuo & Kuo, 2020). Researchers have identified a positive relationship between iPad self-efficacy and perceived learning (Kuo & Kuo, 2020). Furthermore, teachers' technology self-efficacy can be used to predict their technological knowledge (Durak, 2021). The level of teachers' technology self-efficacy also impacts their ability to use educational technology effectively (O'Neil & Krause, 2019), and it influences teachers' intentions to use technology in their classrooms in the future (Joo et al., 2018). Researchers have suggested that further investigation into the factors affecting teachers' technology use is warranted, particularly regarding their comfort with using educational technology (Liu et al., 2018). More research is specifically needed to investigate the factors that impact teachers' technology self-efficacy and other barriers to the successful integration of technology initiatives (O'Neil & Krause, 2019). Other researchers have called for further investigation into the issue of technology self-efficacy through comparisons of various teacher groups and levels (Dovigo, 2021; Durak, 2021; Menabò et al., 2021). The problem is the current literature has not fully addressed factors that may impact in-service, K-12 teachers' technology self-efficacy including age, gender, grade level, subject area, and teaching experience (Jung et al., 2019; Menon et al., 2020; Šabić et al., 2022; Simsek & Sarsar, 2019).

Purpose Statement

The purpose of this quantitative, correlational study was to explore the predictive relationship between teachers' age, gender, teaching experience, and grade level and teachers' technology self-efficacy in a rural, 1:1 iPad setting. The predictive variables in this study included teachers' age, gender, teaching experience, and grade level. Participants self-reported the grade levels they teach, age in years, teaching experience, gender identity, and racial/ethnic identity using a demographic questionnaire. For the age variable, participants selected 21-30 years, 31-40 years, 41-50 years, or more than 50 years. For the teaching experience variable, participants selected 1-5 years, 6-10 years, 11-15 years, or more than 15 years. For gender, teachers selected male, female, non-binary/third gender, prefer not to disclose, or other. Racial identity options included White, Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, two or more races, and other. Finally, for the grade level variable, educators selected elementary school, middle school, or high school. Elementary school was considered kindergarten through fifth grade, middle school was sixth through eighth grade, and high school was considered ninth through 12^{th} grade.

The criterion variable was the teachers' levels of technology self-efficacy. Teachers' technology self-efficacy was measured using the Educator Technology Self-Efficacy Survey (ETS-ES) developed by Gentry et al. (2014b). According to Bandura (1977), self-efficacy refers to the strength of one's belief in his or her ability to produce a desired outcome. Bandura's definition has been extended to include beliefs about one's ability to integrate technology in a way that enhances learning (Menon et al., 2020; O'Neil & Krause, 2019). For the purposes of this study, teachers' technology self-efficacy was used to reference the same variable as terms like digital self-efficacy, digital competence, and information and communications technology

(ICT) self-efficacy. The population included K-12 teachers from a public, rural school district in Pennsylvania that implemented a 1:1 iPad initiative in 2016. The sample included teachers from a variety of grade levels and subject areas.

Significance of the Study

This study is significant because it builds upon the existing literature related to educational technology and the theory of self-efficacy. The results regarding the general impact of 1:1 device initiatives vary by students' grade level. For example, researchers found that iPads can be an effective reading tool for young students (Altun, 2022; Eutsler & Trotter, 2020). Kirkpatrick et al. (2018) found a mixture of positive, negative, and neutral results when investigating the impact of a large-scale, 1:1 iPad initiative on the mathematics and language arts achievement of Canadian middle school students. There does not seem to be consistent evidence supporting the use of iPads as an intervention for older students (Alqahtani, 2020). Investigating factors that differ among grade levels may provide a possible explanation for the varying degrees of program effectiveness among age groups. This study adds to the literature about educational technology by investigating one factor, teachers' technology self-efficacy, that may vary among grade levels. Since teachers' general self-efficacy impacts student outcomes in traditional classroom settings, it may prove fruitful to further investigate teachers' technology self-efficacy in digital settings (Corry & Stella, 2018).

The study also added to what is known about the theory of self-efficacy, as the study investigates how factors such as teachers' grade level, gender, age, and teaching experience impact teachers' technology self-efficacy. Teachers' general self-efficacy has been linked with students' academic outcomes (Zee & Koomen, 2016), but the issue of teachers' self-efficacy in digital settings is an underexplored area within the literature base (Corry & Stella, 2018; Gomez et al., 2022; O'Neil & Krause, 2019). While some researchers have begun to investigate teachers' technology self-efficacy as an important factor in the successful implementation of 1:1 technology programs (Durak, 2021; Kuo & Kuo, 2020), there is a need for more research exploring the factors that may be influencing teachers' technology self-efficacy (O'Neil & Krause, 2019). Furthermore, several studies have investigated teachers' technology self-efficacy in urban or suburban settings (Gomez et al., 2022; Liu et al., 2018) or using samples of preservice teachers (Joo et al., 2018), but there is a dearth of information related to teachers' technology self-efficacy in K-12 rural settings. This study filled these gaps by investigating the predictive strength of teachers' age, gender, teaching experience, and grade level in determining their levels of technology self-efficacy in a K-12 rural school district with a 1:1 iPad initiative.

This study is important to educational institutions with established 1:1 technology initiatives and those seeking to implement technology initiatives. For example, information about how confident and comfortable teachers feel with technology integration may provide important feedback to district administrators regarding professional development (PD) opportunities. Since teachers' technological knowledge can be predicted by their technology self-efficacy (Durak, 2021), more information about teachers' technology self-efficacy could be used to make PD programming decisions. Providing PD that supports teachers' technology integration and increases technology self-efficacy may ultimately improve the efficacy of 1:1 technology programs.

Research Question

RQ: Is there a predictive relationship between teachers' age, gender, teaching experience, and grade level and teachers' technology self-efficacy as measured by the Educator Technology Self-Efficacy Survey (ETS-ES)?

Definitions

1. *Assistive technology* – Assistive technology is a handheld device such as an iPhone or an iPad that is used to support students with specific learning needs (Alqahtani, 2020).
2. *Constructivist technology use* – Constructivist technology use is using classroom technology according to social constructivist tenets that feature technology as a tool in the learning process (Moon et al., 2021).
3. *Instructionist technology use* – Instructionist technology use is using classroom technology to deliver direct instruction (Moon et al., 2021).
4. *Mobile device* – A mobile device is a portable device such as a smartphone, iPad, or tablet (Menon et al., 2020).
5. *Mobile learning* – Mobile learning is a learning environment in which knowledge is transferred by a portable device such as a tablet, personal digital assistant (PDA), or MP3 or MP4 device (Odede, 2021).
6. *One-to-one (1:1) device program* – A 1:1 device program is a program in which a school district provides a device to each student in the district (Kirkpatrick et al., 2018).
7. *Self-efficacy* – Self-efficacy is one's belief in his or her ability to successfully achieve a desired outcome (Bandura, 1977).
8. *Subject culture clash* – Subject culture clash is the conflict between a subject area's characteristics and its conduciveness to technology integration (Xu & Zhu, 2020).
9. *Technology self-efficacy* – Technology self-efficacy is the belief in one's ability to use technology in a way that increases learning (Menon et al., 2020).

CHAPTER TWO: LITERATURE REVIEW

Overview

The purpose of this literature review is to present an overview of the research conducted on one-to-one (1:1) technology initiatives, describe factors that may impact the efficacy of technology initiatives, and investigate the relationship between teachers' technology self-efficacy and variables such as age, gender, teaching experience, and grade level. The first section of this chapter contains the theoretical framework. Bandura's (1977) theory of self-efficacy is important in understanding factors that may impact technology self-efficacy as well as technology use and implementation. The next section includes a synthesis of the current literature. The synthesis includes an overview of the identified impacts of educational technology and the populations that researchers have studied. This section concludes with an overview of the research conducted regarding technology self-efficacy, one of the factors that affects the efficacy of technology initiatives. The technology self-efficacy section includes an investigation into the relationship between teachers' technology self-efficacy and several variables including professional development, technology perceptions, the learning process, prior experience with technology, gender, teaching experience, subject area, grade level, and the COVID-19 pandemic. Finally, a gap in the current literature is identified, which justifies additional research concerning factors that impact technology self-efficacy.

Theoretical Framework

The theory of self-efficacy is important to understanding factors that impact teachers' level of technology self-efficacy. Bandura's (1977) theory of self-efficacy originated in response to the leading views on behavioral change at the time. While some viewed behavior as a result of mainly cognitive processes, others argued that behaviors are shaped solely by external consequences (Bandura, 1977). In his theory of self-efficacy, Bandura reasoned that behavior is a result of the interaction between cognitive processes and response to performance outcomes. He further contended that performance outcomes are not the only way in which individuals alter their behaviors and that other factors, like observation and self-efficacy, modify behaviors. Bandura defined self-efficacy as an individual's belief in his or her ability to achieve a desired outcome. According to Bandura, the strength of self-efficacy impacts behaviors, persistence, and effort. The strength of one's self-efficacy may in turn be impacted by social and environmental factors, including past experiences, vicarious experiences, encouragement, and emotional responses. For example, if individuals have had positive prior experiences, their self-efficacy will be higher (Bandura, 1977). Bandura contended that the higher the levels of self-efficacy, the more individuals' behaviors change. Personally experiencing mastery or even observing others successfully achieving a desired outcome is one way to increase levels of self-efficacy (Bandura, 1977).

Several researchers have used the theory of self-efficacy to frame their studies involving educational technology (Kuo & Kuo, 2020; Lee & Gao, 2020; Menon et al., 2020; O'Neil & Krause, 2019). Researchers have established a positive relationship between teachers' general self-efficacy levels and students' academic achievement (Zee & Koomen, 2016), suggesting that the more teachers believe in their ability to educate their students effectively, the better their students perform. Furthermore, Bandura's concept of modeling has been shown to increase teachers' technology self-efficacy by providing both mastery and vicarious experiences (Byker et al., 2018). Teachers need to experience or observe positive uses of technology to increase their technology self-efficacy levels (Moreira-Fontán et al., 2019). The theory of self-efficacy will be significant to this study since belief in one's abilities can impact factors like persistence and effort (Bandura, 1977). The level of technology self-efficacy influences teachers' intentions to use technology (Joo et al., 2018) and implement technology successfully (O'Neil & Krause, 2019), but researchers have noted that more research is needed to investigate the factors affecting technology self-efficacy (O'Neil & Krause, 2019). Therefore, the foundational theory of self-efficacy provides further justification for this study. Investigating the impact of teachers' age, gender, teaching experience, and grade level on technology self-efficacy may provide a more complete understanding of Bandura's theory of self-efficacy.

Related Literature

A review of the current literature regarding 1:1 educational technology initiatives was conducted. While researchers have identified some positive results associated with educational technology for specific age groups, the overall results remain inconsistent. This section contains an overview of the impacts some researchers have identified, which can best be understood by examining how participants utilized the technology within each study. The results vary based on whether participants learned *with* technology or *from* technology. The results also vary according to the age group studied, as researchers have found differing degrees of impact on preschool and elementary school students, middle and high school students, undergraduate students, and teachers. This section also includes a synthesis of the research regarding teachers' technology self-efficacy, one of the factors researchers have suggested may impact the effectiveness of technology initiatives. The relationship between teachers' technology self-efficacy and several variables including professional development, technology perceptions, the learning process, prior experience with technology, gender, teaching experience, subject area, grade level, and the COVID-19 pandemic are examined. Finally, this section concludes by identifying a gap in the current literature. More research is needed to further investigate factors impacting teachers' technology self-efficacy.

Impacts of Educational Technology

Many researchers have investigated the impact of educational technologies on factors affecting the learning process. Learning is a complex process that is influenced by factors such as attitudes, beliefs, motivation, and social interactions (Schunk, 2016). Researchers have explored several of these factors in relation to educational technology. For example, Watkins et al. (2019) found that utilizing iPads in a university classroom setting allowed for collaborative learning activities. In addition, students held mostly positive perceptions of iPads (Watkins et al., 2019). Similarly, Altun (2022) reported that participants demonstrated more positive attitudes toward e-texts as compared to traditional learning approaches. Likewise, Dashti and Habeeb (2020) found that kindergarten students preferred using iPads to create visual images of their reading over utilizing traditional paper methods, and students claimed an increase in engagement when using iPads. Teachers also reported overall positive perceptions of implementing educational technology in their classrooms to promote collaborative learning experiences and improve instructional approaches (Dovigo, 2021). Individuals who used educational technology like iPads noted benefits such as the user-friendly nature of the devices (Dovigo, 2021) and the assistive technology features that aided learning for struggling students (Björn & Svensson, 2021).

While there are some positive perceptions associated with educational technology (Altun, 2022; Watkins et al., 2019), the actual impact on academic achievement proves more difficult to define. Researchers have suggested that there may be benefits to implementing 1:1 iPad initiatives, but the benefits may be seen in areas other than academic achievement (Kirkpatrick et al., 2018). Furthermore, if there are impacts on academic achievement, they may be small and difficult to detect at a district-wide level (Kirkpatrick et al., 2018). Kirkpatrick et al. (2018) found mixed results when investigating the impact of a 1:1 iPad initiative on the mathematics, English language arts (ELA), and learning skills achievement of seventh-grade students. Specifically, researchers found no effect on learning skills, and they found a mixture of positive, negative, and neutral results for mathematics and ELA achievement after the implementation of a district-wide, 1:1 initiative (Kirkpatrick et al., 2018). Likewise, Watkins et al. (2019) were only able to conclude that iPads did not hinder learning.

Interestingly, when researchers narrowed their focus to explore factors impacting a specific area of learning, such as reading comprehension, the results continue to appear haphazard (Alqahtani, 2020; Bergeson & Rosheim, 2018; Lee & Gao, 2020). For example, Bergeson and Rosheim (2018) found that developing readers ignored digital features meant to aid their comprehension, like hyperlinks, when using iPads to read digital texts. Furthermore, some participants expressed a preference for reading paper texts as opposed to the digital version of the texts (Lee & Gao, 2020). One way to organize the literature regarding the impact of educational technology on academic outcomes is to first determine how the participants used the technology.

Learning with Technology

Moon et al. (2021) found that students who learn *with* technology through a constructivist approach demonstrate higher reading comprehension than students who learn *from* technology using an instructionist approach. In other words, students who used technology as a tool to transform the learning process according to Vygotsky's (1978) social constructivist approach experienced better learning outcomes than those who simply replaced traditional paper materials with digital ones. Similarly, Shyr and Chen (2018) found that university students who engaged with a flipped classroom model that supported self-regulated learning strategies evidenced better learning than those who utilized a more traditional approach to the flipped classroom model. In addition to supporting self-regulated learning strategies, researchers suggested that using technology to create collaborative learning opportunities is vitally important since a sense of community is a strong predictor of perceived learning (Kuo & Kuo, 2020).

Dashti and Habeeb (2020) cautioned that collaboration does not naturally occur because of technology integration, but iPads and other digital tools may be used to support a social constructivist approach to learning. Furthermore, teachers' instructional approaches, attitudes and perceptions toward technology, and technology training, are better predictors of technology use when technology is integrated in constructivist classrooms as compared to traditional classrooms (Li et al., 2019). Since the research base contained more positive results associated with studies that included constructionist approaches to technology integration (Moon et al., 2021), simply implementing technology initiatives is not enough to enact meaningful impacts on learning and achievement. Study results regarding the efficacy of technology initiatives can be interpreted by examining how the technology is being used.

Learning from Technology

Studies that included technology as a mere replacement for traditional learning methods were associated with negative results (Lee & Gao, 2020; Moon et al., 2021; Sheen & Luximon, 2021). For example, researchers exploring the impact of text medium on the reading comprehension of university students concluded that there was no significant difference in comprehension rates or time spent reading between students who read using paper texts versus those who read digital texts (Sheen & Luximon, 2021). In addition, students preferred reading using paper texts, and they used more reading comprehension strategies like highlighting and notetaking when using the paper version (Sheen & Luximon, 2021). Researchers found similar results when investigating the impact of iPads on physical activity and psychosocial beliefs in physical education classes. Researchers concluded that the studied iPad applications were ineffective in increasing physical activity but noted that the applications were chosen for management instead of engagement (Lee & Gao, 2020). When technology is utilized as a way of replacing traditional methods instead of as a way to revolutionize the learning process, there does not appear to be a positive impact (Lee & Gao, 2020; Moon et al., 2021; Sheen & Luximon, 2021).

Teachers' perceptions of iPads also show a difference in how educational technology is being utilized. Some teachers believe that the iPads are a way to transform their pedagogical approach while others view the iPads as simply a supplementary tool to use in addition to their current instructional methods (Dovigo, 2021). Additionally, teachers' perceptions of how iPads should be used may change as they gain experience with using them (Liu et al., 2018). The results associated with educational technology implementation also seem to waver depending on the population studied.

Populations Studied

Researchers have investigated the impacts of educational technology at various school levels, and there does seem to be a marked difference in the outcomes of technology programs depending on the age group of the studied population. Liu et al. (2018) concluded that even the professional development (PD) needs for teachers implementing educational technology initiatives varied by grade level. For example, high school teachers had a more negative view of their district's technology-related PD than elementary school teachers, possibly because high school teachers need more content-focused training for PD to be effective (Liu et al., 2018). The efficacy of technology initiatives also varies by grade level. For example, there were mainly positive effects of iPads on academic outcomes in preschool settings (Altun, 2022; Eutsler & Trotter, 2020) but no significant effects for elementary school students (Lee & Gao, 2020; Moon et al., 2021) or college-age populations (Alqahtani, 2020; Sheen & Luximon, 2021). The limited number of researchers investigating the impact of 1:1 device initiatives on middle school students has yielded mixed results (Kirkpatrick et al., 2018).

Preschool and Elementary School Students

Many researchers have investigated the impacts of iPads on preschool and elementary school students (Altun, 2022; Eutsler & Trotter, 2020; Lee & Gao, 2020; Moon et al., 2021). Studies involving preschool prereaders seemed to utilize more of a constructionist approach to technology integration, as the participants listened to a digital text being read aloud by an adult in a shared reading experience (Altun, 2022; Eutsler & Trotter, 2020). Altun (2022) reported that reading comprehension was higher for shorter e-texts as compared to the paper versions for students with both poor and good reading comprehension. Correspondingly, Eutsler and Trotter (2020) described an increase in attention, proximity to the reader, and discussion when participants engaged with the e-texts as compared to the print version. Additionally, researchers noted that 65% of prereaders chose digital books over paper versions (Eutsler & Trotter, 2020), and participants displayed positive attitudes toward e-texts (Altun, 2022). There appear to be mainly positive impacts on the reading process associated with iPads for the preschool population.

For elementary school students, the effects of iPads on students' achievement seem to be mediated by how the devices were used. Elementary school students utilize technology mainly to practice and reinforce foundational skills, as elementary school teachers reported that their students utilize digital instructional games and apps that allow for repetitive practice more frequently than middle school and high school students (Dogan et al., 2021). When elementary school students use technology as simply a replacement for traditional learning approaches, the technology is largely ineffective (Lee & Gao, 2020; Moon et al., 2021). Lee and Gao (2020) studied the impact of specific iPad apps on the physical activity of 157 fourth- and fifth-grade students and found that the apps were ineffective in increasing physical activity. Similarly, Moon et al. (2021) investigated the impact of two different iPad approaches on the reading comprehension of 47 fifth-grade students and found that students who learned *with* iPads instead of *from* iPads demonstrated higher reading comprehension rates. Elementary school students do seem to have positive perceptions regarding the use of technology, as elementary school students reported a perceived increase in reading and writing skills after using learning apps (Björn & Svensson, 2021).

Middle and High School Students

Educational technology initiatives also have mixed effects on middle and high school students. For example, Kirkpatrick et al. (2018) found that a 1:1 iPad initiative had a mixture of positive, negative, and neutral effects on the learning skills and mathematics and language arts achievement of seventh-grade students. Researchers did not mention how the iPads were used, which may have explained the inconclusive results. Bergeson and Rosheim (2018) concurred that how the iPads are used is an important consideration when interpreting results for middle school populations, as they found that sixth-grade students needed explicit directions about how to use digital text features when reading complex science texts on their iPads. Developing middle school readers largely ignored digital text features that were meant to aid their comprehension, and participants shared that they were not actively engaged in comprehension strategies while reading on the iPads (Bergeson & Rosheim, 2018).

Björn and Svensson (2021) noted that the effects of educational technology initiatives on middle and high school students were mainly seen in study methods and learning processes instead of direct impacts on academic achievement. For example, high school students reported that app-based learning improved their study skills, while elementary school students claimed improvements in actual reading and writing skills after using educational apps. Björn and Svensson suggested that older students were less likely to utilize digital learning tools as compared to elementary students because middle and high school students switch classes and teachers frequently. Since there may be less consistency in how materials are presented and processed, middle and high school students may struggle to implement digital tools in a way that directly impacts academic achievement. It is also important to note that high school students are using individual devices like laptops and tablets as compared to middle school and elementary school students, while elementary students are using devices like SMART Boards that can be used collectively significantly more often than middle school and high school students (Dogan et al., 2021). In other words, high school and middle school students may be utilizing technology as more of a tool to use in the learning process rather than using technology to learn and practice basic foundational skills (Dogan et al., 2021).

Undergraduate Students

Several researchers have also investigated the impacts of educational technology on the learning process for undergraduate students (Alqahtani, 2020; Sheen & Luximon, 2021; Watkins et al., 2019). While there does seem to be some positive associations for undergraduates regarding technology use in the classroom (Odede, 2021), there does not appear to be a clear, positive impact on academic achievement at this level (Alqahtani, 2020). For example, Odede (2021) found overall high levels of technology self-efficacy and positive perceptions of mobile learning in a sample of 200 undergraduate students. Similarly, some students reported positive perceptions regarding incorporating iPads at the university level (Watkins et al., 2019). However, other undergraduate students still preferred to use traditional paper texts (Sheen & Luximon, 2021). Only one study by Qi (2019) contained evidence of a positive association between university students' use of mobile devices and their academic achievement, providing support for bring-your-own-device initiatives at the university level. Alqahtani (2020) explored the efficacy of using iPads as a reading comprehension intervention for three college-aged students diagnosed with intellectual disabilities. When compared with the traditional intervention of repeatedly reading a printed text, the iPad text-to-speech intervention yielded no significant difference in reading comprehension scores (Alqahtani, 2020). However, Alqahtani noted that the iPad intervention took less time to implement than the traditional repeated reading approach, which is an important aspect to consider when recommending practices for improving reading outcomes for students with disabilities.

Björn and Svensson (2021) suggested that it may be more difficult for older students to realign their ingrained study habits to include educational technology, which may make older students less likely to prefer digital approaches. Factors such as technology self-efficacy, perceived ease of use and usefulness of the technology, and domain knowledge have a significant positive relationship with university students' intent to use technology (Rosman et al., 2021). At the university level, iPads do not seem to have a significant impact on academic outcomes, but there are additional ancillary benefits (Alqahtani, 2020). The insignificant impact of iPads on the academic achievement of college students aligns with researchers' suggestion that the benefits associated with 1:1 iPad initiatives may not be found in the area of academic achievement (Kirkpatrick et al., 2018).

Teachers

Technology studies involving teacher populations mainly investigated teachers' perceptions regarding technology and their frequency of technology use in the classroom. According to Gudmundsdottir and Hatlevik (2018), 80% of a sample of new teachers in Norway demonstrated positive views regarding the usefulness of information and communication technology (ICT) in the classroom. Trujillo-Torres et al. (2020) also found that over 90% of teachers surveyed indicated that ICT is a vital part of teaching practices. Kuo and Kuo (2020) found that the best predictor of preservice teachers' perceived learning was the sense of community associated with iPad use, but more research is needed to investigate whether the collaborative learning experiences provided by the iPads influence technology integration. It is important to note that despite teachers' mainly positive perceptions of 1:1 technology initiatives, some negative perceptions still exist. For example, 50% of the sample surveyed by Gudmundsdottir and Hatlevik (2018) believed that ICT could serve as a distraction in the learning process for their students. Additionally, teachers perceive barriers to technology integration, such as the financial cost, as impacting their technology use (Kormos, 2021). There may also be a difference in teachers' perceptions of technology based on the grade they teach, as Dogan et al. (2021) found that high school teachers viewed technology more negatively than their elementary and middle school counterparts. Elementary school teachers also reported the lowest level of perceived technology support (Dogan et al., 2021).

There is a difference in teachers' technology use according to school level (Dogan et al., 2021) and school type (Kormos, 2018). It is important to consider teachers' frequency of technology use at various school levels and types since more frequent use is associated with better learning outcomes for students (Zhai et al., 2019). Although more research is needed to compare teachers' technology use at different school levels, Kormos (2021) found that 55% of surveyed middle school teachers used an Internet browser daily in their classrooms. Additionally, in a study of 1,287 teachers from a single school district in Florida, Dogan et al. (2021) found significant differences in technology use among high school, middle school, and elementary teachers. For example, even though high school students used technology in the classroom more frequently than elementary or middle school students, high school teachers used technology integration strategies less frequently when compared to middle school and elementary school teachers (Dogan et al., 2021). Elementary school teachers reported the highest frequency of technology integration strategies (Dogan et al., 2021). Elementary teachers reported using technology more frequently for independent or small group learning activities, remediation, acceleration, and delivering instruction, while middle and high school teachers more frequently used technology in creating online content or as a tool for students to monitor their own learning (Dogan et al., 2021). Dogan et al. called for more research investigating differences in teachers' technology use and perceptions at various school levels. School type also plays a role in teachers' technology use and perceptions, as urban teachers use technology less frequently and had more negative perceptions of technology as compared to teachers working in rural or suburban settings (Kormos, 2018).

Teachers' intent to use technology is influenced by several variables (Dindar et al., 2021; Menabò et al., 2021). Birgin et al. (2020) contended that there is a significant positive relationship between the frequency of teachers' technology use and their perceived technology proficiency. Dindar et al. (2021) asserted that teachers' technology integration is impacted by a multitude of factors which may include the type of technology used, teachers' digital skills and knowledge, and the support provided to teachers while integrating technology in their classrooms. Tang et al. (2021) pointed out factors such as teachers' mindsets, their technology self-efficacy levels, and the perceived usefulness of the technology as significantly influencing teachers' intent to adopt technology. Similarly, Menabò et al. (2021) found that teachers' perceptions of the usefulness and ease of use of technology as well as their level of technology self-efficacy could be used to predict their technology integration. Technology self-efficacy is a reoccurring factor in the research regarding variables that impact technology integration (Menabò et al., 2021; Tang et al., 2021). Furthermore, teachers' technology self-efficacy is an important area of study since it has the potential to impact program efficacy (Kirkpatrick et al., 2018).

Technology Self-Efficacy

The literature base contains numerous studies that investigated the factors that may impact the efficacy of educational technology initiatives. While more research on the impediments to the successful implementation of educational technology is needed (Kirkpatrick et al., 2018; O'Neil & Krause, 2019), researchers have identified teachers' technology self-efficacy as one factor that they believe alters the success of 1:1 technology programs (Durak, 2021; Kuo & Kuo, 2020; Liu et al., 2018; Menon et al., 2020). Teachers' technology self-efficacy, or teachers' belief in their ability to implement educational technology successfully, is a critical factor that stakeholders and researchers should consider when examining the success of technology initiatives (Kirkpatrick et al., 2018). Technology self-efficacy is an important area of study when investigating the degree of success of technology programs since self-efficacy impacts persistence and effort (Bandura, 1977).

In general, researchers have found that levels of technology self-efficacy impact the adoption or intent to adopt technology initiatives (Joo et al., 2018; Kaarakainen & Saikkonen, 2021; Kao et al., 2020; Rosman et al., 2021; Tang et al., 2021; Xu & Zhu, 2020). In fact, Li et al. (2019) and Menabò et al. (2021) found that teachers' levels of technology self-efficacy could be used to predict their intent to use technology in their classrooms in the future. Researchers have identified several areas that are directly impacted by teachers' levels of technology self-efficacy. Impacted areas include teachers' perceptions (Hsu et al., 2022; Huang et al., 2022; Liu et al., 2018) and the learning process (Durak, 2021; Kuo & Kuo, 2020). Researchers have also identified several factors that influence the levels of technology self-efficacy. Factors impacting technology self-efficacy include training and professional development (Barton & Dexter, 2020; Hur et al., 2020; Kaarakainen & Saikkonen, 2021; Thurm & Barzel, 2022), experience (Dindar et al., 2021; Hsu et al., 2022; Kaarakainen & Saikkonen, 2021), participants' individual characteristics (Hsu et al., 2022; Nami & Vaezi, 2018), and the coronavirus (COVID-19) pandemic (Dindar et al., 2021).

Technology Self-Efficacy and Professional Development

Professional development (PD) is an important factor to consider when investigating the extent to which teachers implement technology in their classrooms (Liu et al., 2018). Researchers have concluded that teachers who receive technology-related PD utilize technology more often than teachers who do not receive technology-related PD (Simsek & Sarsar, 2019). As Moon et al. (2021) pointed out, how technology is used impacts program efficacy. Since PD impacts how teachers are using technology (Liu et al., 2018) and how technology is used, it may, in turn, affect the success of technology initiatives (Moon et al., 2021); therefore, it is imperative to make sure that PD programs are preparing teachers according to best practices (Liu et al., 2018). Furthermore, PD increases teachers' levels of self-efficacy, which is another factor that plays a role in the successful implementation of educational technology initiatives (Gomez et al., 2022).

Since there is an association between technological knowledge and technology self-efficacy, PD programs should focus on encouraging teachers' own beliefs regarding technology initiatives (Durak, 2021). Liu et al. (2018) found that teachers' use of technology moved from a basic approach used to replace traditional instructional methods to a more creative, integrated approach that transformed instruction and learning throughout one year of PD. In other words, with the support of an ongoing PD program, teachers began to move from an instructionist approach to a constructionist approach as the year progressed. Quality PD programs should be designed to support this transition, but more research is needed to determine PD needs for each school level (Liu et al., 2018). For example, Kormos (2021) found that middle school teachers often learned new technology skills from interactions with other faculty or peers but allotting in-service training time to collaborate with colleagues may not prove as beneficial for teachers working at other school levels. It is important to note that teachers' school levels impacted their perceptions of the PD program, as high school teachers expressed fewer positive views about the PD program compared to elementary school teachers (Liu et al., 2018). Educational technology program efficacy and PD perceptions both seem to vary by grade level.

Researchers have noted the importance of training and professional development (PD) in increasing technology self-efficacy levels. For example, PD increases technology self-efficacy, resulting in an indirect impact on participants' technology use (Kaarakainen & Saikkonen, 2021). Furthermore, technology-related training and technology self-efficacy can be used to predict teachers' digital skills (Kaarakainen & Saikkonen, 2021). Teachers who received technology-related in-service training demonstrated higher technology self-efficacy levels and more positive attitudes toward technology than those who did not receive training (Akkaya & Kapidere, 2021). Since mastery experiences are key in increasing self-efficacy levels (Bandura, 1977), teachers' technology self-efficacy can be increased through planned stages of PD that allow teachers to experience technology mastery (Thurm & Barzel, 2022). Additionally, PD should include opportunities for teachers to reflect on their technology self-efficacy and engage in independent, informal learning related to technology integration (Barton & Dexter, 2020). Specific training opportunities have also shown promise in increasing technology self-efficacy, as researchers have found that preservice teachers' technology self-efficacy can be increased through long-term exposure to application-based curricula (Menon et al., 2020). Similarly, Hur et al. (2020) found that online projects that involve training related to intercultural collaboration and communication can increase the technology self-efficacy of preservice teachers.

Technology Self-Efficacy and Technology Perceptions

Researchers have debated the relationship between individuals' perceptions and their levels of technology self-efficacy. The findings of research studies in this area mirror tenets of Bandura's (1977) theory of self-efficacy, as individuals with positive perceptions also evidence increased levels of self-efficacy (Gudek, 2019; Kwon et al., 2019). In other words, teachers who viewed technology as a distraction also evidenced low levels of technology self-efficacy (Gudmundsdottir & Hatlevik, 2018). In fact, teachers' attitudes toward technology can be used to predict their technology use (Li et al., 2019). There is also a relationship between teachers' technology self-efficacy and their perceptions of technology-related professional development (PD) since teachers with positive views of technology also demonstrated positive views of technology-related PD (Liu et al., 2018). Additionally, levels of technology self-efficacy impact participants' perceptions regarding ease of technology use (Hsu et al., 2022; Huang et al., 2022). For example, Hsu et al. (2022) found that university students' technology self-efficacy levels impacted their perceptions of the ease of use of wearable technology. Similarly, university students' levels of computer self-efficacy impacted the perceived ease of use of technology (Huang et al., 2022). While Odede (2021) noted the importance of assessing participants' characteristics like their perceptions and technology self-efficacy before designing mobile learning programs, Warden et al. (2022) found that learners were confident in their ability to utilize technology initiatives regardless of their degree of readiness.

Technology Self-Efficacy and the Learning Process

Technology self-efficacy also affects the learning process for both teachers and students. For example, teachers' technological knowledge can be predicted by their technology self-efficacy (Durak, 2021). Additionally, teachers with higher levels of technology self-efficacy are more motivated and engaged in their daily tasks (Moreira-Fontán et al., 2019). Furthermore, a positive relationship exists between iPad self-efficacy and perceived learning (Kuo & Kuo, 2020). Hsu et al. (2022) found that university students with higher self-efficacy related to wearable technology use in the classroom also demonstrated a deeper understanding of curricular content, took on challenges throughout the learning process, and did not avoid problems.

While most of the impacts of technology self-efficacy are positive, some researchers have revealed negative associations. Heo et al. (2021) found that technology self-efficacy negatively impacts engagement. In other words, students with high levels of self-efficacy related to technology use demonstrated low levels of learning engagement in online learning environments. Researchers surmised that learners who are confident in their technology use may actually become distracted by it (Heo et al., 2021). Researchers have also found that students who described low confidence in using technology also reported low self-efficacy in social interactions with other students (Warden et al., 2022), which may negatively impact the learning process.

Technology Self-Efficacy and Prior Experiences with Technology

Researchers have noted the important role that prior experience with technology plays in the degree of technology self-efficacy. Most researchers have suggested that past experiences using technology are positively associated with technology use and technology self-efficacy (Aslan, 2021; Dindar et al., 2021; Kaarakainen & Saikkonen, 2021; Nami & Vaezi, 2018). For example, Aslan (2021) concluded that there is a significant difference in Turkish teachers' technology self-efficacy levels based on computer access. Pre-service teachers who have computers and the Internet evidenced higher technology self-efficacy than those who did not have computers or the Internet in their homes (Aslan, 2021). Likewise, teachers who had used technology in their daily classroom practices demonstrated increased self-efficacy levels related to teaching in online environments (Dindar et al., 2021). Similarly, Kaarakainen and Saikkonen (2021) concluded that teachers with more experience using technology were more likely to use technology, and digital activity and age explain differences in digital skills. Teachers who had experience working with a Learning Management System (LMS) reported a higher intention to use the LMS than those who were not experienced with using the LMS (Dindar et al., 2021). Teachers with experience working with the LMS also reported more technology support and expressed higher online self-efficacy related to students' engagement, classroom management, and digital instructional strategies and skills (Dindar et al., 2021). Students with their own computers demonstrated an increased level of technological knowledge and perceived ease of use, which resulted in more positive levels of technology self-efficacy (Nami & Vaezi, 2018).

Most of the researchers' findings align with tenets of Bandura's (1977) theory of self-efficacy since past experiences using technology elevated teachers' levels of self-efficacy.

In contrast, researchers in one study found that participants' online experiences did not impact technology self-efficacy (Hsu et al., 2022). Ladendorf et al. (2021) also found that prior online teaching experience did not equate with higher levels of perceived success in online teaching environments during the COVID-19 pandemic. Similarly, Dolighan and Owen (2021) determined that prior experience teaching online courses did not result in higher self-efficacy scores for teaching online during the COVID-19 pandemic. It is important to note that two of the small number of studies containing results that contrast with most findings related to technology self-efficacy and previous experience using technology took place during the COVID-19 pandemic, suggesting that studies from the period of remote instruction caused by the pandemic should be interpreted with caution (Dindar et al., 2021). More research is needed to investigate differences in technology integration based on teachers' levels of prior technology experience (Dindar et al., 2021).

Technology skills are a strong predictor of technology self-efficacy (Kwon et al., 2019), and researchers have suggested that teachers who understand how to use technology have a positive impact on students' academic achievement (Akturk & Ozturk, 2019). Kao et al. (2020) concluded that teachers with more experience using the Internet had higher levels of technology self-efficacy, more positive attitudes toward technology-related professional development, and increased levels of technology integration as compared to teachers with less experience with the Internet. Additionally, a comparison of teachers experienced with technology use versus teachers inexperienced with technology use revealed a difference in how teachers view technology integration. Experienced teachers determine their levels of satisfaction on how a given digital component can aid their teaching performance, while inexperienced teachers base their satisfaction on how easy or difficult the technology is for them to implement (Dindar et al., 2021).

Technology Self-Efficacy and Gender

Most researchers investigating teachers' technology self-efficacy have found a difference in technology self-efficacy levels based on gender. Male teachers have consistently demonstrated higher technology self-efficacy than female teachers (Aslan, 2021; Gudmundsdottir & Hatlevik, 2018; Kartal et al., 2018; Kwon et al., 2019; Šabić et al., 2022; Simsek & Sarsar, 2019). The findings appear to be consistent across populations and geographic regions. For example, Nami and Vaezi (2018) and Hsu et al. (2022) found that male university students in Iran reported higher technology self-efficacy rates than female students. Gudmundsdottir and Hatlevik (2018) reached the same conclusion with their sample of 356 new teachers in Norway, and Saikkonen and Kaarakainen (2021) found slightly higher technology self-efficacy rates among males in their sample of 4,988 teachers from Finland. Similarly, Aslan (2021) and Simsek and Sarsar (2019) found a significant difference in Turkish teachers' technology self-efficacy levels based on gender in favor of males. One of the few studies conducted in the United States regarding teachers' technology self-efficacy found that male middle school teachers had higher technology self-efficacy levels than female middle school teachers in classrooms with 1:1 device initiatives (Kwon et al., 2019). Importantly, Šabić et al. (2022) noted that gender differences in Croatian teachers' technology self-efficacy were significant among older teachers, but younger male and female teachers demonstrated similar levels of technology self-efficacy. Since younger teachers seemed to be able to use technology more effectively, researchers suggested that additional investigation into the mediating effect of age on gender differences in technology self-efficacy levels is needed (Šabić et al., 2022).

On the other hand, a small number of studies have found no significant difference in technology self-efficacy levels based on gender (Akkaya & Kapidere, 2021; Bakar et al., 2020; Birgin et al., 2020; Trujillo-Torres et al., 2020). While Kartal et al. (2018) discovered slightly higher technology self-efficacy rates among male mathematics teachers in Turkey, Bakar et al. (2020) found no difference in the technology self-efficacy levels of male and female mathematics teachers in Malaysia. Likewise, Trujillo-Torres et al. (2020) concluded that there was not a significant difference in technology self-efficacy levels according to gender in a sample of mathematics teachers from Spain. Perhaps the nature of the mathematics content mediated the effect of gender on teachers' technology self-efficacy in the Bakar et al. (2020) and Trujillo-Torres et al. (2020) studies. O'Neil and Krause (2019) also found no statistically significant differences in self-efficacy rates between genders in their study of physical education teachers. Again, the subject area of the teachers may play a role in the relationship between technology self-efficacy and gender, as some teachers may be less inclined to utilize technology if they feel their subject area is not conducive to technology integration (Xu & Zhu, 2020). Šabić et al. (2022) noted that variables like the type of school in which the teachers work and the grade level they teach may be more important factors than gender and age in explaining differences in technology self-efficacy levels. Additionally, Akturk and Ozturk (2019) indicated no difference in teachers' technological pedagogical content knowledge based on gender. Researchers have called for further investigation into differences in teachers' technology self-efficacy based on gender in more types of educational settings (Barton & Dexter, 2020; Menabò et al., 2021; Šabić et al., 2022).

Technology Self-Efficacy and Teaching Experience

The literature base contains mixed reviews regarding the relationship between teachers' technology self-efficacy and their years of teaching experience, as some have found no significant relationship (Bakar et al., 2020; Kwon et al., 2019; Simsek & Sarsar, 2019) while other researchers have identified a significant relationship (Akturk & Ozturk, 2019; Birgin et al., 2020; Trujillo-Torres et al., 2020). While some researchers have collected evidence that younger teachers are utilizing technology more frequently (Saikkonen & Kaarakainen, 2021), Nami and Vaezi (2018) noted that most of the university freshmen in their study identified at the novice level or only slightly better than the novice level as far as technology integration and knowledge. Furthermore, Simsek and Sarsar (2019) found no significant difference in technology self-efficacy according to the level of teaching experience. Bakar et al. (2020) also discerned no significant difference in technology self-efficacy levels of Malaysian mathematics teachers according to their years of teaching experience. Kwon et al. (2019) corroborated these findings, noting that there is no significant relationship between teaching experience and technology self-efficacy.

On the other hand, Kwon et al. (2019) also found a negative relationship between teaching experience and technology skills, suggesting that technology skills decrease as years of teaching experience increase. Age appears to be a factor in the relationship between teachers' technology self-efficacy and their years of teaching experience, as Saikkonen and Kaarakainen (2021) reported that teachers under the age of 30 demonstrated the most frequent technology use, while those over 60 accounted for the most infrequent technology use. Akkaya and Kapidere (2021) concluded that there is a negative relationship between teachers' seniority and their levels of technology self-efficacy. Akturk and Ozturk (2019) also found a significant relationship between teaching experience and teachers' technological pedagogical content knowledge (TPACK), noting that TPACK also decreased as years of teaching experience increased. Additionally, Trujillo-Torres et al. (2020) found evidence that teaching experience impacted high school mathematics teachers' use of technology in Spain. Birgin et al. (2020) found that Turkish teachers' perceived technology proficiency was higher among those with under five years of teaching experience as compared with those with more than 16 years of experience. More research on the relationship between teachers' technology self-efficacy and teaching experience is warranted (Barton & Dexter, 2020).

Technology Self-Efficacy and Subject Area

Technology self-efficacy rates vary by teachers' subject areas (Simsek & Sarsar, 2019), but researchers have not reached a consensus regarding which subject areas are associated with the highest technology self-efficacy levels. For example, Simsek and Sarsar (2019) found that vocational and technical teachers demonstrated higher levels of technology self-efficacy than mathematics and science teachers in Turkey. Conversely, Bakar et al. (2020) concluded that Malaysian mathematics teachers evidenced high levels of technology self-efficacy and found evidence of a significant relationship between mathematics teachers' technology self-efficacy and their TPACK. Xu and Zhu (2020) discovered that the subject culture clash has a significant negative impact on teachers' technology self-efficacy, beliefs, and attitudes. Subject culture clash refers to the reluctance some teachers feel when adopting technology based on their perception that the subject area they teach is not conducive to the use of technology (Xu & Zhu, 2020).

Ladendorf et al. (2021) discovered that teachers' subject area also impacted their perceived success and satisfaction with online learning during the period of remote instruction caused by the COVID-19 pandemic. Mathematics teachers felt the most successful during remote learning, while teachers of performance-based classes that required students to demonstrate their learning through some form of summative assessment felt the least successful (Ladendorf et al., 2021). Factors affecting technology integration are specific to each subject area. For example, technology self-efficacy, time, and technology access impact special education teachers' technology integration (Siyam, 2019). In a study of 2,355 teachers from Finland, Kaarakainen and Saikkonen (2021) described a difference in technology use according to teachers' subject areas, suggesting that this difference could be due to characteristics particular to each subject area that may make certain curricular content easier or cheaper for the teacher to digitize. Researchers have recommended that future investigations examine differences in technology self-efficacy according to the subjects taught at each grade level (Durak, 2021; Jung et al., 2019; Šabić et al., 2022; Simsek & Sarsar, 2019).

Technology Self-Efficacy and Grade Level

Although there are not a robust number of studies investigating differences in teachers' levels of technology self-efficacy according to the grade level they teach, researchers assert that variables like type of school and school level are more important than age and gender in explaining differences in teachers' technology self-efficacy (Šabić et al., 2022). In a study of 6,613 elementary and upper secondary teachers in Croatia, researchers concluded that the high school teachers had higher levels of technology self-efficacy as compared to the elementary and middle school teachers (Šabić et al., 2022). Christensen and Knezek (2019) confirmed these results in a study of 980 South American teachers, finding that high school and higher education teachers demonstrated higher levels of technology self-efficacy as compared to elementary school teachers. Dogan et al. (2021) found that while high school teachers used technology integration strategies less frequently than elementary and middle school teachers, elementary school teachers were significantly less comfortable utilizing multimedia assignments in their classrooms as compared to middle and high school teachers. Li et al. (2022) concluded that the higher the teachers' grade level, the higher their pedagogical knowledge (PK) and technological pedagogical knowledge (TPK) scores. Additionally, high school teachers in Turkey have been found to use technology significantly more often than middle school teachers (Simsek & Sarsar, 2019), which could contribute to the higher levels of technology self-efficacy attributed to high school teacher populations. However, Birgin et al. (2020) concluded that middle school teachers demonstrated higher levels of perceived technology proficiency as compared to high school teachers in Turkey, but the researchers noted that the middle school teachers in this study had more experience working with technology than their high school counterparts.

Researchers have also found that there are differences in factors affecting technology integration between elementary and secondary teachers (Jung et al., 2019). For example, Jung et al. (2019) identified support as the factor having the largest impact on elementary teachers' technology integration, while TPACK was the most influential factor in middle school teachers' technology integration. In addition, Li et al. (2019) identified factors such as instructional approach, attitudes toward technology, and perceptions of technology training as significant predictors of high school teachers' technology integration. In contrast, Kwon et al. (2019) found that technology self-efficacy predicted middle school teachers' technology use, and technology beliefs also had a significant positive relationship with middle school teachers' technology integration. Noting the differences in curricular content and objectives for each school level, Li et al. (2022) suggested that training related to technology integration should match the differing skill sets of each level of teachers. Researchers have called for further investigation of factors affecting teachers' self-efficacy and technology perceptions at different grade levels (Dovigo, 2021; Menabò et al., 2021; Saikkonen & Kaarakainen, 2021).

Technology Self-Efficacy and the COVID-19 Pandemic

The COVID-19 pandemic has added a new dimension to the research regarding factors impacting technology self-efficacy including grade level, previous experience teaching in online learning environments, and learning engagement. Several researchers sought to reexamine factors impacting online learning solely in the context of the pandemic (Menabò et al., 2021; Rosman et al., 2021). While investigating teachers' technology self-efficacy during the period of remote learning due to the COVID-19 pandemic, researchers found that teachers' grade levels impacted their perceived success in teaching online (Ladendorf et al., 2021). High school teachers felt the most successful during the period of remote learning as compared to elementary and middle school teachers, and teachers who instructed only one grade level felt more successful than those who taught multiple grade bands (Ladendorf et al., 2021). However, researchers noted that previous experience with online teaching was not associated with higher technology self-efficacy rates or a higher degree of perceived success in online teaching environments during the period of remote learning caused by the COVID-19 pandemic (Dolighan & Owen, 2021; Ladendorf et al., 2021). This contrasts with findings indicating a positive relationship between technology self-efficacy and previous experience using technology from studies conducted before the pandemic (Aslan, 2021; Dindar et al., 2021; Kaarakainen & Saikkonen, 2021; Nami & Vaezi, 2018).

There is also conflicting information regarding the role of technology self-efficacy in studies conducted during the pandemic. For example, Heo et al. (2021) found a significant negative relationship between technology self-efficacy and learning engagement for South

Korean undergraduate students during the COVID-19 pandemic, while Rosman et al. (2021) indicated that a significant positive relationship exists between technology self-efficacy and intent to use technology in the online distance learning format necessitated by the pandemic. More research is needed to examine the impact of digital tools utilized during the pandemic (Kaarakainen & Saikkonen, 2021), and researchers have noted that studies taking place during this time should be interpreted with caution. For example, Heo et al. (2021) cautioned that online courses created during the pandemic may have been rolled out quickly, resulting in subpar content that did not challenge some students. Similarly, Dindar et al. (2021) theorized that the pandemic may have altered teachers' technology acceptance since they were forced to adopt new digital pedagogical approaches in a short amount of time.

Limitations of Technology Self-Efficacy Literature

Although the literature base contains a multitude of studies related to technology self-efficacy (Durak, 2021; Kuo & Kuo, 2020; Liu et al., 2018; Menon et al., 2020), there are still gaps in the related literature. Corry and Stella (2018) noted that teacher self-efficacy in online education is an underexplored area of the literature base. The current self-efficacy studies focus primarily on the technology self-efficacy of preservice teachers (Joo et al., 2018; Kuo & Kuo, 2020; Menon et al., 2020; O'Neil & Krause, 2019). In other words, the literature base is lacking studies that examine the technology self-efficacy of active K-12 teachers (Akturk & Ozturk, 2019; Ladendorf et al., 2021). Furthermore, the small number of studies that did involve K-12 settings utilized samples of teachers from large urban or suburban schools (Gomez et al., 2022; Li et al., 2019; Liu et al., 2018; Xu & Zhu, 2020) or countries outside of the United States (Dindar et al., 2021; Kaarakainen & Saikkonen, 2021; Kao et al., 2020; Menabò et al., 2021; Xu & Zhu, 2020), suggesting a need for studies involving samples from rural settings within the

United States. Another limitation of the existing literature is that many of the current studies utilized samples composed mainly of females (Barton & Dexter, 2020; Dindar et al., 2021; Kaarakainen & Saikkonen, 2021). More research on teachers' technology self-efficacy and factors that may impact technology self-efficacy is warranted (Kao et al., 2020; Kirkpatrick et al., 2018; O'Neil & Krause, 2019). Specifically, there is a call for more research investigating differences in K-12 teachers' technology self-efficacy levels according to age, gender, teaching experience, and grade level (Jung et al., 2019; Menon et al., 2020; Šabić et al., 2022; Simsek & Sarsar, 2019) in rural educational settings with 1:1 technology initiatives.

Summary

The issue of 1:1 educational technology initiatives is well established in the literature base. The theory of self-efficacy has aided researchers in understanding how beliefs about technology abilities affect technology use and performance. Researchers have identified benefits associated with educational technology, but the impact on academic achievement seems to depend on how the devices are used. For example, students learning with technology seem to demonstrate more positive learning outcomes than students learning from technology. In addition, the results seem to vary based on the population studied. Researchers have found positive effects on academic outcomes for preschool populations, mixed effects for middle and high school students, and little to no effect for elementary and university students. Research including teacher populations usually includes information related to teachers' technology perceptions and technology integration.

Researchers have identified teachers' technology self-efficacy as a critical factor in determining technology program efficacy. There is evidence of a relationship between teachers' technology self-efficacy and variables such as professional development, technology perceptions, prior experiences with technology, gender, and subject area. There are mixed reviews regarding the relationship between teachers' technology self-efficacy and factors affecting the learning process, teaching experience, and grade level. The COVID-19 pandemic has also altered the relationship between teachers' technology self-efficacy and grade level, previous experience with technology, and learning engagement. While researchers have found some evidence that teachers' technology self-efficacy levels vary by grade level, more research in this area is needed. There is a gap in the literature regarding the impact of in-service K-12 teachers' age, gender, teaching experience, and grade level on technology self-efficacy in rural settings with 1:1 device initiatives. The current study addressed this gap by investigating the predictive relationship between teachers' age, gender, teaching experience, and grade level and the technology self-efficacy of teachers in a rural, 1:1 iPad setting.

CHAPTER THREE: METHODS

Overview

The purpose of this quantitative, correlational study was to address a gap in the literature by examining the predictive ability of teachers' age, gender, teaching experience, and grade level and teachers' technology self-efficacy in a rural, one-to-one (1:1) iPad setting. This chapter begins with an introduction to the design of the study, including a description of the predictor and criterion variables. The next section of the chapter contains the research question and the null hypothesis. Finally, this chapter concludes with a description of the participants and setting, instrumentation, procedures, and data analysis plans.

Design

A quantitative, non-experimental correlational design was used to investigate the predictive relationship between teachers' age, gender, teaching experience, and grade level and their technology self-efficacy. According to Creswell and Creswell (2018), qualitative research is used to understand the meaning of a process or phenomenon, while quantitative research is used to investigate the relationships among variables and test theories. Since this study investigated factors that may impact technology self-efficacy, quantitative research was more appropriate. In addition, a nonexperimental design is more applicable than an experimental design when the independent variable is difficult to control in real-world settings (Gall et al., 2007). Nonexperimental designs allow the researcher to select existing groups with varying degrees of a given characteristic, or the researcher may choose to compare a group that possesses the characteristic with a group that does not (Creswell & Guetterman, 2019). In this study, there were pre-existing groups created by the teachers' ages, genders, years of teaching experience, and grade levels. The researcher did not manipulate the independent variables since it was not feasible to alter age, gender, teaching experience, or the grade level taught by each teacher in the context of a real-world educational setting.

Furthermore, a correlational design is appropriate for research studies that examine the relationship between two or more predictor variables and a criterion variable (Gall et al., 2007). In this study, the predictor variables included teachers' age, gender, years of teaching experience, and the grade level of the educator, while the criterion variable was the teachers' level of technology self-efficacy. Participants selected their age from multiple age band options, including 21-30 years, 31-40 years, 41-50 years, and more than 50 years. Participants selected male, female, nonbinary/third gender, prefer not to disclose, or other for the gender variable. Teaching experience referred to the number of years the participant has worked as an educator, and options for this question included 1-5 years, 6-10 years, 11-15 years, and more than 16 years. Grade level referred to the grade level each participant teaches. Participants selected elementary school, middle school, or high school using a demographic survey. Educators teaching kindergarten through fifth grade were considered elementary school, those teaching sixth through eighth grade were considered middle school, and those working in ninth through 12th grade were considered high school. Bandura (1977) defined self-efficacy as an individual's belief in his or her ability to achieve a desired outcome. Similarly, technology self-efficacy is defined as one's confidence in the ability to use technology to enhance learning (Menon et al., 2020; O'Neil & Krause, 2019). Several researchers have used correlational designs to investigate the factors affecting teachers' technology self-efficacy (Akkaya & Kapidere, 2021; Kwon et al., 2019; Simsek & Sarsar, 2019), so a correlational design was also appropriate for this study.

While correlational designs are especially practical in educational contexts since it is challenging for researchers to manipulate conditions in real-world settings (Creswell &

Guetterman, 2019), there are also several limitations to this type of study design. One limitation of the correlational approach is that researchers cannot draw definitive conclusions about the cause-and-effect relationships between variables, and a follow-up study using a true experimental design is usually needed (Gall et al., 2007). While results may seem to indicate a cause-effect relationship, there may be only an association between the independent and dependent variables (Creswell & Guetterman, 2019). Furthermore, correlational studies are limited in that there could be alternative explanations for the results (Gall et al., 2007). Researchers must interpret the results cautiously since a correlational study is less controlled than a true experiment (Creswell & Guetterman, 2019). Due to the less controlled nature of the correlational approach, the researcher may only be able to suggest that the results provide evidence for a given interpretation (Gall et al., 2007).

While a causal-comparative study could also be used when a researcher is interested in exploring the relationship between variables, a correlational study was a better approach in this case since it allowed the researcher to analyze the combined relationship of multiple independent variables and one dependent variable (Creswell & Guetterman, 2019). A correlational study is also more appropriate in situations where the researcher is hoping to determine the strength or significance of the relationships among variables since a causal-comparative design does not account for the magnitude of the relationship (Gall et al., 2007). A correlational study also enabled the researcher to control for previously analyzed variables while investigating the predictive strength of the remaining predictor variables (Tabachnick & Fidell, 2019). Since there is evidence that years of teaching experience and teachers' age influence general self-efficacy levels (Shaukat et al., 2019), it was important to control for these variables in the current study.

Research Question

The following research question guided this study:

RQ: Is there a predictive relationship between teachers' age, gender, teaching experience, and grade level and teachers' technology self-efficacy as measured by the Educator Technology Self-Efficacy Survey (ETS-ES)?

Hypothesis

The null hypothesis for this study was:

H_0: There is no statistically predictive relationship between teachers' age, gender, teaching experience, and grade level and teachers' technology self-efficacy as measured by the Educator Technology Self-Efficacy Survey (ETS-ES).

Participants and Setting

This section details the participants and the setting for this quantitative, correlational study investigating the predictive relationship of teachers' ages, genders, years of teaching experience, and grade levels and their levels of technology self-efficacy. For example, this section includes a description of the population and the participants used for this study. The participants and setting section also includes a description of the sampling technique and information about the sample size. Finally, this section concludes with a description of the research setting.

Population

This study included a convenience sample of teachers from a sprawling, rural public school district in central Pennsylvania. To protect the privacy of students, teachers, and the school district, pseudonyms are used to describe details about the research population, participants, and setting. According to the Pennsylvania Department of Education (2022), the

Rural School District (RSD) covers roughly 374 square miles and enrolls approximately 2,400 students. In the RSD, 48.7% of students are considered economically disadvantaged, 4.4% are English language learners, and 19.8% are enrolled in special education (Pennsylvania Department of Education, 2022). Additionally, 87.8% of students identify as White, 8.9% identify as Hispanic, and 1.3% identify as two or more races (Pennsylvania Department of Education, 2022). The population was sampled in the spring semester of the 2022-2023 school year. All teachers in the population were contacted via email, informed of the purpose of the study, and asked to voluntarily complete the survey instrument and demographic questionnaire. The sample of teachers is a convenience sample because the participants were easily accessible to the researcher while still fulfilling the purpose of the proposed study (Gall et al., 2007).

Participants

For this study, the total number of participants sampled was 118. The number of participants sampled exceeds the minimum number of 85 calculated for multiple linear regression with four predictor variables, assuming a medium effect size, statistical power of .8, and alpha level of .05 using G*Power (Faul et al., 2009). The convenience sample of teachers for this study came from two elementary schools, one middle school, and two high schools within one rural school district in central Pennsylvania. The sample consisted of 35 male teachers, 82 female teachers, and one participant who selected “prefer not to disclose” for the gender question. The sample consisted of 11 participants in the 21-30 age range, 22 participants in the 31-40 age range, 47 participants in the 41-50 age range, and 38 participants over the age of 50. There were 15 participants with 1-5 years of teaching experience, 10 participants with 6-10 years of experience, 13 with 11-15 years of experience, and 80 participants who reported 16 or more years of teaching experience. Additionally, 115 participants identified as White, and one participant identified as two or more races. Finally, 14 of the participants taught all core subjects, 20 were teachers of English, 17 taught mathematics, 11 taught science, 10 taught social studies, 21 taught specials and electives, and 25 reported “other” as their subject area.

Participants were organized into three naturally occurring groups. For example, of the 118 participants, 40 taught kindergarten through 5th grade, 31 taught sixth through eighth grade, and 47 taught grades nine through 12. The sample contained 40 elementary teachers. Of the 40 elementary school teachers, three were 21-30 years old, nine were 31-40, 15 fell into the 41-50 age range, and 13 reported ages over 51 years. There were six elementary teachers with 1-5 years of teaching experience, three teachers with 6-10 years of experience, six with 11-15 years of experience, and 25 elementary teachers had 16 or more years of teaching experience. There were 35 female elementary teachers and five elementary male teachers. Additionally, all 40 of the elementary teachers identified as White. There were 14 teachers who taught all core subjects, six who taught English, four who taught mathematics, two who taught science, four who taught special and electives, and 10 who listed their subject area as “other.”

The sample also contained 31 middle school teachers. Of the 31 middle school teachers, three were 21-30 years old, four were 31-40 years old, 14 were 41-50 years old, and 10 were 51 years of age or older. Only four middle school teachers reported 1-5 years of teaching experience, two reported 6-10 years, two reported 11-15 years, and the remaining 23 participants claimed 16 or more years of teaching experience. There were 17 female middle school teachers and 14 middle school male teachers. Additionally, 30 of the middle school teachers identified as White, and one middle school teacher identified as two or more races. There were eight middle school teachers who taught English, five who taught mathematics, four who taught science, four who taught social studies, four who taught special and electives, and six who listed their subject area as “other.”

Finally, the sample contained 47 high school teachers. Of the 47 high school teachers, five were 21-30 years old, nine were 31-40 years old, 18 were 41-50 years old, and 15 of the high school teachers were 51 years of age or older. Additionally, five high school teachers reported 1-5 years of teaching experience, five reported 6-10 years, five reported 11-15 years, and the remaining 32 high school teachers claimed 16 or more years of teaching experience. There were 30 female high school teachers, 16 high school male teachers, and one high school teacher who selected “prefer not to disclose” for the gender question. All 47 of the high school teachers identified as White. There were six high school teachers who taught English, eight who taught mathematics, five who taught science, six who taught social studies, 13 who taught special and electives, and nine who listed their subject area as “other.”

Setting

The setting for this study was a rural school district in central Pennsylvania that had implemented a 1:1 iPad program. Beginning in 2016, every student in the Rural School District (RSD) received a school-issued iPad to be used inside and outside the classroom. Originally, students were only able to take their iPads home with them if their parents or guardians purchased insurance for the device through the school district. As a result of the COVID-19 pandemic, all students are now permitted to take their iPads home with them each day during the school year. Depending on the age of the students and teachers’ instructional preferences, students are expected to use iPads daily in the classroom environment. Beginning around the time of the iPad rollout in 2016, the RSD provided educators with professional development training covering a wide range of topics related to the successful implementation of the 1:1 iPad initiative. Trainings have included app demonstrations, opportunities for teachers to share how they were able to successfully implement iPads and MacBooks into their teaching, and time for hands-on learning experiences with new apps, devices, and digital platforms.

The RSD noticed some initial positive impacts after the iPad rollout in 2016. Typically, the RSD technology department loads each student's iPad with common apps and platforms necessary for basic educational use, such as Google Workspace, and teachers guide students in downloading any additional subject-specific apps that they wish to use in their classrooms. In the fall of 2017, elementary teachers in the district began incorporating eSpark, a digital tool that suggests reading and mathematics apps for each student to provide targeted, individualized instruction (eSpark Learning, 2018). By the end of the 2017-2018 school year, elementary students in the RSD demonstrated an average of five national percentile points of growth on the Measures of Academic Progress (MAP) tests developed by the Northwest Evaluation Association (eSpark Learning, 2018). Despite the initial academic progress associated with the 1:1 iPad initiative, the RSD has not released up-to-date information regarding the impacts of the 1:1 iPad initiative.

The sample for this study consisted of teachers from five different buildings within the school district. The district contains two elementary schools, one middle school, and two high schools. One elementary school contains kindergarten through fifth grade, while the other contains kindergarten through sixth grade. The middle school contains grades sixth through eighth. Finally, one of the high schools contains grades nine through 12, while the other high school contains grades seven through 12.

Instrumentation

In this section, the instrumentation is described. The Educator Technology Self-Efficacy Survey (ETS-ES) was used to gather data about teachers' technology self-efficacy levels for this study. The ETS-ES is a reliable and valid measure of teachers' level of confidence in using technology to improve student learning outcomes (Gentry et al., 2014b). This section contains more information about the ETS-ES instrument and the demographic questionnaire created by the researcher that accompanied the survey.

Educator Technology Self-Efficacy Survey

The purpose of the Educator Technology Self-Efficacy Survey (ETS-ES) was to measure teachers' levels of comfort with using technology according to the 2008 International Society for Technology in Education (ISTE) standards (Gentry et al., 2014b). Gentry et al. (2014b) developed the ETS-ES because limited measures of teachers' technology skills existed. Furthermore, none of the existing measures linked teachers' technology behaviors with the ISTE teacher standards. Since teachers' perceptions of technology, along with factors like access, experience, curriculum, and the benefits of technology, determine technology use, the developers felt that a reliable and valid instrument to gauge teachers' perceptions was needed. The instrument's creators intended it to be used by educational stakeholders in K-12 schools, colleges, and universities to determine professional development needs, develop effective pre-service teacher programs, evaluate instructional technology departments, and create technology expert groups that could mentor others.

To develop the instrument, Gentry et al. (2014b) recruited an expert panel of teachers, university faculty, instructional technologists, and pre-service teachers who worked collaboratively to develop the ETS-ES items. The expert panel created 50 Likert-style statements corresponding to five of the ISTE teacher standards. Each item also had to have a corresponding observable behavior. After a period of review, debate, and collaboration that lasted for a total of two weeks, the instrument developers conducted a pilot study using the ETS-ES items created by the panel. The pilot study included 116 educators, support staff, and administrators from 36 different schools in Texas who were taking part in a five-week online professional development course. The pilot study contained 108 females but only 14 males, and the participants ranged in age from 22 to 68 years old. Of the 77 K-12 teachers who participated in the pilot study, 53.2% of them reported having more than five years of experience and 46.8% reported five or fewer years of teaching experience.

After employing the ETS-ES in the pilot study, researchers then tested the reliability and validity of the instrument. The ETS-ES has been used by published researchers (O'Neil & Krause, 2019) and doctoral students (Domeny, 2017; Edwards, 2018; Sassone, 2020) to measure teachers' technology self-efficacy validly and reliably. Gentry et al. (2014b) defined technology self-efficacy as teachers' perceptions of using and integrating technology into their classrooms in a way that promotes 21st-century skills. Each subscale of the instrument corresponds with one of the ISTE teacher standards, including encouraging student learning in digital settings, creating digital learning experiences and assessments, modeling digital learning, promoting digital citizenship, and participating in professional development (ISTE, 2008).

The expert panel's process of developing a pilot survey through collaboration and review using the ISTE standards as a guide ensured that the instrument achieved content validity and a high level of face validity (Gentry et al., 2014b). After conducting the pilot study, each member of the expert panel reported whether he or she agreed or disagreed with each ETS-ES item's validity in measuring teachers' technology self-efficacy. The corrected item-total correlation for the positively-worded statements ranged from .50 to .67 for items related to encouraging student learning in digital settings, .51 to .69 for items related to creating digital learning experiences, .42 to .73 for items related to modeling digital learning, .47 to .58 for items related to promoting digital citizenship, and .50 to .72 for items related to participating in professional development (Gentry et al., 2014a). For the negatively-worded statements, the corrected item-total correlation ranged from .19 to .59 for items related to encouraging student learning in digital settings, .49 to .73 for items related to creating digital learning experiences, -.06 to .69 for items related to modeling digital learning, .45 to .61 for items related to promoting digital citizenship, and .47 to .60 for items related to participating in professional development (Gentry et al., 2014a). Gentry et al. (2014b) noted that researchers may choose to eliminate items 26, 27, and 38 from the ETS-ES in future studies because they demonstrated Pearson correlation coefficients less than .30, and the survey was already robust in length without these three items. The corrected item-total correlation for the remaining items ranged from .42 to .73 (Gentry et al., 2014a). After conducting item analysis, researchers noted that the overall Cronbach's alpha remained at a high level of reliability even if any one of the items were to be deleted. The instrument is reliable because the intra-rater reliability reached 100% agreement, and the instrument has a high level of overall internal consistency as evidenced by a Cronbach's alpha of .958 (Gentry et al., 2014a).

The ETS-ES contains a total of 50 survey questions that correspond to five of the ISTE standards, including 10 questions for each of the five standards or subscales. The five standards or subscales include encouraging student learning in digital settings, creating digital learning experiences and assessments, modeling digital learning, promoting digital citizenship, and participating in professional development (ISTE, 2008). There are 25 positively-worded statements and 25 negatively-worded statements in the ETS-ES instrument (Gentry et al., 2014b). Participants answered each of the Likert-style survey questions with five possible responses indicating their degree of agreement with each statement. Participants' responses for the positive statements were scored as follows: Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree = 1. Participants' responses for the negative statements were scored as follows: Strongly Agree = 1, Agree = 2, Neutral = 3, Disagree = 4, Strongly Disagree = 5 (Gentry et al., 2014b).

The ETS-ES was scored by summing participants' answers for each item using Qualtrics. According to Gentry et al. (2014b), the minimum score for the overall survey is 50, and the maximum score is 250. Since there are 10 questions for each of the five ISTE standards, the minimum score for each of the sub-scales is 10 and the maximum score is 50. A higher score on the ETS-ES indicates a higher level of technology self-efficacy, and a lower score indicates a lower level of technology self-efficacy. Participants accessed the survey digitally via an emailed link. The instructions provided by Gentry et al. (2014b) told participants to indicate their degree of agreement with each statement. Participants then completed the ETS-ES instrument at their convenience using Qualtrics. The ETS-ES took participants approximately 15 minutes to complete. See Appendix A for the ETS-ES instrument and Appendix B for permission to use the ETS-ES instrument.

In addition to the ETS-ES, participants were also asked to answer several demographic questions. Participants accessed the researcher-created demographic questionnaire via the same link they used to complete the ETS-ES instrument. The demographic questionnaire took participants less than five minutes to complete. The demographic questionnaire contained questions about each teacher's grade level, content area, gender, ethnicity, age, and years of teaching experience. The grade-level question included multiple age band options, including kindergarten through fifth grade, sixth through eighth grade, and ninth through 12th grade. The options for the teaching experience question included 1-5 years, 6-10 years, 11-15 years, and more than 16 years. The content area options included English, mathematics, science, social studies, all core subjects, specials and electives, and other. Gender options included male, female, non-binary/third gender, prefer not to disclose, and other. Ethnicity options included White, Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, two or more races, and other. The options for teachers' ages included 21-30 years, 31-40 years, 41-50 years, and more than 50 years. See Appendix C for the demographic questionnaire.

Procedures

The researcher first discussed the planned study with the Rural School District (RSD) to ensure access to the proposed population. The researcher also submitted the proposal to Liberty University and the RSD to seek feedback regarding the planned study. The researcher then applied for Institutional Review Board (IRB) approval through Liberty University (see Appendix D). After receiving IRB approval, the researcher sent an email to all teachers in the RSD. The email contained an overview of the study as well as a link to the Educator Technology Self-Efficacy Survey (ETS-ES) and the demographic questionnaire. In the body of the email, participants were informed of the purpose of the study, notified that their participation was voluntary, and assured that there was no risk of harm by participating in the research. The email also contained a statement regarding participants' anonymity, as participants were not asked to provide their names at any point during the study. Participants were informed that they were granting informed consent by clicking the button to continue to the survey and demographic questionnaire. Participants completed the survey and questionnaire using Qualtrics (see Appendix E for the recruitment email and instructions sent to participants and Appendix F for the participant consent form).

The survey window was open for a period of two weeks. With one week remaining in the survey window, the researcher attempted to increase response rates by sending a reminder email asking participants to complete the survey if they had not already had the opportunity to do so. After the two weeks passed, the researcher gathered the data into a Microsoft Excel spreadsheet and conducted statistical analyses on the collected data using Statistical Package for the Social Sciences (SPSS) software. The researcher then reported the findings in Chapters Four and Five.

All collected data were protected throughout each phase of the study. For example, participants were not asked to provide their names when completing the demographic questionnaire or the ETS-ES survey, ensuring anonymity. The demographic information that could be used to identify participants was kept in a password-protected document. Only the researcher was able to access this document. The data from both the demographic questionnaire and the survey will be maintained for a period of three years after the completion of this study. After a period of three years, the data will be deleted.

Data Analysis

A hierarchical multiple regression was used to investigate the predictive relationship between teachers' age, gender, teaching experience, and grade level and teachers' technology self-efficacy. A multiple regression is appropriate for determining the correlation between two or more predictor variables and a continuous criterion variable (Gall et al., 2007). Furthermore, a multiple regression is flexible enough to analyze many different types of information, including interval, ordinal, and categorical data (Gall et al., 2007). In a multiple regression, each participant has scores on multiple predictor variables and at least one criterion variable, and the strength of the relationship among the variables can be ascertained (Green & Salkind, 2017). A hierarchical multiple regression is especially useful when analyzing each independent variable's impact on the dependent variable while controlling for previously entered independent variables (Tabachnick & Fidell, 2019).

The current study aligns with the description of a multiple regression because the researcher was interested in determining the strength of the relationship among several predictor variables and a continuous criterion variable. In other words, a multiple regression allowed the researcher to determine the predictive strength of each predictor variable. Specifically, a hierarchical multiple regression allowed the researcher to examine the impact of teachers' age, teaching experience, gender, and grade level on teachers' technology self-efficacy. The teachers' gender, age, teaching experience, and grade level were all nominal, polytomous predictor variables. Additionally, the criterion variable, teachers' technology self-efficacy level, was continuous. In this study, a hierarchical multiple regression allowed the researcher the ability to examine the strength of the relationship among the predictor and criterion variables while controlling for previously entered predictor variables.

Data screening included a visual examination of the data to locate missing or inaccurate information. A scatterplot was used to identify extreme bivariate outliers. There are several additional assumption tests that the researcher completed for a multiple regression. For example, the researcher needed to test for a linear relationship, a multivariate normal distribution, and non-multicollinearity (Gall et al., 2007). The researcher also used a scatterplot to determine whether a normally distributed linear relationship existed (Green & Salkind, 2017). The researcher tested for non-multicollinearity by calculating the variance inflation factor (VIF). It is important to test for non-multicollinearity to ensure that the predictor variables are not highly correlated with each other (Gall et al., 2007). Acceptable values fall between one and five, and a value greater than 10 indicates a violation of the assumption (Gall et al., 2007). According to Gall et al. (2007), the researcher needs to report the correlation coefficient (*r*), multiple correlation coefficient (*R*), coefficient of determination (R^2), and significance level (*p*). Pearson's *r* was used to report the effect size. A slight relationship exists when *r* is between .20 and .35, a limited prediction can be made when *r* is between .35 and .65, a good prediction can be made when *r* is between .66 and .85, and an *r* of .86 and above indicates that the variables may be measuring the same construct (Creswell & Guetterman, 2019). The null hypothesis will be rejected at the 95% confidence level.

CHAPTER FOUR: FINDINGS

Overview

The purpose of this quantitative, correlational study was to examine the predictive strength of a set of demographic variables in determining teachers' technology self-efficacy. In this study, the predictor variables included teachers' gender, age, grade level, and teaching experience. Information for each predictor variable was collected through the demographic questionnaire that preceded the Educator Technology Self-Efficacy Survey (ETS-ES). The researcher used the ETS-ES to measure the criterion variable, teachers' technology self-efficacy. This study utilized a convenience sample of 118 educators from the Rural School District (RSD) in central Pennsylvania. Chapter Four contains the research question and hypothesis, descriptive statistics, and results for the hierarchical multiple regression conducted by the researcher.

Research Question

RQ: Is there a predictive relationship between teachers' age, gender, teaching experience, and grade level and teachers' technology self-efficacy as measured by the Educator Technology Self-Efficacy Survey (ETS-ES)?

Null Hypothesis

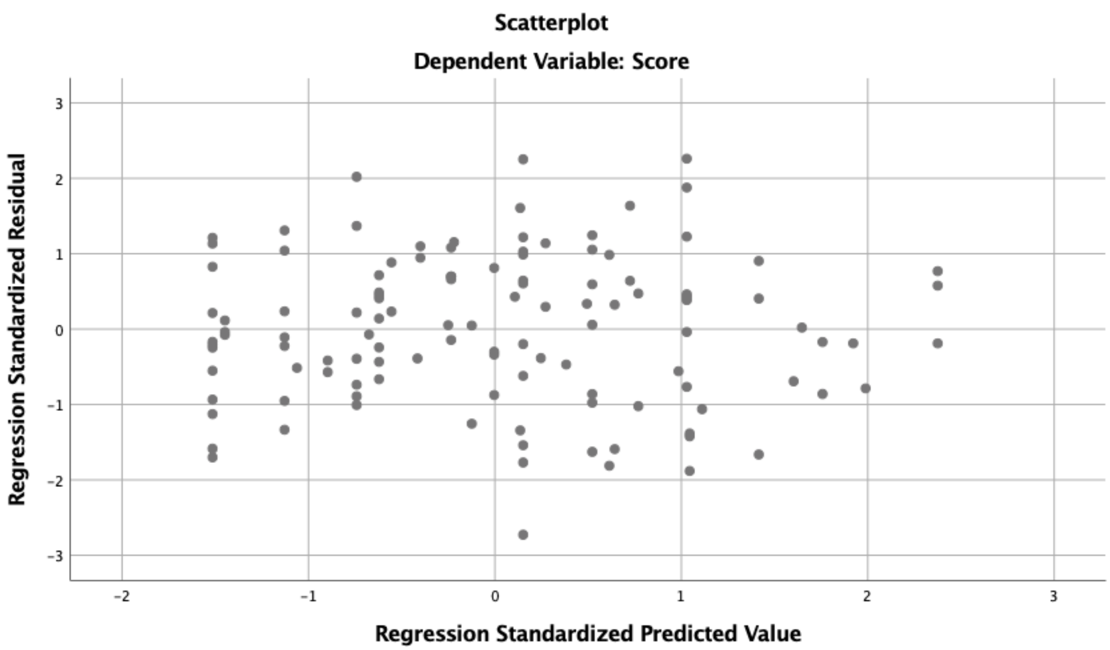
H_0: There is no statistically predictive relationship between teachers' age, gender, teaching experience, and grade level and teachers' technology self-efficacy as measured by the Educator Technology Self-Efficacy Survey (ETS-ES).

Data Screening

The researcher visually examined data looking for incomplete or inaccurate information for each variable. Of the original 134 responses, the researcher deleted 16 incomplete survey responses, leaving a total of 118 responses ($N = 118$). No inconsistencies were identified. The researcher also examined a scatterplot to identify extreme bivariate outliers. No outliers were identified. See Figure 1 for the scatterplot. Mahalanobis distance values were examined to look for possible outliers. Since the maximum value of 13.20 was less than the critical value for four independent variables of 18.47 (Tabachnick & Fidell, 2019), no outliers were present.

Figure 1

Scatterplot of Standardized Residual by Standardized Predicted Value



Descriptive Statistics

The researcher obtained descriptive statistics for each of the variables. Originally, 134 responses were recorded for the demographic questionnaire and the ETS-ES. The researcher deleted 16 incomplete responses, leaving a total of 118 educator responses ($N = 118$). Scores on the Educator Technology Self-Efficacy Survey (ETS-ES) ranged from 94 to 232. The lowest score possible for the ETS-ES is 50, while the highest possible score is 250. The lower the score, the lower the teacher's level of technology self-efficacy (Gentry et al., 2014b). Table 1 provides the descriptive statistics for each variable.

Table 1

Descriptive Statistics

	M	*SD*	*N*
Score	163.9	27.1	118

Assumption Testing

Assumption of Linearity

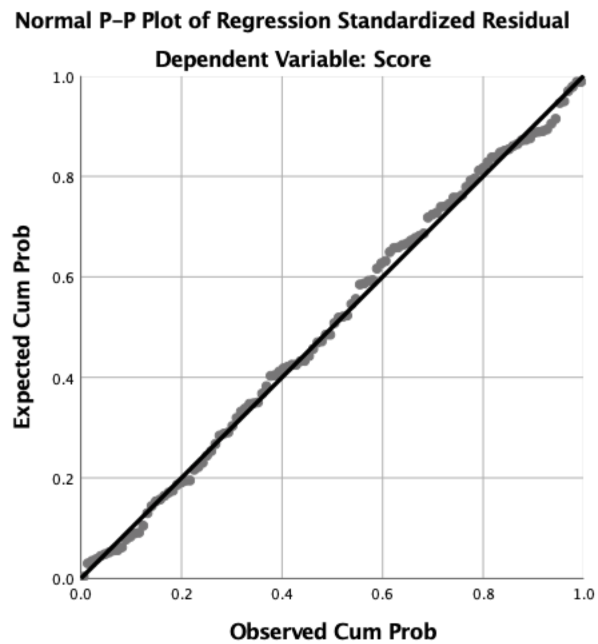
The researcher tested for the assumption of linearity by examining the scatterplot of standardized residuals. The researcher noticed that the regression residuals were skewed slightly to the left side. Since the slight skewness is still within normal limits and the residuals are distributed in a rectangular shape with most of the scores falling in the center (Pallant, 2020), the researcher concluded that the assumption of linearity was met. See Figure 1 for the scatter plot of standardized residuals.

Assumption of Normal Distribution of Regression Residuals

The researcher tested for the assumption of normal distribution of regression residuals using a normal probability plot of regression standardized residuals. After conducting a visual examination of the normal probability plot, the researcher concluded that the regression residuals were normally distributed. Since the residuals were normally distributed, the assumption was met. See Figure 2 for the normal probability plot.

Figure 2

Normal P-P Plot of Regression Standardized Residual



Assumption of Non-Multicollinearity

The researcher used the Variance Inflation Factor (VIF) to assess the assumption of non-multicollinearity. According to Gall et al. (2007), if a VIF value greater than 10 is present, the assumption is violated. A VIF value greater than 10 would indicate that the predictor variables are too highly correlated with each other, and multicollinearity is present (Gall et al., 2007). The assumption of non-multicollinearity was met for each variable in this study since the VIF values fell between 1 and 5, and no VIF value greater than 10 was present. See Table 2 for the coefficients and Table 3 for the collinearity statistics.

Table 2

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Correlations		
		B	*SE*	Beta			Zero-order	Partial	Part
1	(Constant)	184.886	9.237		20.017	.000			
	Gender	-12.285	5.202	-.214	-2.361	.020	-.214	-.214	-.214
2	(Constant)	202.617	11.838		17.115	.000			
	Gender	-12.088	5.106	-.211	-2.367	.020	-.214	-.216	-.211
	Age	-6.092	2.616	-.207	-2.329	.022	-.211	-.212	-.207
3	(Constant)	193.438	13.879		13.937	.000			
	Gender	-10.997	5.167	-.192	-2.129	.035	-.214	-.196	-.189
	Age	-6.109	2.609	-.208	-2.342	.021	-.211	-.214	-.208
	Grade	3.576	2.842	.113	1.258	.211	.145	.117	.112
4	(Constant)	191.346	14.118		13.554	.000			
	Gender	-11.219	5.180	-.196	-2.166	.032	-.214	-.200	-.193
	Age	-7.928	3.391	-.270	-2.338	.021	-.211	-.215	-.208
	Grade	3.430	2.851	.109	1.203	.231	.145	.112	.107
	Experience	2.446	2.907	.097	.842	.402	-.078	.079	5

a. a. Dependent Variable: Score

Table 3

Collinearity Statistics

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Gender	1.000	1.000
2	(Constant)		
	Gender	1.000	1.000
	Age	1.000	1.000
3	(Constant)		
	Gender	.972	1.029
	Age	1.000	1.000
	Grade	.972	1.029
4	(Constant)		
	Gender	.969	1.032
	Age	.593	1.685
	Grade	.968	1.033
	Experience	.591	12

a. a. Dependent Variable: Score

Results

A hierarchical multiple regression was conducted to determine the ability of demographic variables such as teachers' gender, age, grade level taught, and teaching experience to predict teachers' technology self-efficacy. The researcher used IBM SPSS Version 25 to conduct analyses. The predictor variables included teachers' gender, age, grade level taught, and years of teaching experience. The criterion variable was the teachers' technology self-efficacy scores. The researcher failed to reject the null hypothesis at the 95% confidence level because the researcher could not prove a predictive relationship between all four predictor variables and the criterion variable. There was a significant, predictive relationship between the predictor variables of teachers' gender ($p < .05$) and age ($p < .05$) and the criterion variable of teachers' technology self-efficacy scores. Gender was the best predictor, while age had the next most impact on teachers' technology self-efficacy. Teachers' grade levels ($p > .05$) and teaching experience ($p > .05$) were not statistically significant predictors. Table 4 provides the model summary.

Table 4

Model Summary

					Change Statistics				
Model	*R*	R^2	Adjusted R^2	*SE* of the Estimate	R^2 Change	*F* Change	*df*1	*df*2	Sig. *F* Change
1	.214[a]	.046	.038	26.629	.046	5.576	1	116	.020
2	.298[b]	.089	.073	26.136	.043	5.424	1	115	.022
3	.318[c]	.101	.078	26.070	.012	1.584	1	114	.211
4	.327[d]	.107	.075	26.103	.006	.708	1	113	.402

a. Predictors: (Constant), Gender
b. Predictors: (Constant), Gender, Age
c. Predictors: (Constant), Gender, Age, Grade
d. Predictors: (Constant), Gender, Age, Grade, Experience
e. Dependent Variable: Score

The predictor variable of gender was entered into Block 1, explaining 4.6% of the variance in teachers' technology self-efficacy. The average technology self-efficacy score for males was 173.86, while the average technology self-efficacy score for females was 159.24. On average, males demonstrated higher technology self-efficacy scores than females. After age was entered into Block 2, the total variance (R^2) explained by the model as a whole was 8.9%, F (2, 115) = 5.61, $p < .05$. The age variable explained an additional 4.3% of the variance in teachers' technology self-efficacy after controlling for gender differences, R^2 change = .43, F change (1, 115) = 5.42. The gender and age variables were both statistically significant in Model 2, with gender recording a higher semipartial correlation value ($sr = -.211$, $p < .05$) than the age variable ($sr = -.207$, $p < .05$). Pearson's $r = .30$, so a slight relationship exists. In addition, the 21-30 age group demonstrated the highest technology self-efficacy scores, with an average of 178. The 41-50 age range exhibited the second-highest scores, with an average of 167.38. The 31-40 age group demonstrated an average technology self-efficacy score of 164.68. Those over the age of 50 demonstrated the lowest average technology self-efficacy scores at 154.92.

Next, the grade level taught variable was entered into Block 3. The total variance explained by Model 3 as a whole was 10.1%, F (3, 114) = 4.28, $p > .05$. The grade level variable explained an additional 1.2% of the variance in teachers' technology self-efficacy after controlling for gender and age differences, R^2 change = .012, F change (1, 114) = 1.58. Only the gender and age variables were statistically significant in Model 3, with age recording a higher semipartial correlation value ($sr = -.21$, $p < .05$) than the gender variable ($sr = -.19$, $p < .05$). Pearson's $r = .32$, so a slight relationship exists.

Finally, the teaching experience variable was entered into Block 4. The total variance explained by Model 4 as a whole was 10.7%, F (4, 113) = 3.38, $p > .05$. The teaching experience variable explained an additional 0.6% of the variance in teachers' technology self-efficacy after controlling for gender, age, and grade level differences, R^2 change = .006, F change (1, 113) = .71. Again, only the gender and age variables were statistically significant in Model 4, with age recording a higher semipartial correlation value ($sr = -.21$, $p < .05$) than the gender variable ($sr = -.19$, $p < .05$). Pearson's $r = .33$, so a slight relationship exists. Table 5 provides the regression model results.

Table 5

ANOVA Table

Model		Sum of Squares	*df*	Mean Square	*F*	Sig.
1	Regression	3954.394	1	3954.394	5.576	.020[b]
	Residual	82258.157	116	709.122		
	Total	86212.551	117			
2	Regression	7659.086	2	3829.543	5.606	.005[c]
	Residual	78553.465	115	683.074		
	Total	86212.551	117			
3	Regression	8735.444	3	2911.815	4.284	.007[d]
	Residual	77477.106	114	679.624		
	Total	86212.551	117			
4	Regression	9217.941	4	2304.485	3.382	.012[e]
	Residual	76994.610	113	681.368		
	Total	86212.551	117			

a. Dependent Variable: Score
b. Predictors: (Constant), Gender
c. Predictors: (Constant), Gender, Age
d. Predictors: (Constant), Gender, Age, Grade
e. Predictors: (Constant), Gender, Age, Grade, Experience

CHAPTER FIVE: CONCLUSIONS

Overview

A hierarchical multiple regression was conducted using teachers' self-reported demographic information as the predictor variables and teachers' technology self-efficacy scores as the criterion variable. Predictor variables included teachers' gender, age, grade level taught, and teaching experience. This data was analyzed using SPSS and presented in Chapter Four. Based on the results of the hierarchical multiple regression, the researcher failed to reject the null hypothesis at the 95% confidence level since there was not a significant, predictive relationship between all four demographic variables and the criterion variable. The gender and age variables did significantly contribute to the prediction of teachers' technology self-efficacy scores, but the variables of teachers' grade level taught and the years of teaching experience did not significantly contribute to the teachers' technology self-efficacy scores. Chapter Five contains a discussion of the results of the hierarchical multiple regression. The discussion is followed by sections regarding the implications of the study, the limitations of the current study, and suggestions for future research.

Discussion

The purpose of this quantitative, correlational study was to explore the predictive relationship between demographic variables such as teachers' gender, age, grade level, and teaching experience and their levels of technology self-efficacy in a rural 1:1 iPad setting. The convenience sample utilized for this study contained 118 teachers from the Rural School District (RSD) in central Pennsylvania. Participants voluntarily completed a digital demographic questionnaire and the Educator Technology Self-Efficacy Survey (ETS-ES) during a two-week data collection period in the spring semester of the 2022-2023 school year. The ETS-ES is a reliable and valid way of measuring teachers' comfort with using technology according to the 2008 International Society for Technology in Education (ISTE) standards (Gentry et al., 2014b). The issue of technology self-efficacy and its impact on the success of 1:1 device programs is well-established in the literature base (Durak, 2021; Kuo & Kuo, 2020; Liu et al., 2018; Menon et al., 2020), but the literature has not fully addressed factors that may be impacting K-12 teachers' technology self-efficacy, including age, gender, grade level, subject area, and teaching experience (Jung et al., 2019; Menon et al., 2020; Šabić et al., 2022; Simsek & Sarsar, 2019).

This study was guided by the following research question:

RQ1: Is there a predictive relationship between teachers' age, gender, teaching experience, and grade level and teachers' technology self-efficacy as measured by the Educator Technology Self-Efficacy Survey (ETS-ES)?

A hierarchical multiple regression was conducted to address the research question. The null hypothesis was that there would be no significant, predictive relationship between the predictor variables and the criterion variable. The researcher failed to reject the null hypothesis at the 95% confidence level since the researcher could not prove a statistically significant, predictive relationship between all four predictor variables and the criterion variable of teachers' technology self-efficacy scores. The gender and age variables did make a significant contribution in predicting teachers' technology self-efficacy scores, but the grade level and teaching experience variables did not make a significant contribution. Males demonstrated higher average technology self-efficacy scores than females, and the 21-30 age group demonstrated the highest average technology self-efficacy scores when compared to the 31-40, 41-50 and over 50 age groups. The results of this study provide a more thorough understanding of Bandura's theory of self-efficacy and the impact of specific demographic variables such as gender, age, grade level, and teaching experience on teachers' technology self-efficacy. The results regarding the impact of the predictor variables on technology self-efficacy scores can be used by school leaders to create more targeted technology-related professional development opportunities.

Theory of Self-Efficacy

According to Bandura's (1977) theory of self-efficacy, an individual's level of self-efficacy modifies behavior. For example, the higher one's level of self-efficacy, the more persistence and effort the individual will demonstrate (Bandura, 1977). Much of the current body of research aligns with the theory of self-efficacy, as researchers have found that teachers' levels of technology self-efficacy influence their intent to use technology (Joo et al., 2018; Li et al., 2019; Menabó et al., 2021; Tang et al., 2021) and ability to implement technology successfully (O'Neil & Krause, 2019). Just like one's general levels of self-efficacy impact behavior, a teacher's technology self-efficacy also influences behavior.

The current study expands upon Bandura's theory by adding to what is known about the variables influencing teachers' technology self-efficacy, or a teacher's degree of comfort with integrating technology in a way that enhances the learning process (Menon et al., 2020; O'Neil & Krause, 2019). According to the results of the current study, teachers' age and gender are significant predictors of teachers' technology self-efficacy. The results of the current study help to explain why certain teacher demographics, such as male teachers and teachers in the 21-30 age group, may demonstrate higher levels of technology self-efficacy. Since self-efficacy influences behaviors, persistence, and effort (Bandura, 1977), teacher groups with higher levels of technology self-efficacy may ultimately integrate technology into their classrooms with more frequency and in a way that is more effective than those with lower technology self-efficacy scores. In other words, age and gender may help predict teachers' behaviors related to technology.

Gender

Most researchers in the existing literature base have identified a significant relationship between teachers' gender and their technology self-efficacy, as a majority have found that male teachers exhibit higher technology self-efficacy than female teachers (Aslan, 2021; Gudmundsdottir & Hatlevik, 2018; Kartal et al., 2018; Kwon et al., 2019; Šabić et al., 2022; Sarikaya, 2022; Simsek & Sarsar, 2019). The results of the current study confirm evidence that there is a statistically significant relationship between teachers' gender and their technology self-efficacy scores. This study also confirms that male teachers exhibit higher average technology self-efficacy scores than female teachers. Despite the relatively uniform results contained within the literature base, researchers have called for additional investigation into the effect of gender on technology self-efficacy (Barton & Dexter, 2020; Menabó et al., 2021; Šabić et al., 2022). The results of this study add to the extant literature because the gender variable was identified as the best predictor of teachers' technology self-efficacy. In other words, a significant, predictive relationship exists between teachers' gender and their technology self-efficacy. Although the results of this study contradict a small number of researchers who found no significant relationship between gender and technology self-efficacy (Akkaya & Kapidere, 2021; Bakar et al., 2020; Birgin et al., 2020; Trujillo-Torres et al., 2020), the current study confirms and extends a large portion of the existing knowledge base.

Interestingly, some researchers have suggested that the role gender plays in shaping technology views may have shifted due to the COVID-19 pandemic. For example, Fokides and Kapetangiorgi (2022) found that age no longer played a role in determining Greek educators' perceptions of technology after the pandemic. However, others have noted that studies taking place in the context of the pandemic must be interpreted cautiously since teachers were forced to adopt new technologies quickly during the remote learning period (Dindar et al., 2021). While the current study took place after the COVID-19 pandemic, more research will be needed to determine whether the predictive strength of the gender variable in determining teachers' technology self-efficacy has changed from pre-pandemic levels. Additional longitudinal studies may be helpful in investigating changes in technology self-efficacy levels over the course of the pandemic.

Age

The results of the current study also confirm researchers' findings in the current literature base regarding the relationship between teachers' age and their technology self-efficacy. Researchers have identified a significant relationship between teachers' age and their technology self-efficacy (Sarikaya, 2022; Şen & Yildiz Durak, 2022), noting that teachers under 30 years of age use technology most frequently and teachers over the age of 60 use technology with the least frequency (Saikkonen & Kaarakainen, 2021). Excluding teachers under 30 and those over 60, technology use increases as teachers age (Saikkonen & Kaarakainen, 2021). Similarly, other researchers have found the 20-30 age group to demonstrate the highest technology integration self-efficacy scores (Şen & Yildiz Durak, 2022). Although the researcher of the current study did not collect information related to each age group's frequency of technology use, teachers in the 21-30 age range did exhibit the highest average technology self-efficacy scores, and those over the age of 50 demonstrated the lowest average technology self-efficacy scores. These results confirm the findings of Şen and Yildiz Durak (2022) since younger teachers demonstrated higher average technology self-efficacy levels. Additionally, the results of the current study expand upon those regarding the frequency of technology use presented by Saikkonen and Kaarakainen

(2021) since teachers in the youngest age group demonstrated the highest average technology self-efficacy levels and teachers in the oldest age group evidenced the lowest average technology self-efficacy levels. Perhaps the technology self-efficacy scores help to explain teachers' varying rates of technology use. Even though the 31-40 and 41-50 age ranges evidenced similar average technology self-efficacy scores in the current study, there is evidence that technology self-efficacy scores decrease as age increases.

Since the results of the current study suggest that a significant, predictive relationship exists between teachers' age and their technology self-efficacy scores, the current study confirms and extends studies in the extant literature. Some researchers have even suggested that gender differences are only significant among older teacher groups, and more research is needed to determine the mediating effect that age may have on gender differences in technology self-efficacy scores (Šabić et al., 2022). The current study confirms the need for additional research regarding the mediating effect of age, as age was the second strongest predictor of technology self-efficacy in the current study.

Grade Level

The current study contradicts other researchers' claims that the grade level variable is more important than the gender and age variables in predicting teachers' technology self-efficacy (Šabić et al., 2022). The opposite was true in the current study, as the gender and age variables were the best predictors of teachers' technology self-efficacy. The grade level variable was not a significant predictor of teachers' technology self-efficacy. These findings also contradict researchers who have suggested that teachers at the high school or collegiate level have higher technology self-efficacy scores than those who teach in younger grades (Christensen & Knezek, 2019; Šabić et al., 2022).

Researchers have called for further investigation into the relationship between teachers' grade level and their technology self-efficacy (Dovigo, 2021), possibly due to the contradictory information found in the literature base regarding the relationship between grade level taught and technology skills, use, and knowledge. For example, Li et al. (2022) noted that teachers in the upper grades evidenced higher technological pedagogical knowledge (TPK). On the other hand, Dogan et al. (2021) reported that high school teachers view technology more negatively than elementary and middle school teachers, and high school teachers use technology integration strategies less frequently as compared to elementary and middle school teachers. A possible explanation for these seemingly contradictory results may be how the technology is being used at each grade level, as technology is used mainly as a way for students to monitor their learning and increase study skills at the high school level (Bjorn & Svensson, 2021; Dogan et al., 2021). At the elementary level, though, teachers mainly use technology to differentiate or individualize lessons (Dogan et al., 2021). While the current study did not find evidence of a significant, predictive relationship between grade level taught and technology self-efficacy, perhaps it may be more informative to investigate the relationship between technology skills, use, and knowledge and technology self-efficacy.

Teaching Experience

The teaching experience variable was also not a significant predictor of teachers' technology self-efficacy in the current study. This finding aligns with the claims of several researchers who found no significant relationship between teaching experience and teachers' technology self-efficacy (Bakar et al., 2020; Kwon et al., 2019; Şen & Yildiz Durak, 2022; Simsek & Sarsar, 2019). However, the results of the current study seem to contradict at least one other study in the literature base regarding teaching experience and teachers' technology self-efficacy. Akkaya and Kapidere (2021) found a significant, negative relationship between teachers' seniority and their levels of technology self-efficacy.

While most researchers have not been able to definitively link teachers' technology self-efficacy levels to their years of teaching experience, some have found an association between years of teaching experience and technology-related skills. For example, despite finding no significant relationship between teachers' years of experience and their level of technology self-efficacy, Kwon et al. (2019) did find a negative relationship between years of teaching experience and technology skills. Specifically, teachers' technology skills decreased as the number of years of teaching experience increased (Kwon et al., 2019). Similarly, other researchers have found a negative relationship between teaching experience and technological pedagogical content knowledge (TPACK), as teachers' TPACK decreased as their years of experience increased (Akturk & Ozturk, 2019). Additionally, the years of teaching experience variable does seem to impact technology use (Trujillo-Torres et al., 2020), and perceived technology proficiency is higher among teachers with under five years of teaching experience as compared with those who have more than 16 years of teaching experience (Birgin et al., 2020). The current study did not demonstrate evidence of a significant, predictive relationship between teachers' years of teaching experience and teachers' levels of technology self-efficacy. However, it may be worthwhile to further investigate the relationship between teaching experience and technology-related skills.

Implications

This study adds to the existing body of knowledge found within the literature base, and the results have the potential to improve the lives and working conditions of educators, students, and other stakeholders in the field of education. First, the current study adds to the literature base by filling gaps previous researchers have identified. Teachers' technology self-efficacy is an under-researched area (Corry & Stella, 2018). Furthermore, Akturk and Ozturk (2019) and Ladendorf et al. (2021) have called for more research on the technology self-efficacy of K-12 in-service teachers. Many studies within the current literature base utilized pre-service teacher populations (Joo et al., 2018; Kuo & Kuo, 2020; Menon et al., 2020; O'Neil & Krause, 2019). Since the current study examined the technology self-efficacy of K-12 active teachers, it adds to the knowledge base. Additionally, the existing research settings involved large urban or suburban schools (Gomez et al., 2022; Li et al., 2019; Liu et al., 2018; Xu & Zhu, 2020) or countries outside of the United States (Dindar et al., 2021; Kaarakainen & Saikkonen, 2021; Kao et al., 2020; Menabò et al., 2021; Xu & Zhu, 2020). The current study adds to the literature regarding what is known about teachers' technology self-efficacy by utilizing a sample of K-12, in-service teachers from a rural school district in central Pennsylvania.

The results of this study have the potential to improve conditions in educational settings. According to Liu et al. (2018), professional development affects how teachers use technology. Interestingly, how teachers use technology in their classrooms then affects the success of technology initiatives (Moon et al., 2021). Since professional learning opportunities play an indirect yet vital role in the efficacy of technology programs, educational leaders must create professional development programs that prepare teachers according to best practices (Liu et al., 2018). It is perhaps more important to note that quality professional development opportunities can increase teachers' technology self-efficacy scores (Gomez et al., 2022). The results of this study may help educational leaders plan more targeted professional development opportunities for teachers. For example, if educational leaders designed technology-related professional development opportunities that accounted for gender and age differences, they may be able to target certain demographic groups that need more guidance and practice. Since mastery experiences or observation of others' mastery experiences can increase self-efficacy levels (Bandura, 1977), affording the targeted demographic populations with opportunities to achieve mastery may boost technology self-efficacy scores. In addition, technology self-efficacy can predict lifelong learning characteristics (Şen & Yildiz Durak, 2022). If educational institutions wish to employ educators who are devoted, lifelong learners, it is vitally important that they work to boost teachers' technology self-efficacy scores.

Students may also benefit from the results of this study. According to Moreira-Fontán et al. (2019), increased levels of teachers' technology self-efficacy are associated with more motivation and engagement with daily tasks. By increasing teachers' technology self-efficacy through targeted professional development opportunities, students may benefit from more motivated, engaged teachers.

Limitations

There were several limitations in this study. First, while correlational studies allow the researcher to examine the relationship among variables, all correlational studies are limited in that they cannot be used to draw cause-effect conclusions (Gall et al., 2007). The results of the current study indicate that there is a significant, predictive relationship between some demographic variables, like gender and age, and the dependent variable of teachers' technology self-efficacy. However, the researcher must be cautious in interpreting the results because the researcher cannot conclude that even the strongest predictors cause the resulting technology self-efficacy score. A more controlled, true experimental design would need to be conducted to establish a causal relationship (Gall et al., 2007).

Since this study utilized a convenience sample of teachers in a rural, K-12 public school district in central Pennsylvania, the results may vary in different educational settings. For example, the results cannot be generalized to urban or suburban areas. Additionally, the results may not apply to other school types, such as private schools, cyber schools, charter schools, or in college or university settings. The researcher utilized a convenience sample of teachers since it was easily accessible for the researcher. Future studies investigating the predictive strength of teachers' demographic variables in a variety of settings and populations may help to confirm the results of this study. In addition, the convenience sample contained mainly female participants. Although the sample reflected the demographics of the target population of Rural School District (RSD) teachers, the large percentage of females makes the results less generalizable to populations with differing demographics.

This study may also be limited by the characteristics of the participants who chose to complete the digital survey. For example, teachers who feel comfortable using technology may have felt more inclined to participate in the digital survey. Those who are not as comfortable using technology may have been reluctant to click the survey link and use technology to report their responses. While using paper copies of the Educator Technology Self-Efficacy Survey (ETS-ES) and the demographic questionnaire may not have been as convenient for the researcher and some of the participants, paper copies may have encouraged a greater number of individuals with lower technology self-efficacy to participate. Additionally, although the survey data used in this study was easy to obtain anonymously, the self-reported nature of the survey makes it a limitation of this study.

Recommendations for Future Research

Based on the results of this study, future research is needed to further investigate the predictive strength of teachers' demographic variables in determining teachers' technology self-efficacy. Suggestions for future research are listed below:

1. Replicate the existing study to explore more about which gender and age groups best predict teachers' technology self-efficacy.

2. Replicate the existing study with a different population of teachers from various education settings. For example, future researchers should investigate the predictive strength of teachers' demographic variables in determining technology self-efficacy in suburban or urban settings, in colleges and universities, and in private, cyber, or charter schools.

3. Utilize paper copies of the Educator Technology Self-Efficacy Survey (ETS-ES) and the demographic questionnaire to ensure that individuals with lower technology self-efficacy are encouraged to participate.

4. Future researchers may also consider using a random sample of teachers instead of a convenience sample of volunteers to ensure that participants form a representative sample of the population.

5. Examine the predictive strength of additional variables such as teachers' education level, subject taught, amount of technology-related professional development training, frequency and type of technology use, and technology skills and knowledge in determining teachers' technology self-efficacy.

6. Conduct a longitudinal study to examine how teachers' technology self-efficacy levels have changed over the course of the COVID-19 pandemic.

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APPENDIX A

Educator Technology Self-Efficacy Survey (ETS-ES)

Indicate your agreement with the following statements

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I empower my students to demonstrate their creative thinking by using digital tools to generate new ideas and develop innovative products and processes.					
I am able to develop technology-enriched learning environments that enable all students to pursue individual curiosities in an active setting.					
I regularly involve my students in activities where they use digital tools to plan and manage projects focused on real life events and problems.					
I find it challenging to promote student reflections using collaborative tools.					
I allow my students to only use digital tools that I myself feel comfortable with.					
I am unsure of how to set up a classroom where students can express themselves using technology.					
I actively involve my students in an ongoing examination of their thought processes and patterns, and believe collaborative tools enable them to clarify understanding with each other.					
I find it difficult to model collaborative learning for my students.					
I find it challenging to help my students find and use digital tools to solve real-world problems.					
I know how to work with students, colleagues, and others in face-to-face and virtual environments to model the collaborative knowledge construction process.					

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am not aware of digital tools that allow students to take charge of and manage their own learning in terms of exploring curiosities, setting learning goals and learning strategies, and assessing their own progress.					
I am confident in my ability to collect, analyze, and report data on my student's performance in order to improve my own instruction.					
I am confident in customizing and personalizing learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources.					
I feel overwhelmed when asked to integrate digital tools to promote student learning and creativity.					
I train my students to use digital tools to independently manage their own learning objectives, plan their learning strategies, and assess their own progress and results.					
I struggle to provide students with multiple and varied assessments that are aligned with both the content and the technology standards.					
I feel challenged and overwhelmed when I try to incorporate digital tools to personalize learning activities.					
I am confident in my ability to design authentic learning experiences that incorporate contemporary tools and resources.					
I feel a sense of engagement and satisfaction when designing or adapting learning experiences that incorporate digital tools to promote student learning and creativity.					
I am unsure of how I can use digital tools and resources to design authentic learning experiences for my students.					

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I would describe myself as an innovative educator.					
My prior learning has prepared me to use digital tools to collaborate with students, colleagues and parents.					
I feel as though I do not have the time I need to communicate effectively with students, parents, and peers using digital age media.					
My lack of technology skills may hinder my ability to acquire and keep pace with new technological advances in the future.					
I value the use of digital tools to locate, analyze, evaluate and use resources to support research, teaching and learning.					
I tell students that it’s important to use digital tools to locate, analyze, evaluate and use resources to support their own research and learning, but don’t typically practice this in my own teaching.					
I am confident that the technology skills I have today will help me acquire new skills for the future.					
I feel as though I lack the knowledge and skills I need to teach in our global and digital society.					
I feel confident in my ability to effectively communicate relevant information to students, parents, and peers using a variety of digital age media.					
I feel like it’s a struggle to use digital tools to communicate and collaborate with colleagues, parents, students, and members of the community to support learning in my classroom.					

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I rarely use digital communication tools for my students to interact with other students for online discussions and project teamwork.					
I struggle to provide equitable access to digital tools, curriculum, and online resources.					
I feel as though I model and exhibit legal and ethical behavior in our evolving digital culture.					
I am unsure of the rules of online etiquette (netiquette) and how to appropriately interact with others online.					
I do not regularly teach my students safe, legal and ethical use of online information with regard to author's rights, copyright issues, privacy, cyber-bullying and securing data.					
I routinely integrate digital communication and collaboration tools for my students to engage with					
I frequently model digital etiquette (netiquette) and online social interaction responsibilities.					
I am continually considering and addressing different student needs, including access to software, hardware, curriculum a					
I do not fully understand the local and global societal issues and responsibilities in our evolving digital culture.					
I actively promote, model, and teach the safe, legal and ethical use of online information, including author's rights, copyright issues, privacy, cyber-bullying and securing data.					

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I have been described as a good role model for infusing technology into teaching.					
I consistently engage in professional development that enables me to be confident in demonstrating effective use of digital tools in my classroom.					
I sometimes feel overwhelmed when attempting to improve my professional practice by integrating digital tools and resources.					
I am somewhat resistant to change, and therefore am slower to integrate a new tool into my teaching until I have seen evidence of effectiveness.					
I don't always keep up with trends in the research for practical effectiveness of current and emerging digital tools for teaching and learning.					
I participate in several different 'informal learning communities/networks' in which I seek out ways to learn and grow with new tools for promoting student creativity and collaboration.					
I struggle to join or maintain any informal learning communities/networks for learning new digital tools for teaching and learning.					
I rarely discuss educational technology tools and resources with my colleagues.					
I continually evaluate research trends on the practical effectiveness of current and emerging digital tools for teaching and learning.					
I demonstrate and discuss with my colleagues the effective use of digital resources to improve student learning and the profession of teaching.					

APPENDIX B

Permission to Use and Include Educator Technology Self-Efficacy Survey (ETS-ES)

Re: [EXTERNAL] Permission to Include ETS-ES

Gentry, Dr. James <[redacted]>
To: Shertzer, Rebecca

Tue 12/13/2022 9:22 AM

Hi Rebecca,

Please feel free to use the survey and modify it as needed. After your study is complete, please let me see your completed work. :-)

Jim Gentry :-)

JAMES GENTRY
Director, Instructional Development and Course Design
Center for Educational Excellence
Tarleton State University
P: [redacted]
E: [redacted]

"Let's Keep Churning the Learning!"

On Dec 13, 2022, at 8:00 AM, Shertzer, Rebecca <[redacted]> wrote:

Dr. Gentry,

I am a doctoral candidate at Liberty University, and I am writing to request your permission to use your Educator Technology Self-Efficacy Survey (ETS-ES) to collect data for my dissertation regarding teachers' technology self-efficacy in a rural 1:1 iPad setting. I understand that you have granted general permission to use the ETS-ES as long as it is properly cited, but with your permission, I would also like to include a copy of the instrument in my dissertation manuscript.

I would be happy to share the results of my study with you upon completion.

Thank you,
Rebecca Shertzer
Doctoral Candidate
Liberty University

APPENDIX C

Demographic Questions

Which grade level do you mainly teach?

- ○ Kindergarten-grade 5
- ○ Grades 6-8
- ○ Grades 9-12

How many years have you been a teacher?

- ○ 1-5 years
- ○ 6-10 years
- ○ 11-15 years
- ○ 16+ years

Which content area do you mainly teach?

- ○ English
- ○ Mathematics
- ○ Science
- ○ Social Studies
- ○ All core subjects
- ○ Specials and electives
- ○ Other ____

What is your gender?

- ○ Male
- ○ Female
- ○ Non-binary / third gender
- ○ Prefer not to disclose
- ○ Other ____

What is your ethnicity?

- ◯ White
- ◯ Black or African American
- ◯ American Indian or Alaska Native
- ◯ Asian
- ◯ Native Hawaiian or Pacific Islander
- ◯ 2 or more races
- ◯ Other ____

What is your age?

- ◯ 21-30 years
- ◯ 31-40 years
- ◯ 41-50 years
- ◯ 51+ years

APPENDIX D

IRB Approval

LIBERTY UNIVERSITY
INSTITUTIONAL REVIEW BOARD

January 25, 2023

Rebecca Shertzer
Jillian Wendt

Re: IRB Exemption - IRB-FY22-23-658 A Predictive Correlational Study of Factors Affecting Teachers' Technology Self-Efficacy

Dear Rebecca Shertzer, Jillian Wendt,

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and no further IRB oversight is required.

Your study falls under the following exemption category, which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:104(d):

Category 2.(i). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording).
The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects.

Your stamped consent form(s) and final versions of your study documents can be found under the Attachments tab within the Submission Details section of your study on Cayuse IRB. Your stamped consent form(s) should be copied and used to gain the consent of your research participants. If you plan to provide your consent information electronically, the contents of the attached consent document(s) should be made available without alteration.

Please note that this exemption only applies to your current research application, and any modifications to your protocol must be reported to the Liberty University IRB for verification of continued exemption status. You may report these changes by completing a modification submission through your Cayuse IRB account.

If you have any questions about this exemption or need assistance in determining whether possible modifications to your protocol would change your exemption status, please email us at [redacted]

Sincerely,
G. Michele Baker, MA, CIP
Administrative Chair of Institutional Research
Research Ethics Office

APPENDIX E

Recruitment Email

Dear Educator:

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree. The purpose of my research is to investigate the relationship between teachers' levels of self-efficacy regarding technology use and several demographic variables. I am writing to invite eligible participants to join my study.

Participants must be employed as educators with [redacted]. Participants, if willing, will be asked to complete a digital demographic questionnaire (5 minutes) and a digital survey regarding technology self-efficacy (15 minutes). Participation will be completely anonymous, and no personal, identifying information will be collected.

To participate, please click here.

A consent document is provided as the first page of the survey. The consent document contains additional information about my research. After you have read the consent form, please click the button to proceed to the survey. Doing so will indicate that you have read the consent information and would like to take part in the survey.

Participants will receive a Hershey's chocolate bar for participating.

Sincerely,

Rebecca Shertzer
Doctoral Candidate
Teacher at [redacted]

APPENDIX F

Consent Document

Title of the Project: A Predictive Correlational Study of Factors Affecting Teachers' Technology Self-Efficacy
Principal Investigator: Rebecca Shertzer, Doctoral Candidate, School of Education, Liberty University

Invitation to be Part of a Research Study

You are invited to participate in a research study. To participate, you must be employed as an educator with [redacted]. Taking part in this research project is voluntary.

Please take time to read this entire form and ask questions before deciding whether to take part in this research.

What is the study about and why is it being done?

The purpose of the study is to investigate the relationship between teachers' comfort regarding technology use and several demographic variables. Demographic variables in this study include teachers' age, gender, years of teaching experience, and the grade level(s) taught.

What will happen if you take part in this study?

If you agree to be in this study, I will ask you to do the following:

1. Complete a digital demographic questionnaire that will take no longer than five minutes.
2. Complete the Educator Technology Self-Efficacy Survey (ETS-ES), which contains 50 Likert-style questions related to technology use. The ETS-ES will take approximately 15 minutes to complete.

How could you or others benefit from this study?

Participants should not expect to receive a direct benefit from taking part in this study.

Benefits to society include an improved understanding of how certain demographic variables impact teachers' technology self-efficacy. With more information about how comfortable various teacher groups are with using educational technology, school leaders will be able to provide more effective, targeted professional development opportunities. Better training for teachers has the potential to increase student learning outcomes.

What risks might you experience from being in this study?

The expected risks from participating in this study are minimal, which means they are equal to the risks you would encounter in everyday life.

How will personal information be protected?

The records of this study will be kept private. Research records will be stored securely, and only the researcher will have access to the records.

- Participant responses will be anonymous.
- Data will be stored on a password-protected computer. After three years, all electronic records will be deleted.

How will you be compensated for being part of the study?

Participants will not be monetarily compensated for participating in this study. However, as a nominal display of appreciation of your time, Hershey's chocolate bars will be available to all participants in a central location during the data collection period. Since the researcher will not be able to identify who has completed the survey and who has not, participants and nonparticipants alike may help themselves to the chocolate bars upon completion of the survey.

Is study participation voluntary?

Participation in this study is voluntary. Your decision whether to participate will not affect your current or future relations with Liberty University. If you decide to participate, you are free to not answer any question or withdraw at any time prior to submitting the survey without affecting those relationships.

What should you do if you decide to withdraw from the study?

If you choose to withdraw from the study, please exit the survey and close your Internet browser. Your responses will not be recorded or included in the study.

Whom do you contact if you have questions or concerns about the study?

The researcher conducting this study is Rebecca Shertzer. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact her at [redacted]. You may also contact the researcher's faculty sponsor, Dr. Jillian Wendt, at [redacted].

Whom do you contact if you have questions about your rights as a research participant?

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the IRB. Our physical address is Institutional Review Board, [redacted]; our phone number is [redacted], and our email address is [redacted].

Disclaimer: The Institutional Review Board (IRB) is tasked with ensuring that human subjects research will be conducted in an ethical manner as defined and required by federal regulations. The topics covered and viewpoints expressed or alluded to by student and faculty researchers are those of the researchers and do not necessarily reflect the official policies or positions of Liberty University.

Your Consent

Before agreeing to be part of the research, please be sure that you understand what the study is about. You can print a copy of this document for your records. If you have any questions about the study later, you can contact the researcher using the information provided above.